Thunder Tiger

RAPTOR

90 3D Version

MANUAL

ASSEMBLY & MAINTENANCE

"For any instruction revisions or other information concerning this product, go to: www.thundertiger.com."

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INTRODUCTION

Thank you very much for purchasing the Thunder Tiger Raptor 90 3D R/C helicopter. The design of Raptor 90 3D is based on the original Raptor 90 series helicopter and modified for extreme aerobatics. It has all needed must-have optional parts for 3D flying, such as metal main rotor hub, non-linear flapping damper, metal BRG, 3D light paddles and so on. It also adopts the push-pull control system on collective pitch and elevator to achieve the most precise control. The flybar ratio is changeable to fit all kinds of flying style. Use of high quality material make the helicopter one tough machine that can handle everyday 3D beating. Raptor 90 3D is born for 3D flying, and you don't have to do any further modification for aggressive 3D maneuver. This is by far the best machine you have never seen. Just enjoy the model and have fun.

UNIQUE SIDEFRAME SYSTEM

Aluminum side plates are used in conjunction with molded material to construct the main structure. This design produces minimum weight with maximum strength. If the sideframes were completely made of molded material, then to achieve equal strength the plastic would have to be very thick and heavy. Using molded material at the right place avoids using metal angle brackets or putting compound bends in metal frames. Slots have been added in the frame design to permit the use of optional gear ratios to optimize engine performance to suit any pilot's demand.

BELL-HIILLER MIXING CONTROL UNIT

Main rotor control geometry has been carefully engineered to minimize cross-coupling in collective and cyclic commands. Blade pitch arms and the Bell-Hiller mixing arms are designed at an angle such that the pushrod interlinking them are at 90 degrees when the blades are at 0 degree. The pilots will get the symmetrical cyclic control feel and flybar authority either at +10 or -10 degrees of collective. We design this system with the 3-D pilot in mind. We guarantee you this whole design philosophy provides a strong and accurate control mechanism.

SHAFT DRIVE TAIL ROTOR

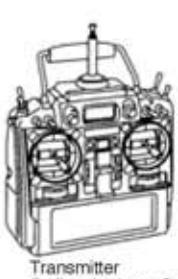
The Raptor 90 3D is designed with a constant drive tail rotor system to permit full tail rotor control during autorotations. 180 autos, backward autos and pirouette autos are all within your reach now. It has the same aluminum torque tube system as the Thunder Tiger/Taya Imperio helicopter. This allows obtaining the maximum performance from any modern heading lock gyros.

3D CAD DESIGN

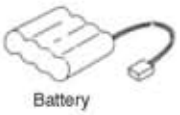
We use the latest 3D Computer Aided Design to design and manufacture the Raptor 90 3D. Our high-tech CAD program allows simulation of all moving parts to ensure no interference. The analysis automatically analyze the weight, the mass distribution, and inertia to help us pursue a design that will provide the high level of maneuverability needed for all-out 3-D aerobatics.

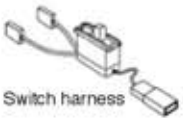
OTHER ITEMS REQUIRED

RADIO SET

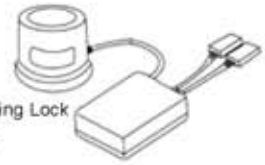

Transmitter
(helicopter type, 6 or more channels)

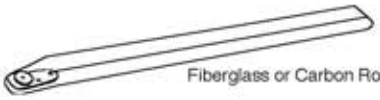

Receiver


Battery


Switch harness


High Speed/Torque Servo x 4
Rudder Servo x 1


Heading Lock Gyro

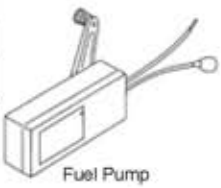

Fiberglass or Carbon Rotor Blade

ENGINE


Heli Engine (90size)
9609 PRO-90H(R)

Glow Plug

Glow Fuel(15%-30%)

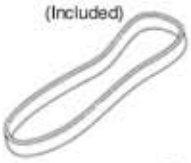

Fuel Pump

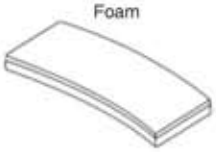

Hi-torque 12V Electric starter

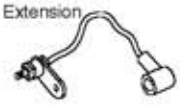
Extended 6mm Hex
Starting Tool

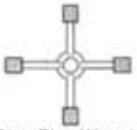
12V Battery


1.5V Glow Starter
(1.2V~1.5V)


Rubber Band
(Included)


Foam


Remote Glow Plug
Extension


Glow Plug Wrench

Engine System

Use a high quality 90 size 2-stroke model helicopter engine, such as the Thunder Tiger TT PRO-90H, OS 91 SZ-H, YS 91 ST, Webra 91, or equivalent. Please beware, some engines may not fit because of their shape and size. The Raptor 90 3D kit comes with a cooling fan hub to fit the TT PRO-90H, OS 91 SZ-H, Webra 91.

We recommend a high quality muffler or tuned exhaust system designed to fit on the left side of the model.

Rotor Blades

It is important to use main rotor blades that are of high quality and suitable for your flying style. If fiberglass or carbon graphite blades are used, the length should be between 680 and 710 mm. Blade weight should be between 170 and 200 grams.

Starter System

To start the engine, it is necessary to use an electric starter with a 6mm shaft extension. The starter and the 6 mm extension are available from Thunder Tiger, the part numbers are No.2675 and No.3801.

Use a strong high torque 12 volt electric starter which is designed for models.

TOOLS REQUIRED FOR ASSEMBLY


Screw Driver

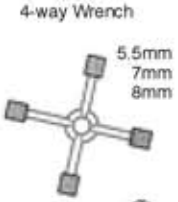

Needle Nose Pliers

5.5mm Wrench


Ball Link Pliers


Nipper


Scissors



Metric
4-way Wrench

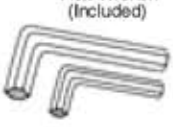

Hobby Knife


Instant Glue


Blue Loctite


Grease

Epoxy


Hex Wrench
(Included)

Socket Drivers

Tools for Assembly

The Raptor 90 3D is designed for easy maintenance using standard hobby tools. Please only use genuine Thunder Tiger parts. Please keep the model clean and well tuned. It will provide you with long lasting pleasure in return.

REPAIR AND REPLACEMENT PARTS

Purchase replacement parts from the hobby shop where you have purchased the Raptor 90 3D. Please contact the Thunder Tiger distributor in your country, and the distributor can tell you where to obtain the parts. For example, in the U.S, all Thunder Tiger products are distributed by Ace Hobby Distributors. On the web site www.acehobby.com, there is a list of all the hobby shops in the USA that can order any Thunder Tiger parts from Ace for you. Technical questions regarding the Raptor will be answered quickly by sending an email to service@acehobby.com or call Technical Support at 949-833-7498. In Europe, Asia and Australia, please contact the distributor in your country.

WARNING

To ensure safety, please read the instruction manual thoroughly before assembly. Radio control helicopters are sophisticated equipment, and not toys. Radio control model helicopters are capable of causing serious bodily injury if not properly assembled or operated. The manufacturer and distributors assume no liability for damages that could occur from the assembly or use of this product. This product is designed for hobby use only. Operating model helicopters requires diligence and skill. The best way to ensure quick and successful learning is to seek help and guidance from accomplished pilots. It is strongly recommended to join the appropriate radio control modeling governing society in your country. For example, in the United States, it is strongly encouraged to join the Academy of Model Aeronautics. AMA is a nonprofit organization that provides members in the United States with liability insurance and monthly modeling magazines. For further information or to find a model helicopter club, please contact AMA at:

Academy of Model aeronautics
515 East Memorial Drive
Muncie, IN 47302
USA
(317) 287-1256

We also encourage you to subscribe to different radio control helicopter magazines and learn about RC flying events, new flying techniques, safety procedures, and hints. Rotory Modeler is a bi-monthly and Model Helicopter Techniques is a quarterly newsletter published in the USA. Model Helicopter World is a month magazine published by Traplet Publication in England and sold worldwide. Rotor is a monthly German magazine. Helico is a Swiss quarterly magazine.

ATTENTION

- We are unable to accept replacement or return of this model after it has been used or assembly has begun.
- It is legally prohibited to duplicate or reprint this manual in any format without a written permission from the manufacturer.
- The manufacturer has the right to make changes to this model or instruction without notice.
- We have done our best to the accuracy of information in this manual. If you are aware of any mistake, we welcome you to notify us.
- We will not accept any responsibility for any accident, breakdown, fault or trouble caused by improper usage of this model. Please thoroughly inspect your model and range check the radio before flight. Please keep the model in its best condition in order to enjoy it.
- This model does not include all the items necessary for flying, such as engine, serevos, gyro...etc.
- It is difficult for beginners to fly RC helicopters by themselves. It is highly recommended that beginners seek the help of experienced RC helicopter pilots. We recommend beginners start with an inexpensive model such as the Thunder Tiger Raptor 30 that is also designed by Mr. Taya.
- RC helicopters are not toys. The manufacturer does not assume the liability for any property or bodily damage caused by the model or the operator.

■ In order to enjoy a safe and enjoyable experience, please read the manual carefully and completely understand the helicopter structure and operation before the first flight.

■ Read the warnings to avoid injuries to you and others.

WARNING – The following could cause heavy injury or death if used incorrectly.

- Keep the model away from other people or animal when starting the engine.
- Do not fly any model helicopter near or above people or cars. Models can sometimes lose control due to pilot or mechanical failure.

WARNING – The following could also cause serious injury or death if not careful.

- Take precaution with model fuel. Model engine glow fuel is highly flammable.
- Please check the model carefully before each flight. Make sure that nothing has loosened up or come apart.
- Make sure everything moves freely without binding or excessive friction.
- Do not operate the model in rain, snow, thunderstorm, or adverse weather.

WARNING – The following could also cause serious injury or death if not careful.

- Please make sure that your radio frequency is not used before flight. If someone else is flying with the same frequency as your radio, do not turn on your transmitter. Otherwise, it can cause a crash and even bodily and property damages.
- Please monitor the fuel level during flight and land before running out of fuel.
- Before each flight, please check that all servos and controls move properly.
- Do not modify any parts or use other than genuine Thunder Tiger parts.
- Do not fly in places that are forbidden by law.
- Use Loctite on screws that do not use a locknut.
- When operating the model, please beware that no loose cloth or jewelry can get entangled in the model helicopter.
- Make sure the transmitter and receiver switches are on before starting the engine.
- Do not touch the engine or the muffler right after flying because they are very hot.
- Do not use this model for anything other than hobby.

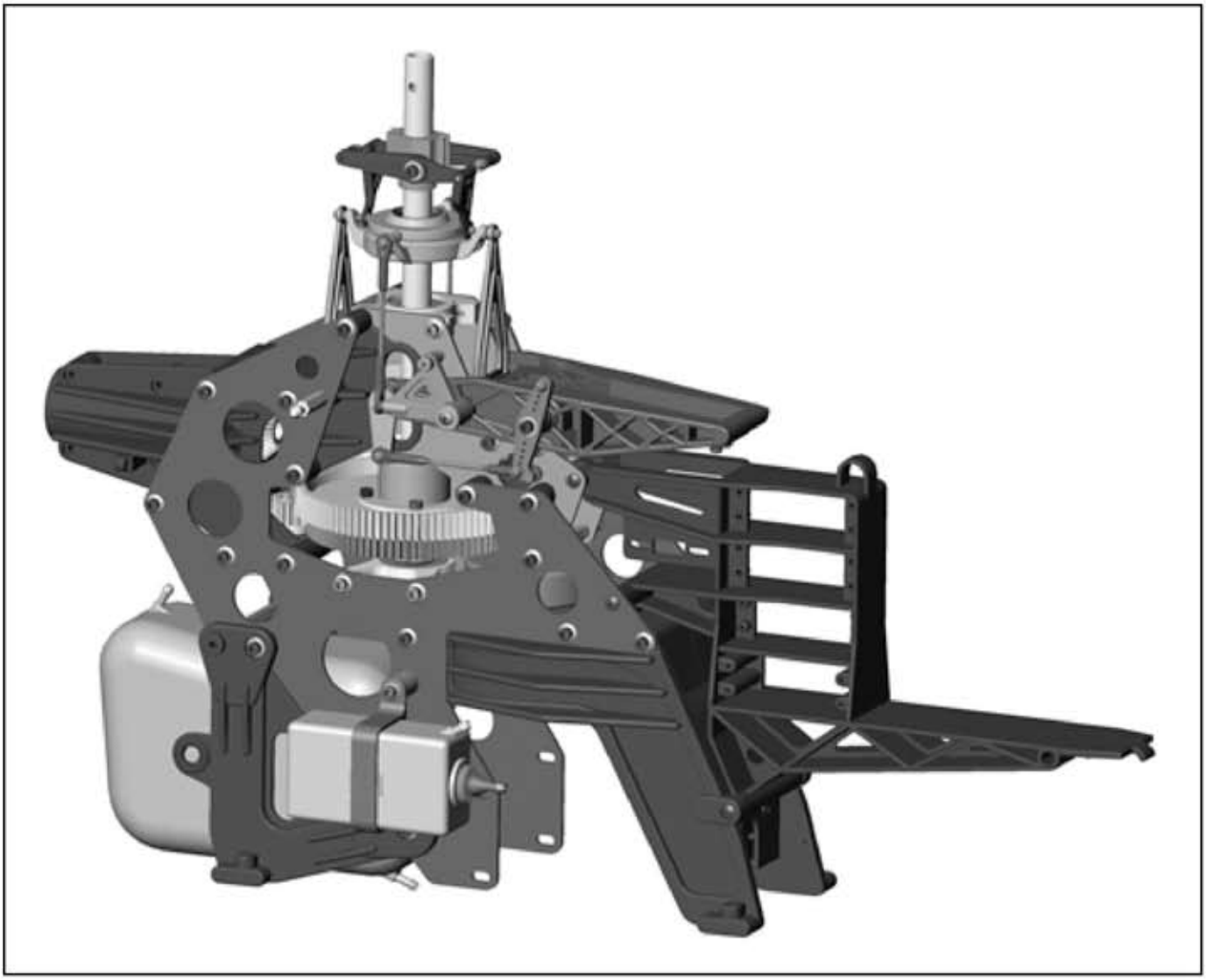
WARNING – The following damages can happen to the model.

- Do not leave the model in a car for a long time. The heat in the summer or the cold in the winter and the humidity can cause damage to the model.
- Be careful and watch the sharp edges and corners on the model.

BUILDING HINT – The instruction is divided into six assembly chapters: Main Frame, Rotor Head, Tail Rotor, Final Assembly, Radio Installation, and Settings. There are many major assembly steps in each chapter, please follow the instruction to do each " Subassembly" first, then combine the subassemblies into a major assembly.

1

MAIN FRAME ASSEMBLY



For the kit, parts are bagged according to each major assembly and are labeled "Bag A, Bag B, etc." The heading for each assembly indicates which bag to open. As a good practice, only open up the bag that you need for the particular assembly. Check the parts in that bag against the parts list shown for each assembly as well as each sub-assembly to make sure there are no missing parts. To prevent losing small hardware, please empty the small nuts and bolts and parts into small plastic trays on your work table. At the end of each major assembly, there should be no left over parts.

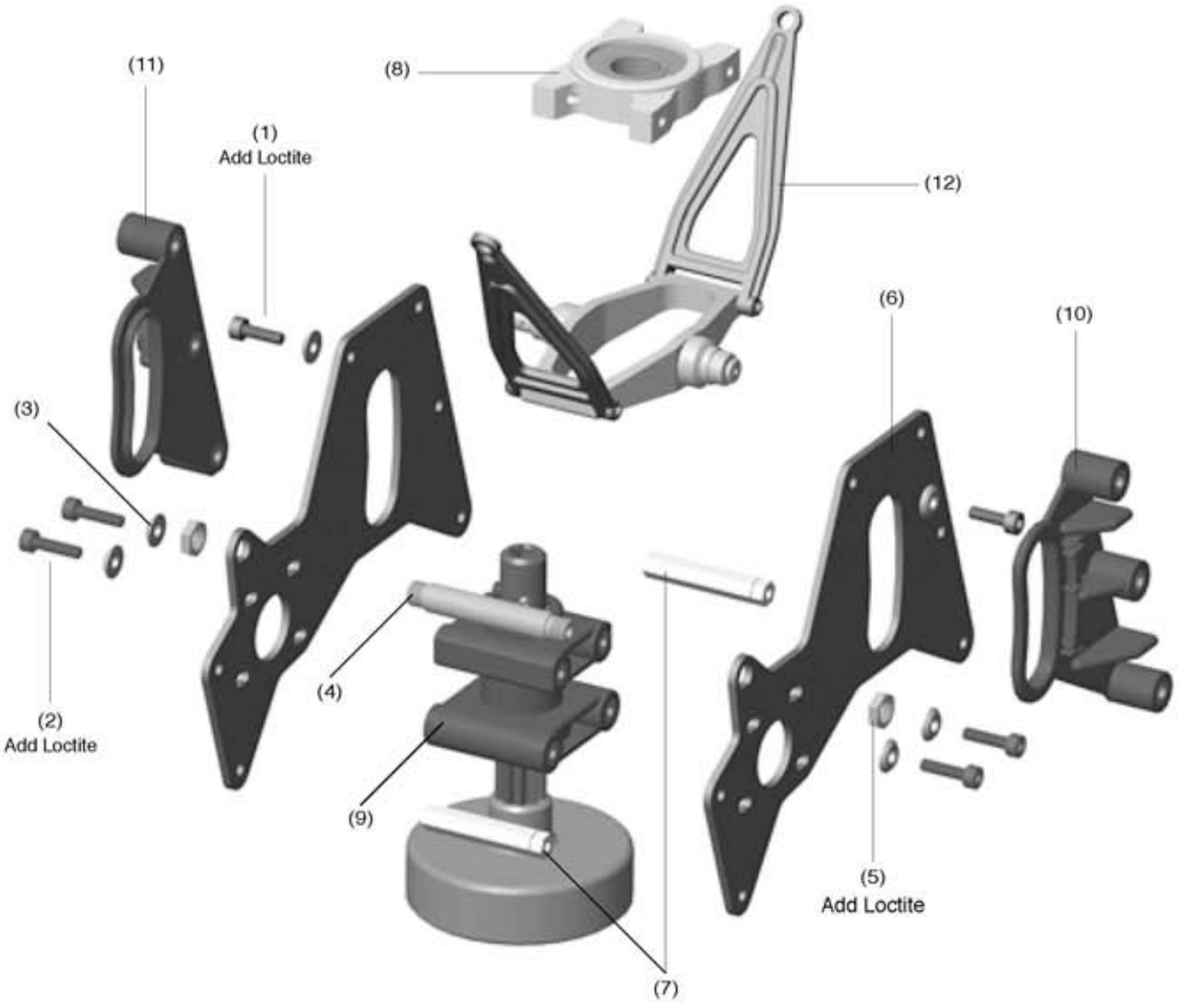
1-1 Upper Frame Assembly BAG A

No.	Material No.	Description	Qty.
1	HMC3-10B	Socket Screw M3x10	2
2	HMC3-12B	Socket Screw M3x12	4
3	BK0087	Washer d3xD8x1.4	6
4	BK0393	Pitch Frame Cross Member	1
5	BK0394	Pitch Frame Cross Member Nut	2
6	BK0375T	Upper Frame	2

No.	Material No.	Description	Qty.
7	BK0659	Frame Spacer M	2
8	BV0869	Metal Upper BRG Block	1
9	1-1-1	Pinion Gear Subassembly	1
10	1-1-2	Pitch Guide L Subassembly	1
11	1-1-3	Pitch Guide R Subassembly	1
12	1-1-4	Elevator Control Arm Subassembly	1

Assemble the upper main frames by starting with the two Metal Upper Frames. The Pinion Gear Subassembly must be assembled first according to Figure 1-1-1. Next insert three hex-shape frame spacers into the plastic Pitch Guide according to Figure 1-1-2 and 1-1-3. Assemble the Elevator Control Arm subassembly according to 1-1-4. Insert it in between the two Upper Frames. The metal Elevator Control Arm is not symmetrical. The side with the longer profruding round knob should be on the right side of the helicopter. Then attach the other subassemblies to the Upper Frames. Locate Hex Wrenches in BAG L which you need for assembly.

Please add a tiny drop of non-permanent type Loctite on the tip of all bolts before screwing them into the hex shaped aluminum frame spacers. Never use too much Loctite, otherwise it will become nearly impossible to remove later on for servicing. Only use the non-permanent type of Loctite. If encountering difficulty in removing any bolt that was locked up by Loctite, heat up the head of the screw or bolt with the tip of a hot soldering iron, it will help soften the cured Loctite.



1-1-1 Pinion Gear Subassembly

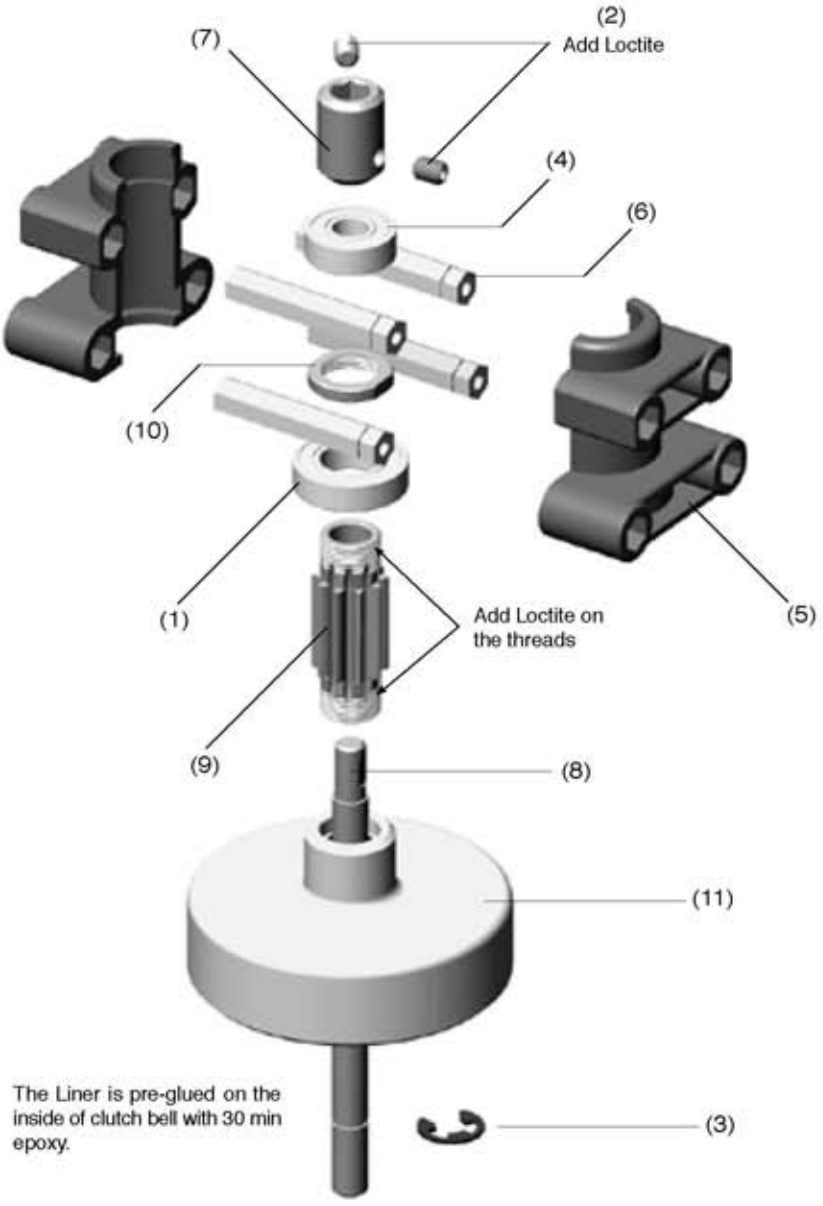
No.	Material No.	Description	Qty.
1	HMV6800ZZY	BRG d10xD19x5	1
2	HME4-5B	Set Screw M4x5	2
3	HMS5	E Ring M5x8	1
4	HMV696Z	BRG d6xD15x5	1
5	BK0388	Clutch BRG Case	2
6	BK0659	Frame Space M	4
7	BK0594	Starter Coupling	1
8	BK0592	Starter Shaft	1
9	BK0422	Drive Pinion 11T	1
10	BK0366	Pinion Gear Nut	1
11	BV0522-2	Clutch Bell Set	1

When installing pinion gear, add a small drop of Loctite to the threads. Make sure not to get Loctite on lower clutch bell bearing.

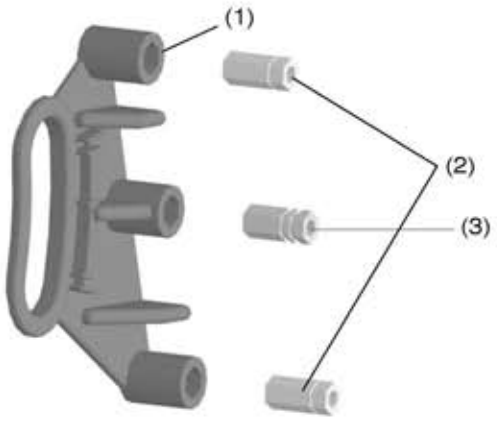
Important:

Please see the section 1-6 for pinion gear selection to suit your flying performance.

For 90 class engine, we recommend the 11 teeth pinion for 3D flying and for beginners, and the 12 teeth pinion for F3C flying.



1-1-2 Pitch Guide L Subassembly

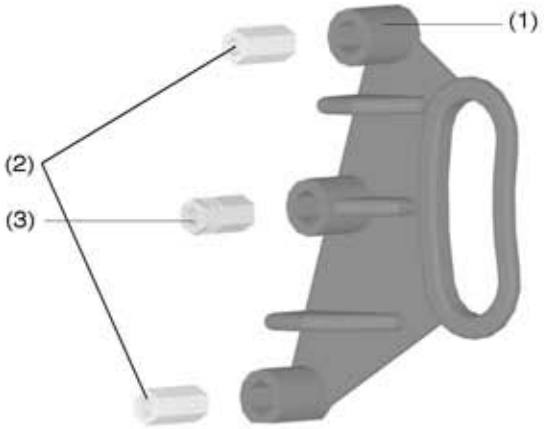


No.	Material No.	Description	Qty.
1	BK0384	Pitch Guide Collar L	1
2	BK0658	Frame Spacer S	2
3	BK0693	Cross Member	1

Note:
The (3) spacer with threads is supposed to be located at middle position to fit the Body Fitting Post.

1-1-3 Pitch Guide R Subassembly

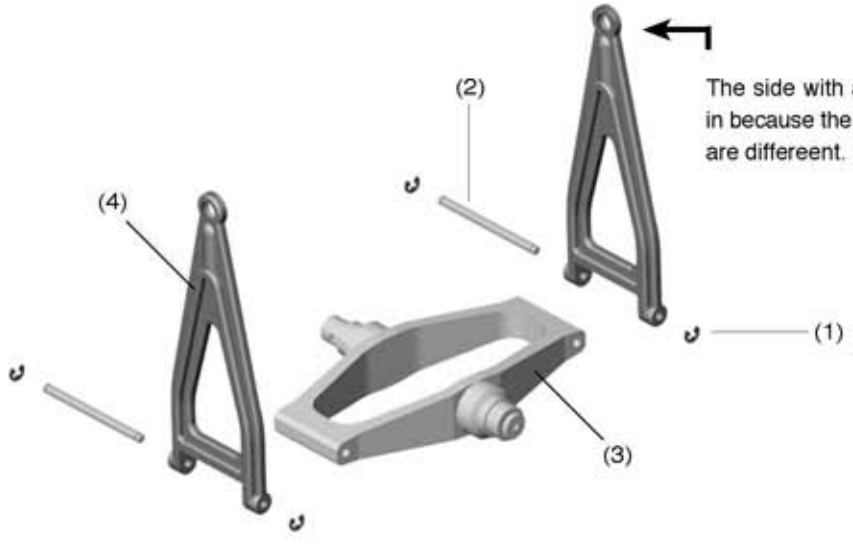
No.	Material No.	Description	Qty.
1	BK0385	Pitch Guide Collar R	1
2	BK0658	Frame Spacer S	2
3	BK0693	Cross Member	1



Note:
The (3) spacer with threads is supposed to be located at middle position to fit the Body Fitting Post.

1-1-4 Elevator Control Arm Subassembly

No.	Material No.	Description	Qty.
1	HMS15	E Ring	4
2	BK0880	Elevator Link Shaft	2
3	BK0455	Metal Elevator Control Arm	1
4	BK0663	Elevator Arm Link	2



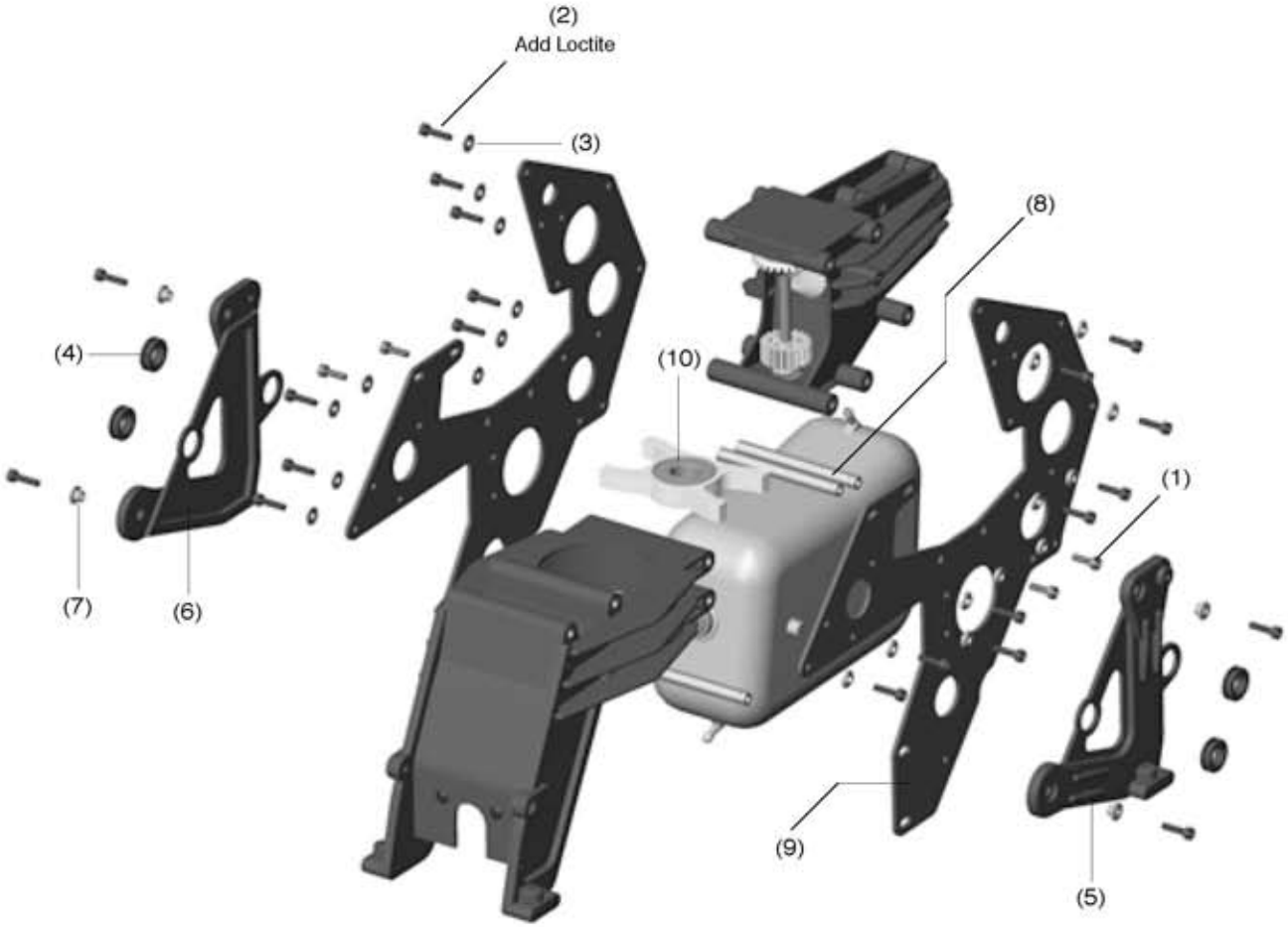
The side with a number should face in because the opening on both sides are differeent.

1-2 Lower Frame Assembly BAG B

No.	Material No.	Description	Qty.
1	HMC3-10B	Socket Screw M3x10	4
2	HMC3-12B	Socket Screw M3x12	21
3	BK0087	Washer d3xD8x1.4	22
4	BK0274	Tank Rubber Grommets	4
5	BK0380	Rear Frame L	1
6	BK0381	Rear Frame R	1
7	BK0629	Washer	4

No.	Material No.	Description	Qty.
8	BK0660	Frame Spacer L	3
9	BK0376T	Lower Metal Frame	2
10	BV0870	Metal Lower BRG Block	1
11	1-2-1	Tail Drive Unit Subassembly	1
12	1-2-2	Cooling Fan Casing Subassembly	1
13	1-2-3	Fuel Tank Subassembly	1

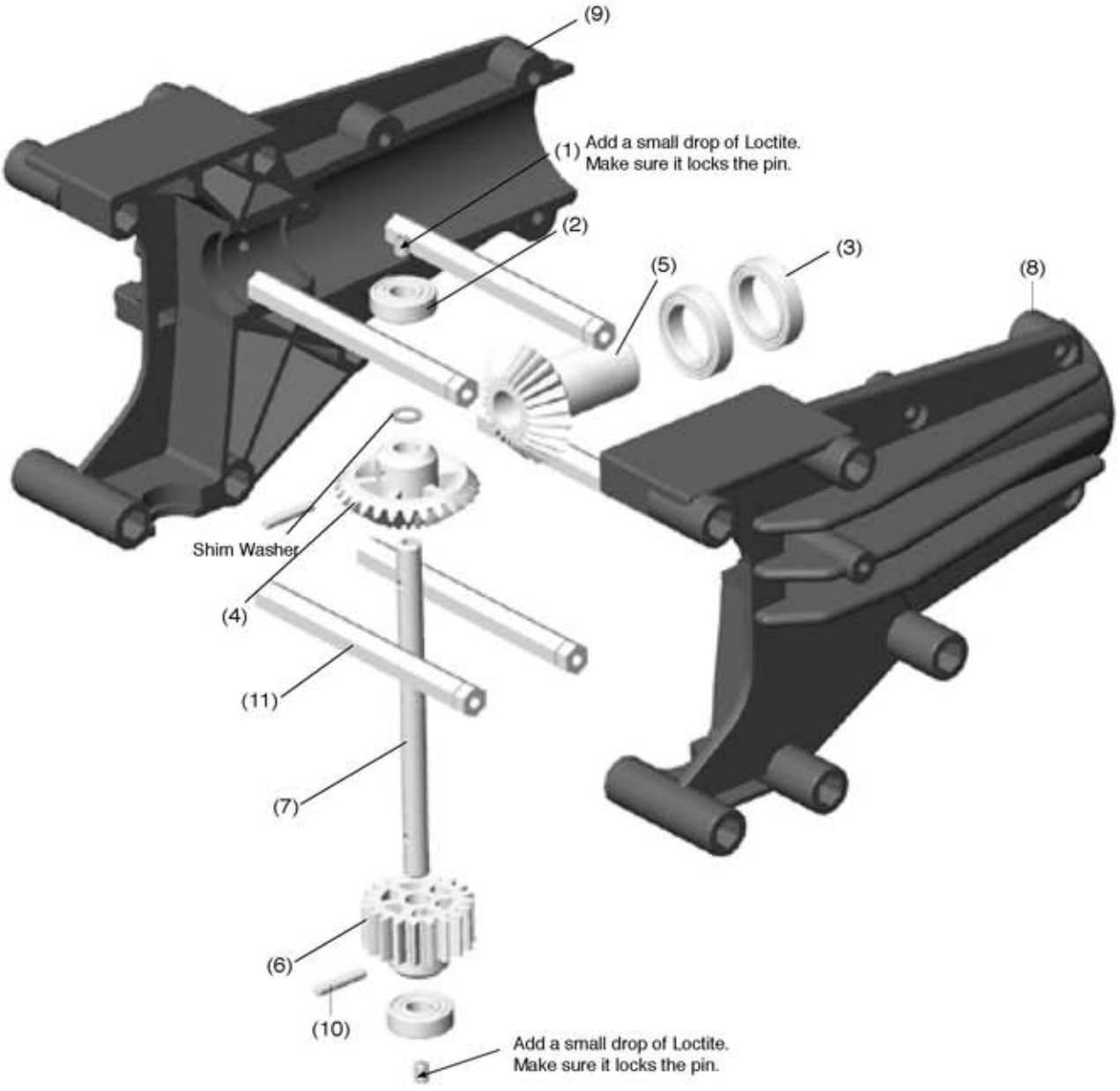
Please complete subassembly steps 1-2-1 through 1-2-3 first. Then attach the subassemblies to the two Lower Frames. Note that the Metal Lower BRG is installed with the bearing open side facing up. Please add a small drop of Loctite on every bolt before screwing it into the aluminum hex spacer. Do not apply Loctite to the bolts which are going to secure the Lower BRG Block and Engine Mount at this moment.



1-2-1 Tail Drive Unit Subassembly

No.	Material No.	Description	Qty.
1	HME3-4B	Set Screw M3x4	2
2	HMV1350	BRG d5xD13x4	2
3	HMV6701ZZ Y	BRG d12xD18x4	2
4	BK0362	Tail Drive Bevel Gear A	1
5	BK0363	Tail Drive Bevel Gear B	1
6	BK0364	Tail Drive Pinion	1
7	BK0365	Tail Drive Gear Shaft	1
8	BK0382	Tail Boom Bracket L	1
9	BK0383	Tail Boom Bracket R	1
10	BK0414	Pin 2x12	2
11	BK0660	Frame Spacer L	5

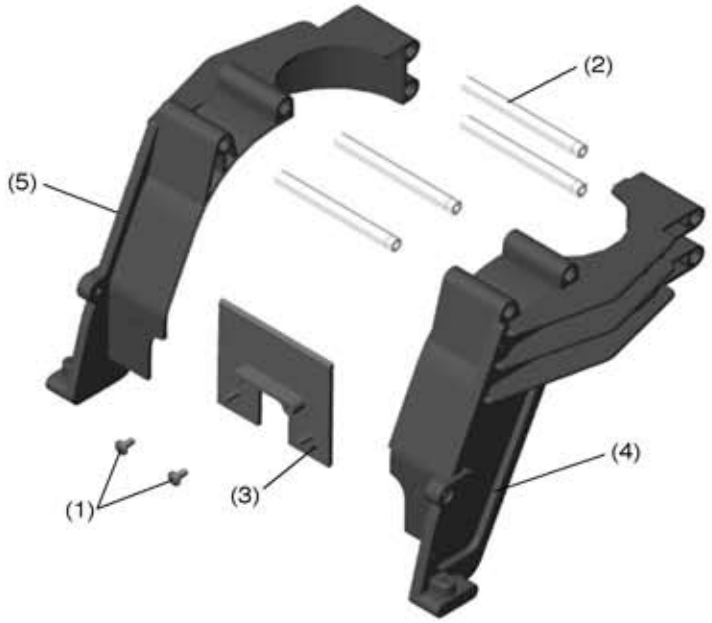
Install BK0364 and BK0362 onto BK0365 Tail Gear Drive Shaft. Then insert the two Pins and secure them with two M3x4 Set Screws. Add a tiny drop of Loctite on the set screw thread before inserting them. Always use a very small amount of Loctite liquid on the thread, otherwise it may be nearly impossible to remove the set screws in the future for servicing. After installing the two M3x4 set screws (No. 1), try to push on the 2x12 pins with a small Allen wrench to make sure the set screws have locked the pins in place securely. Install the four ball bearings and the hex shaped Frame Spacers according to the drawing. Before closing the two halves of the Tail Boom Brackets, please check the gear mesh between gears No. 4 and No. 5. If there exists too much freeplay, add some 5 mm i.d. washers on top of gear No. 4. (The 5 mm i.d. washers are provided in BAG G).



1-2-2 Cooling Fan Casing Subassembly

No.	Material No.	Description	Qty.
1	HSE3-6B	Self-Tapping Screw M3x6	2
2	BK0660	Frame Spacer L	4
3	BK0662	Cooling Fan Baffle	1
4	BK0665	Fan Casing L	1
5	BK0666	Fan Casing R	1

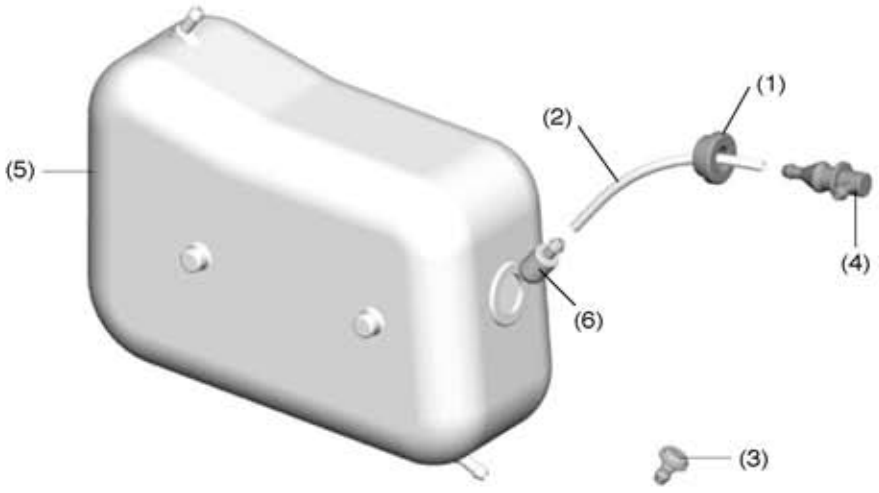
The servo tray and cooling fan shrouds on the Raptor 90 are different from the Raptor 60 in order to accommodate the full head sink on the O.S 91. engine.
If using T.T 90, Y.S 91 or Webra 91 engine, make sure to install the fan shroud baffle with two self-tapping screws. This will ensure optimal cooling of your engine head.



1-2-3 Fuel Tank Subassembly

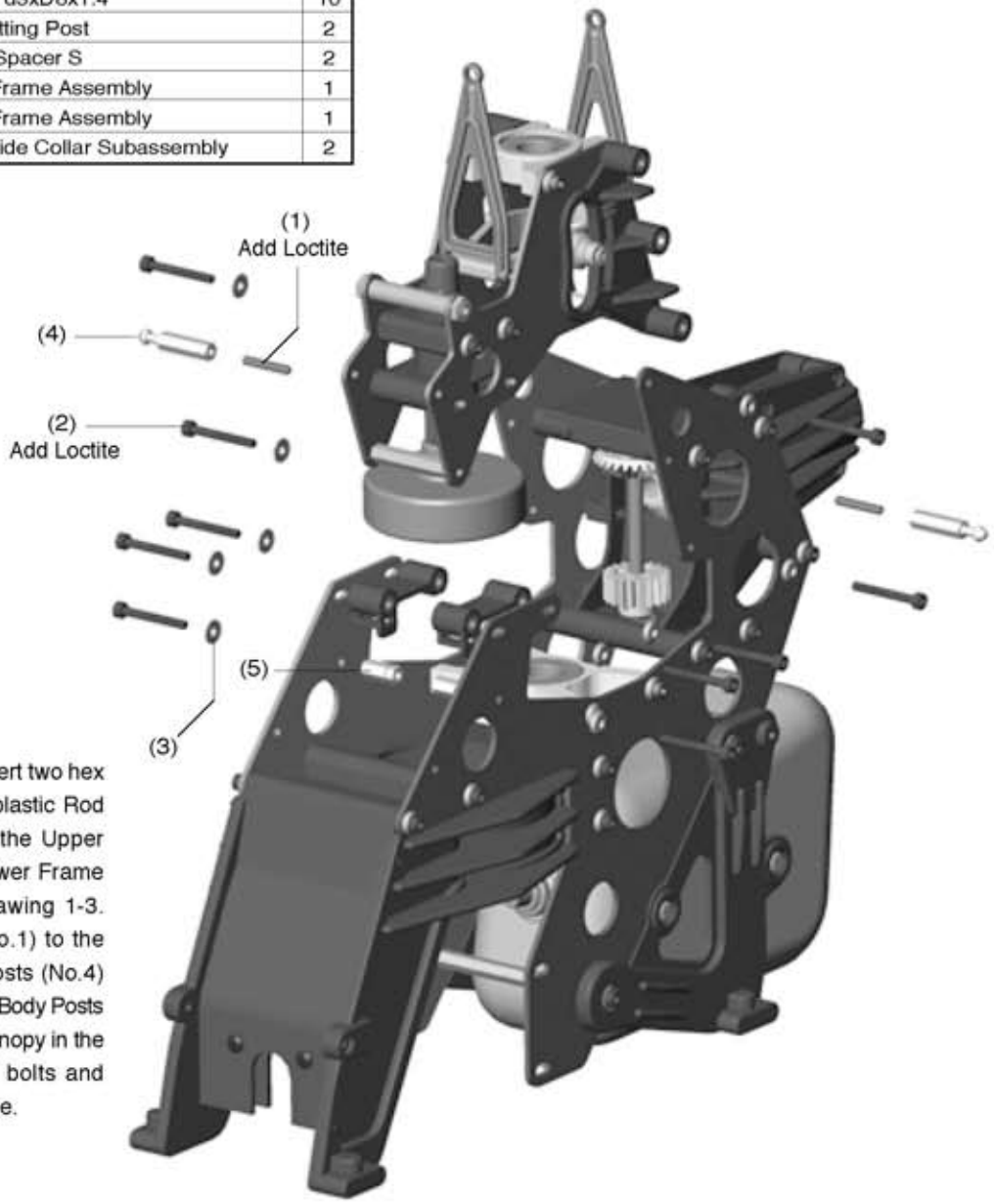
No.	Material No.	Description	Qty.
1	BK0062	Fuel Tank Stopper	1
2	BB0374	Silcon Tube (L=105mm)	1
3	BK0445	Fuel Plug	1
4	BK0463	Fuel Tank Nipple	1
5	BK0503-1	Fuel Tank	1
6	BE1867	Clunk Weight	1

The fuel tank comes assembled from the factory because every tank has been checked for leak. If you were to take the tank apart here is how to put it back together. Install the silicone fuel line to the Fuel Nipple. Then add the rubber fuel tank stopper and the clunk weight. The stock silicone fuel line is very soft and thin which is designed to allow the clunk to pick up fuel easily during 3-D aerobatics. The pickup line should be inspected and replaced if necessary every month, otherwise when it becomes soggy it can break off. A thicker silicone line maybe substituted but make sure the clunk will reach the bottom when moving the fuel tank to all different orientations.



1-3 Main Frame Assembly BAG C

No.	Material No.	Description	Qty.
1	HME3-18.5B	Set Screw M3x18.5	2
2	HMC3-25B	Socket Screw M3x25	10
3	BK0087	Washer d3xD8x1.4	10
4	BK0103	Body Fitting Post	2
5	BK0658	Frame Spacer S	2
6	1-1	Upper Frame Assembly	1
7	1-2	Lower Frame Assembly	1
8	1-3-1	Rod Guide Collar Subassembly	2



As show in Figure 1-3-1, insert two hex Frame Spacers S into the plastic Rod Guide Collars. Then join the Upper Frame Assembly to the Lower Frame Assembly according to drawing 1-3. Secure the Set Screws (No.1) to the frames, and fit the Body Posts (No.4) to the Set Screews. The two Body Posts will be used to secure the canopy in the future. Add Loctite on all bolts and inside BK0103 threaded hole.

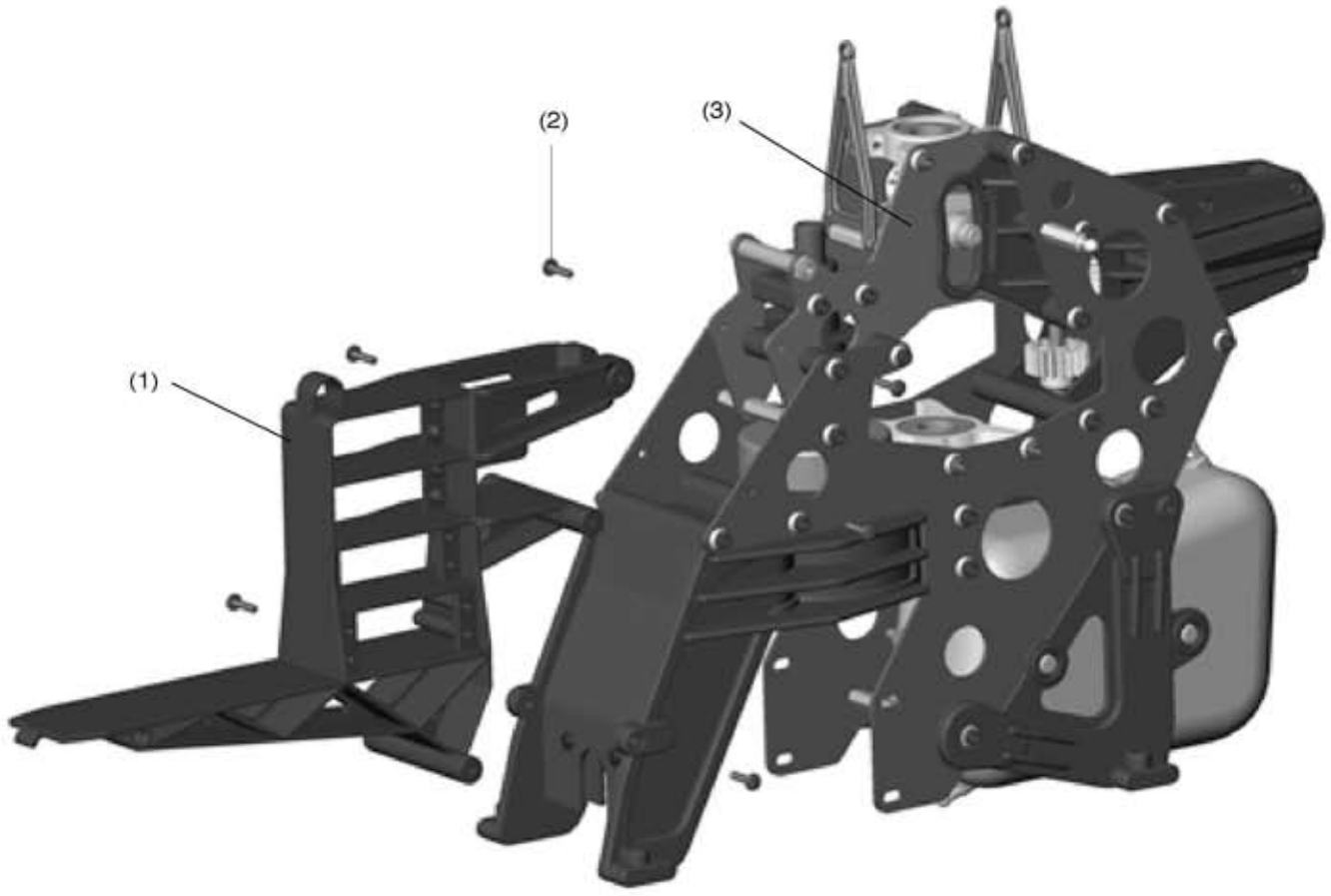
1-3-1 Rod Guide Collar Subassembly

No.	Material No.	Description	Qty.
1	BK0389	Rod Guide Collar	1
2	BK0658	Frame Spacer S	2

1-4 Installation of Servo Frame BAG C

No.	Material No.	Description	Qty.
1	BK0667	Servo Frame	1
2	HSE3-12B	M3x12 Self-Tapping Screw	6
3	1-3	Main Frame Assembly	1

Install the one-piece servo frame with six self-tapping screws. Do not use Loctite when attaching self-tapping screws to plastic parts. Loctite is only for threading metal into metal parts.



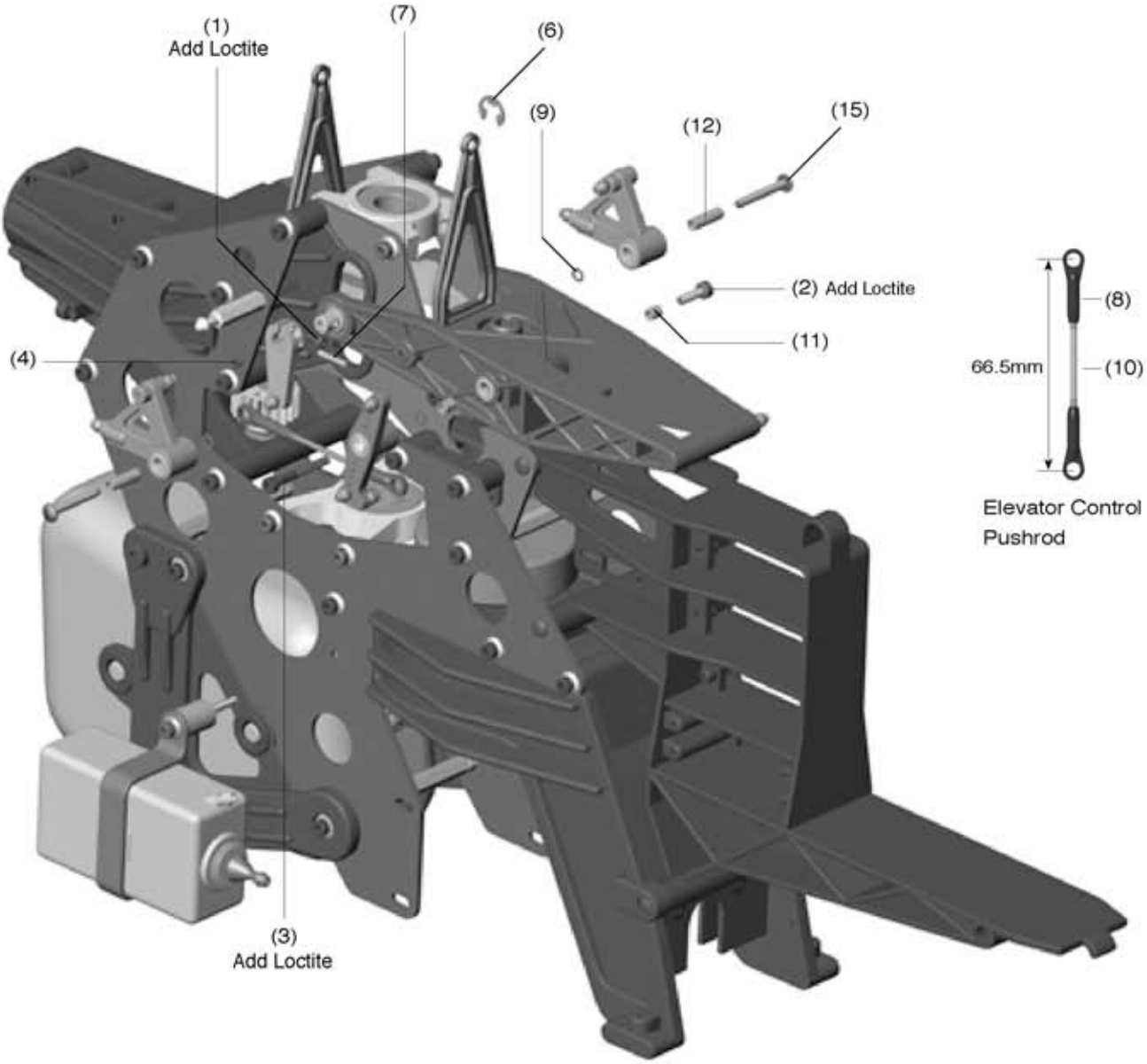
1-5 Installation of Pitch Frame

BAG D

No.	Material No.	Description	Qty.
1	HMC2-6B	Socket Screw M2x6	1
2	HMC3-10B	Socket Screw M3x10	1
3	HMC3-25B	Socket Screw M3x25	1
4	HME3-3B	Set Screw M3x3	1
5	HMJ3-20N	Self-Tapping Screw M3x20	2
6	HMS4	E Ring	1
7	HMY2-10	Pin 2x10	1
8	BK0086	Ball link 4.8x20	2
9	BK0088	Washer d3xD5x0.5	3

No.	Material No.	Description	Qty.
10	BK0093	Link Rod 2x46	1
11	BK0407	Collar d3xD4x4.5	2
12	BK0410	Collar d3xD4x13	2
13	1-5-1	Aileron Lever Subassembly	1
14	1-5-2	Metal Elevator Parallel Lever Subassembly	1
15	1-5-3	Elevator Control Lever Subassembly	1
16	1-5-4	Pitch Control Frame Subassembly	1
17	1-5-5	Header Tank Subassembly	1

Please complete subassemblies 1-5-1 through 1-5-5 first, then add them to the Main Frame. Fit the Pitch Control Frame Subassembly. Attach the E Ring on the left side of the Metal Elevator Control Arm. Then fit the Elevator Control Lever to the right side, insert the pin and fix it with a set screw. Secure the Pitch Control Frame with a M3*10 Socket Screw and a collar on the left side. And attach the Elevator Push Pull Lever to the right side of the Pitch Control Frame as shown. Adjust the two bolts so that the Pitch Control Frame can move freely without excessive play. Finally, add the two plastic Aileron Levers and the 66.5mm elevator pushrod. Add the Washers (BK0088) to make sure that the Aileron Lever and the Metal Elevator Parallel Lever will not touch each other during operation.

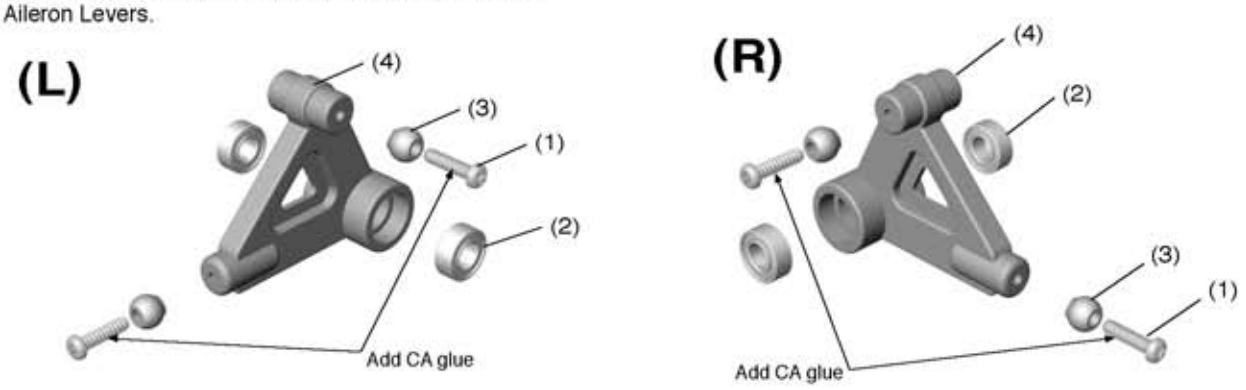


1-5-1 Aileron Lever Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	Self-Tapping Screw M2x10	2
2	HMV840ZZY	BRG d4xD8X3	2
3	BK0075	Link Ball 4.8	2
4	BK0340	Aileron Control Arm	1

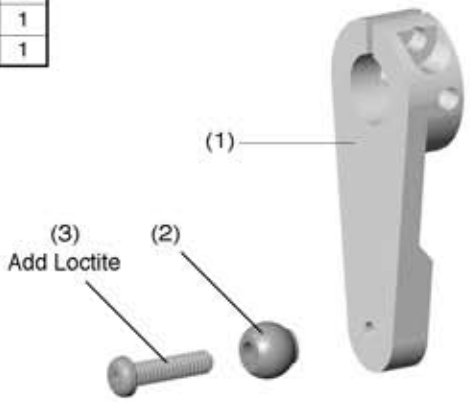
No.	Material No.	Description	Qty.
1	HMJ2-10N	Self-Tapping Screw M2x10	2
2	HMV840ZZY	BRG d4xD8X3	2
3	BK0075	Link Ball 4.8	2
4	BK0340	Aileron Control Arm	1

Add a tiny drop of thick CA glue at the tip of the M2x10 self-tapping screw (No. 1) before screwing it into the Aileron Levers.



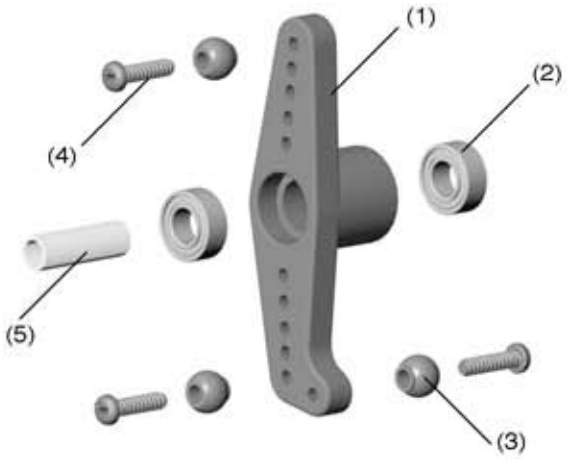
1-5-2 Metal Elevator Parallel Lever Subassembly

No.	Material No.	Description	Qty.
1	BK0876	Elevator Control Arm	1
2	BK0075	Link Ball φ4.8	1
3	HMF2-8N	Philip Machine Screw M2x8	1



1-5-3 Elevator Control Lever Subassembly

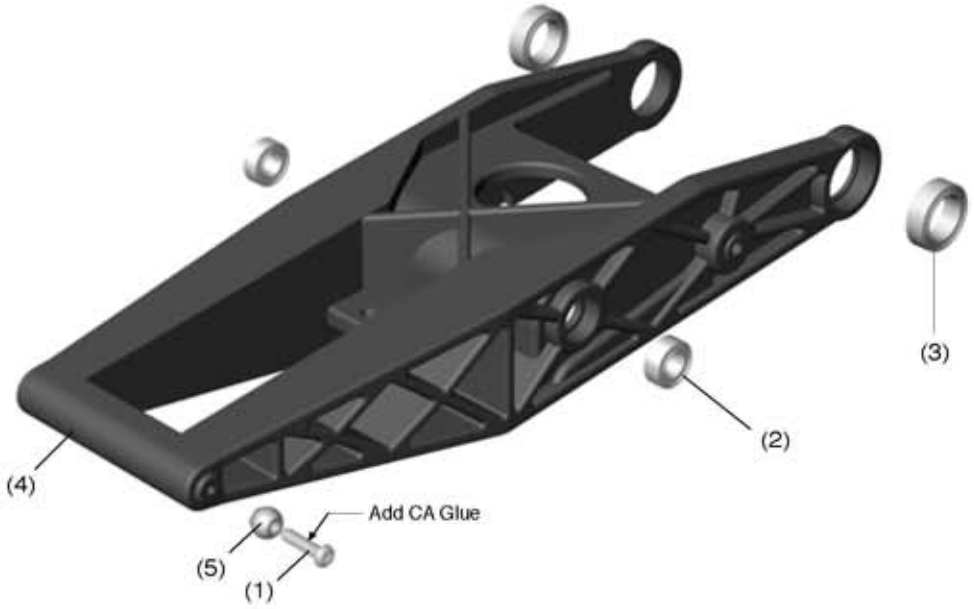
No.	Material No.	Description	Qty.
1	BK0882	Elevator Push Pull Lever	1
2	HMV840ZZY	BRG d4xD8x3	2
3	BK0075	Link Ball φ4.8	3
4	HMJ2-8N	Selfing-Tapping Screw M2x8	3
5	BK0410	Collar d3xD4x13	1



1-5-4 Pitch Control Frame Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	1
2	HMV840ZZY	BRG d4xD8x3	2
3	HMV1280ZZY	BRG d8xD12x3.5	2
4	BK0336	Pitch Frame	1
5	BK0075	Link Ball φ 4.8	1

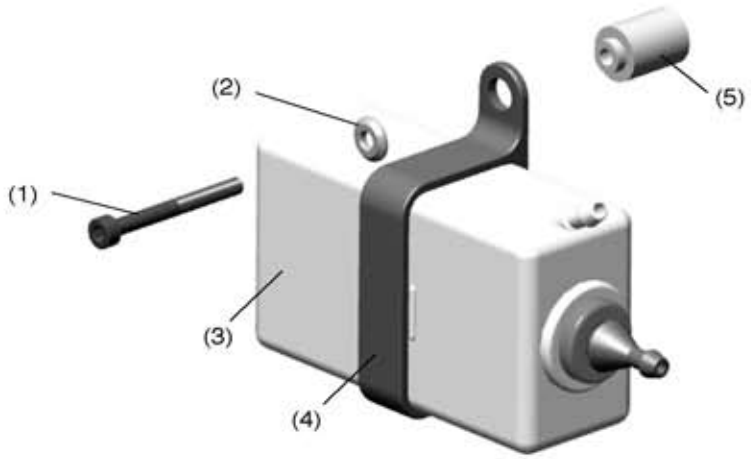
Optional: add a tiny drop of thick CA on the outside rim of the fovr ball bearings before inserting them into the plastic Pitch Frame. Be careful not to get any glue into the ball bearings. Add a tiny drop of thick CA glue at the tip of the M2x10 self-tapping screw (No. 1) before screwing it into the Pitch Frame.



1-5-5 Header Tank Subassembly

No.	Material No.	Description	Qty.
1	HMC3-25B	Socket Screw M3x25	1
2	BK0087	Washer d3xD8x1.4	1
3	BV0502	Header Tank	1
4	BK0506	Tank Mount	1
5	BK0698	Header Tank Supporter	1

The Raptor 90 3D kit includes a header fuel tank that can be attached to the right of the side frame.



1-6 Installation of Main Shaft BAG E

No.	Material No.	Description	Qty.
1	BK0093	Link Rod 2x46	2
2	BK0086	Ball Link 4.8x2.0	4
3	BK0547	Hardened Main Shaft	1
4	BK0234	Lock Ring	1
5	HSA3-6B	Button Head Socket Screw M3x6	2

No.	Material No.	Description	Qty.
6	HMM4B	Lucknut M4	1
7	BK0617	Bolt M4x25	1
8	BV0504	Metal Swashplate	1
9	1-6-1	Washout Subassembly	1
10	1-6-2	Main Gear Subassembly	1

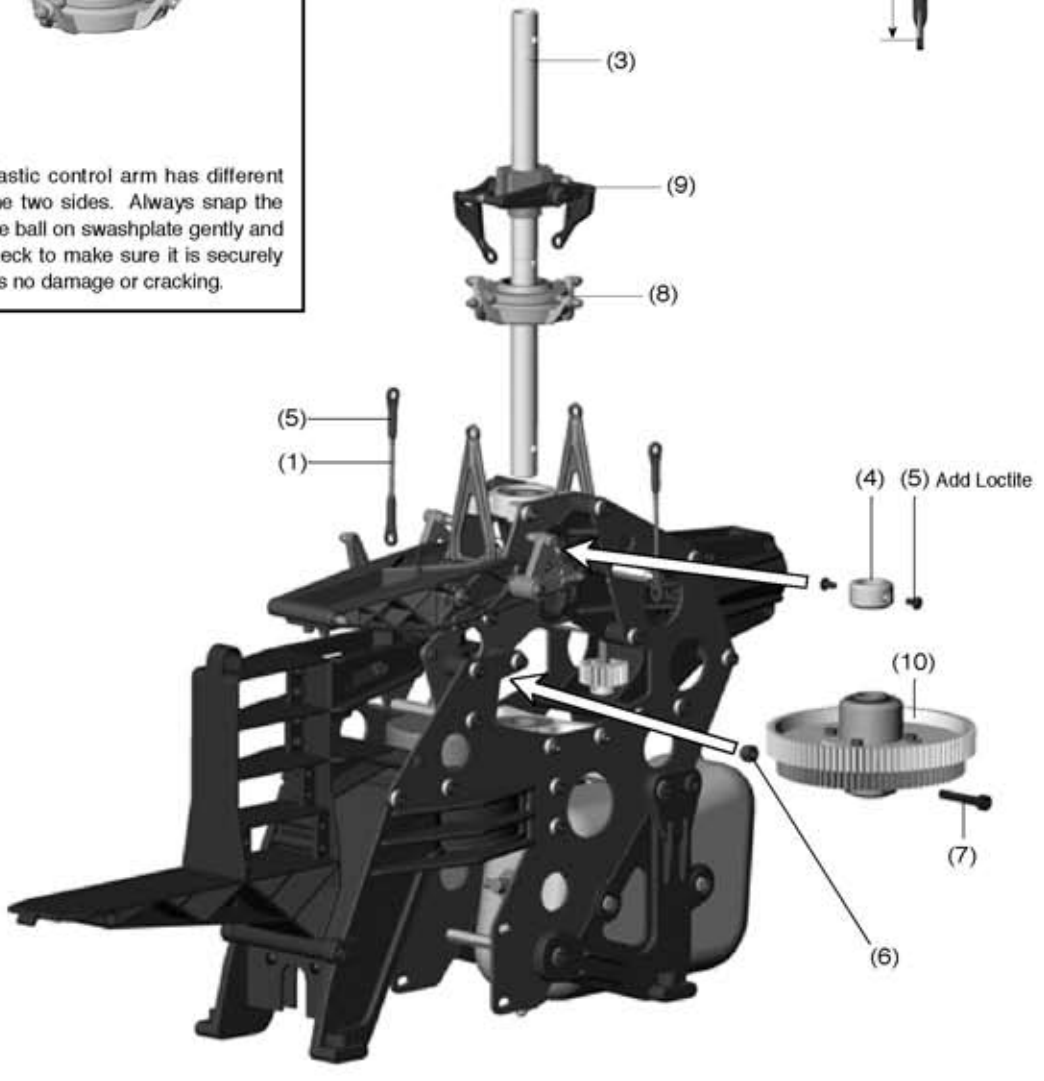
Assemble the constant drive Main Gear Subassembly according to Figure 1-6-2 first. Then build up the Wash Out Subassembly according to 1-6-1. Insert the No.3 Main Shaft into the bearings and then add the No.4 Lock Ring and slide in the Main Gear Subassembly. Add two M3x6 Button Head Screws to the Locking Ring, and the two screws are threaded into the holes on the main rotor shaft.

The locking ring prevents the main shaft from sliding up. Line up the hole on the main gear and the main shaft, then insert M4x25 mm Bolt through them. Place a 4 mm M4 locknut on the other side of the autorotation hub, and then tighten the Bolt. Do not over tighten the Bolt, otherwise the autorotation assembly will be distorted. Loosen the 3mm bolts holding the Upper and lower bearing blocks for the 12mm main shaft. Wiggle the main shaft in the bearing blocks until the main shaft spins freely in the bearings. This ensures the upper and lower bearing blocks are aligned. Push the lower bearing block up until the main shaft has no up and down play. Then tighten the 3mm bolts for the upper and lower bearing blocks.

INSTALLATION OF THE LINKS

Bigger Hole Face to Swashplate

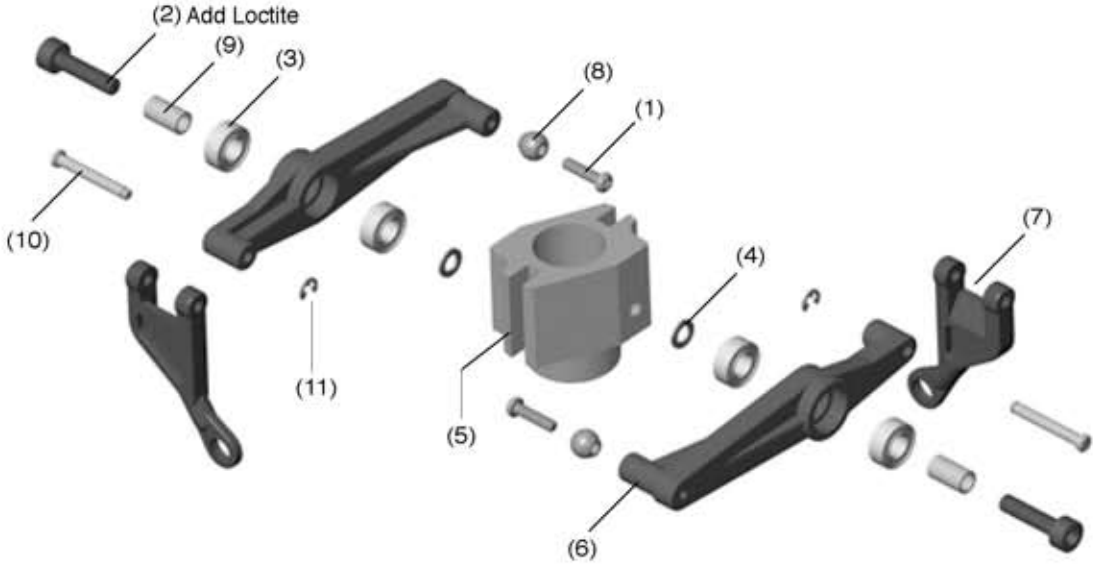
The hole on the plastic control arm has different opening sizes on the two sides. Always snap the bigger opening to the ball on swashplate gently and afterward please check to make sure it is securely attached and there is no damage or cracking.



1-6-1 Wash Out Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	2
2	HMC3-12B	Socket Screw M3x12	2
3	HMV840ZZY	BRG d4xD8x3	4
4	BK0088	Washer d3x5x0.5	2
5	BK0472	Washout base	1
6	BK0342	Flybar Control Lever	2
7	BK0343	Washout Link	2
8	BK0075	Link Ball φ4.8	2
9	BK0409	Collar d3xD4x7	2
10	BK0487	Pin	2
11	HMS15	E Ring	2

Insert the pin into the Washout Link. Add a tiny drop of Loctite on the inside and outside of BK0409 Collar which will help give a completely slop free control system. Do not let the Loctite seep into the bearing. Adjust the tightness of the M3x12 bolts so the mixing arms can move freely but without wobble or racheting the ball bearings. Add a tiny drop of thick CA glue at the tip of the M2x10 self-tapping screw (No. 1) before screwing it into the Flybar Control Levers (No. 6).

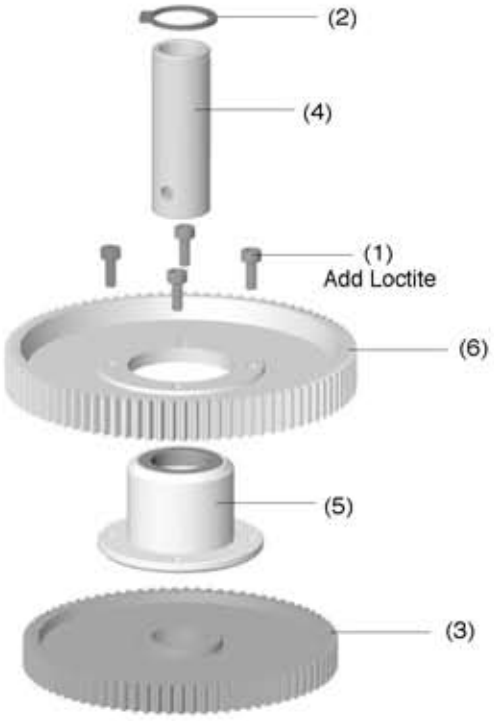


1-6-2 Main Gear Subassembly

No.	Material No.	Description	Qty.
1	HMC3-8B	Socket Screw M3x8	4
2	HMQ16	Retaining Ring	1
3	BK0357	Tail Drive Spur Gear 83T	1
4	BK0359	One Way Clutch Shaft	1
5	BV0368	Auto Rotation Hub	1
6	BK0356	Main Spur Gear 91T	1

It is necessary to add grease inside the one way clutch before your first flight. The clutch might lock up once grease is gone. The one way clutch grease(PV0517) is recommended for this lubrication.

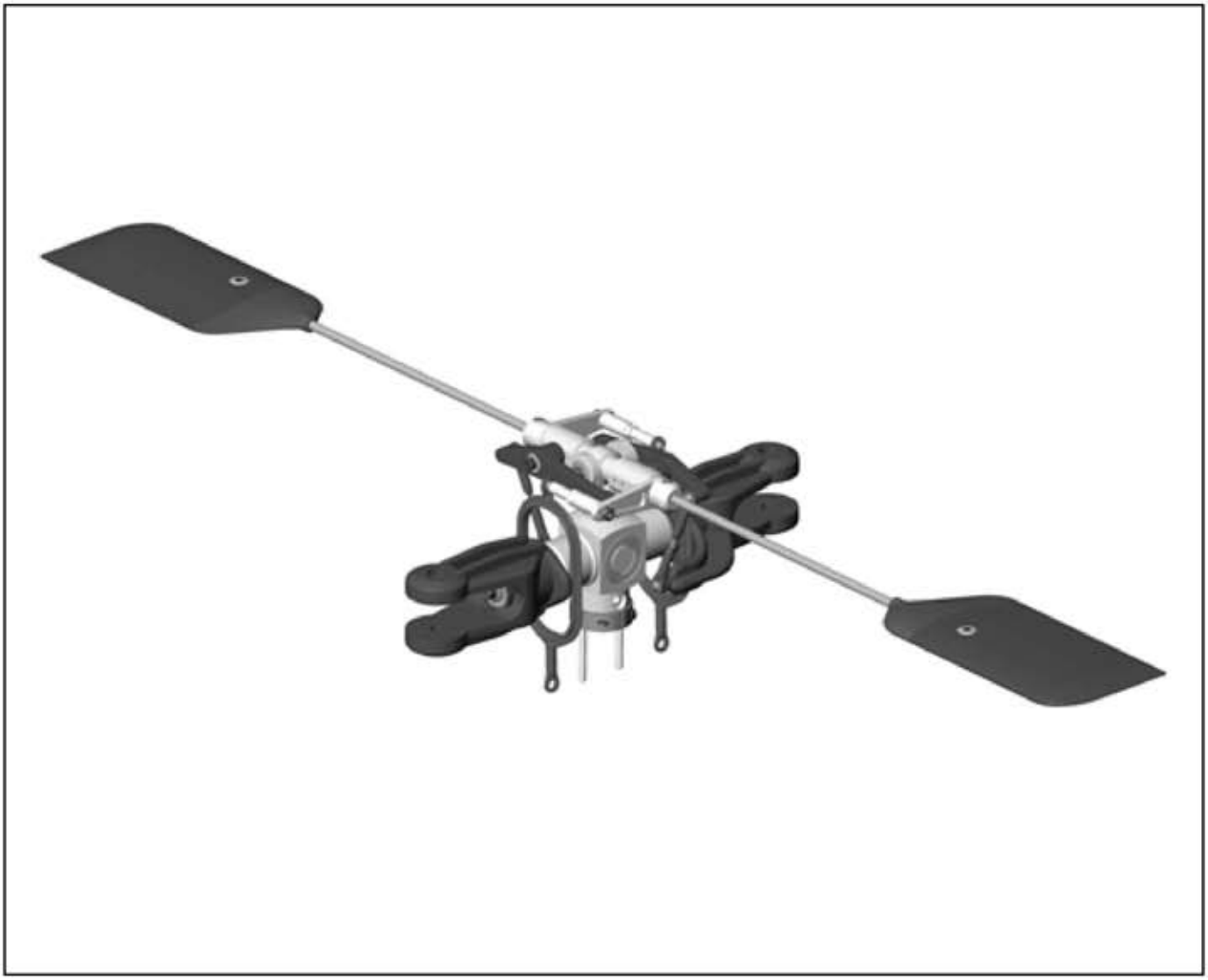
Make sure the inside of Auto Rotation Hub is clean without any dirt before you insert the one way clutch shaft.



PV0517 ONEWAY BEARING GREASE

2

ROTOR HEAD ASSEMBLY

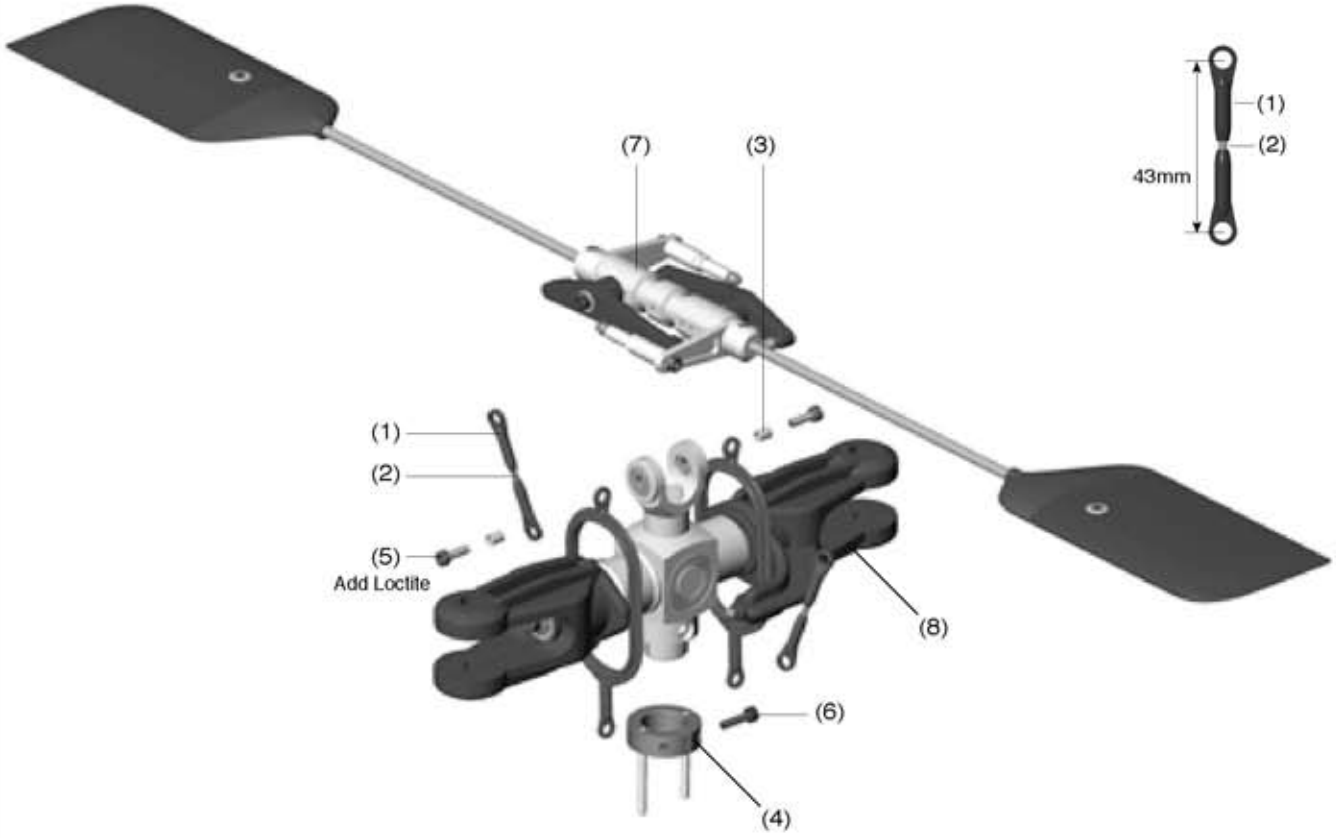


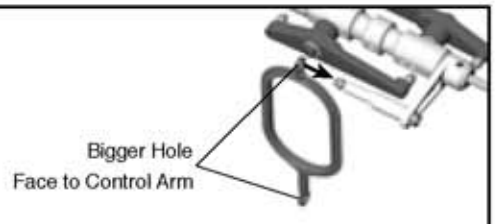
2-1 Metal Rotor Head Assembly BAG F

No.	Material No.	Description	Qty.
1	BK0086	Ball Link φ4.8	4
2	BK0292	Link Rod 2.3x24	2
3	BK0408	Collar d3xD4x5.5	2
4	BV0549	Washout Base Guidance Ring	1

No.	Material No.	Description	Qty.
5	HMC3-10B	Socket Screw M3x10	2
6	HMC3-12B	Socket Screw M3x12	1
7	2-1-1	Flybar Seesaw Subassembly	1
8	2-1-2	Metal Main Rotor Hub Subassembly	1

Make the two pushrods for controlling the blade pitch. The distance 43 mm is measured between the center of two pushrod holes.
Attach the Seesaw Hub of the Control Paddle Assembly to the Main Rotor Head with Socket Screws (M3x10).
Please add a small drop of Loctite along the entire length of the M3x10 Socket Screw (No.5) and on the outside of the collar d3xD4x5.5 (No.3). Temporarily install the Washout Base Guidence Ring, but do not tighten the No.6 M3 Socket Screw yet.





The hole on the Flybar Control Rod has different opening on two sides. Always snap the bigger opening to the link ball.

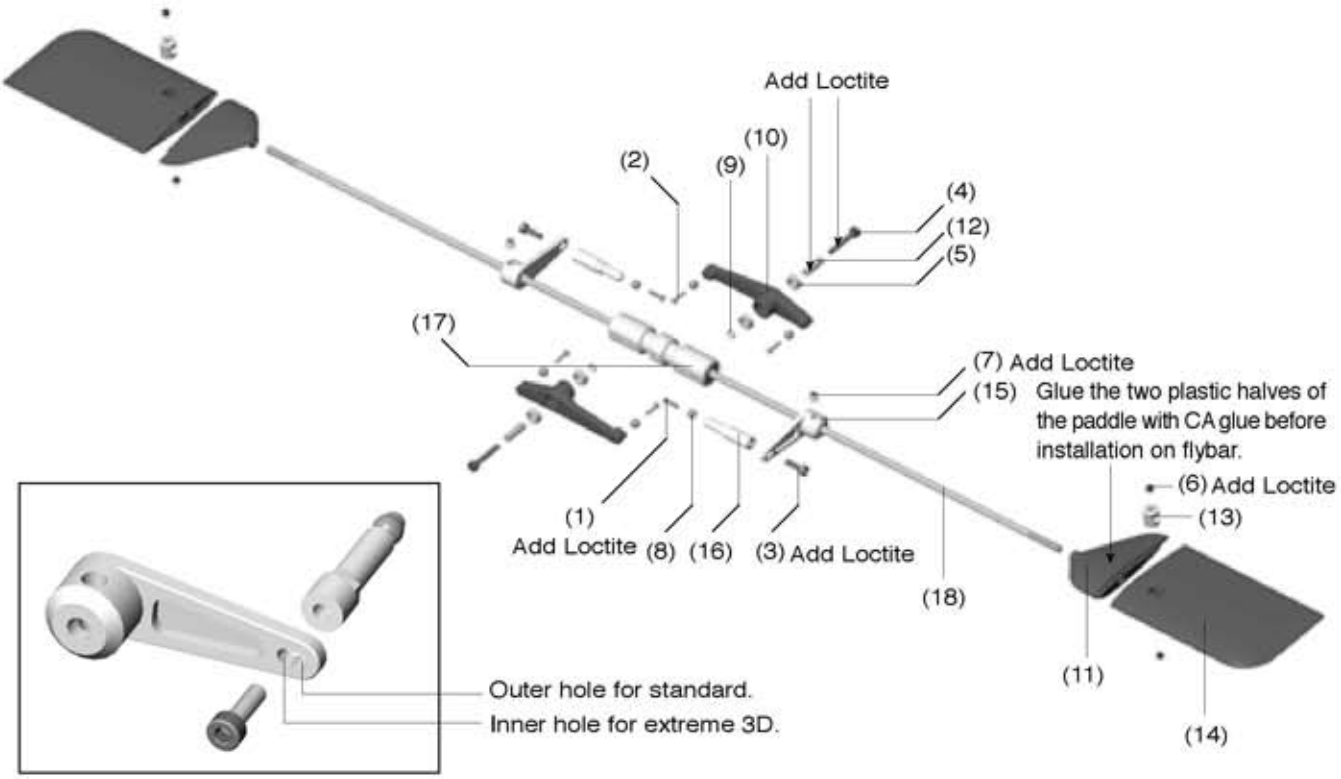
2-1-1 Flybar Seesaw Subassembly

No.	Material No.	Description	Qty.
1	HMF2-8N	Phillips Machine Screw M2x8	2
2	HMJ2-10N	Selfing-Tapping Screw M2x10	4
3	HMC3-10B	Socket Screw M3x10	2
4	HMC3-18B	Socket Screw	2
5	HMV840ZZY	BRG d4xD8x3	4
6	HME4-3B	Set Screw M4x3	4
7	HME4-5B	Set Screw M4x5	2
8	BK0075	Link Ball φ 4.8	6
9	BK0088	Washer d3xD5x0.5	2

No.	Material No.	Description	Qty.
10	BK0324	Mixing Lever	2
11	BK0406L	Paddle Root	2
12	BK0410	Collar d3xD4x13	2
13	BK0416	Paddle Stopper	2
14	BK0432L	Flybar Paddle	2
15	BK0633	Flybar Control Frame	2
16	BK0871	Longer Stabilizer Arm	2
17	BV0865	Longer Seesaw	1
18	BK0866	SUS Flybar	1

Assemble the metal flybar control arms according to the drawings. Slide Flybar Control Arm onto the No.18 Flybar Rod. Slide the flybar into the No.17 Seesaw Hub. Make sure the Flybar has equal protrusion from each side of the Seesaw Hub measure them with a ruler, then install and tighten the No.8 HME4-5B set screws. Add the paddles. Make sure the two paddles and the two flybar control arms are all parallel. Lock the paddles with No.6 set screws.
Assemble and install the No.10 Mixing Levers and No.5 Bearings according to the drawing using No.12 Collar and No.9 d3xD5x0.5 washer.

Note: Before installing the Mixing Lever (No.10), please add a small drop of Loctite along the entire length of the M3x18 button head socket screw (No.4) and on the outside of the collar d3xD4x13 (No.12). Be careful do not let the Loctite seep into the bearings. There are two choices of holes positions on the aluminum seesaw for attaching the mixing lever arm. The outside hole gives higher Bell-Hiller mixing ratio. For aggressive 3D flying, you can attach the Bell-Hiller mixing arms to the inner hole which gives lower flybar ratio.



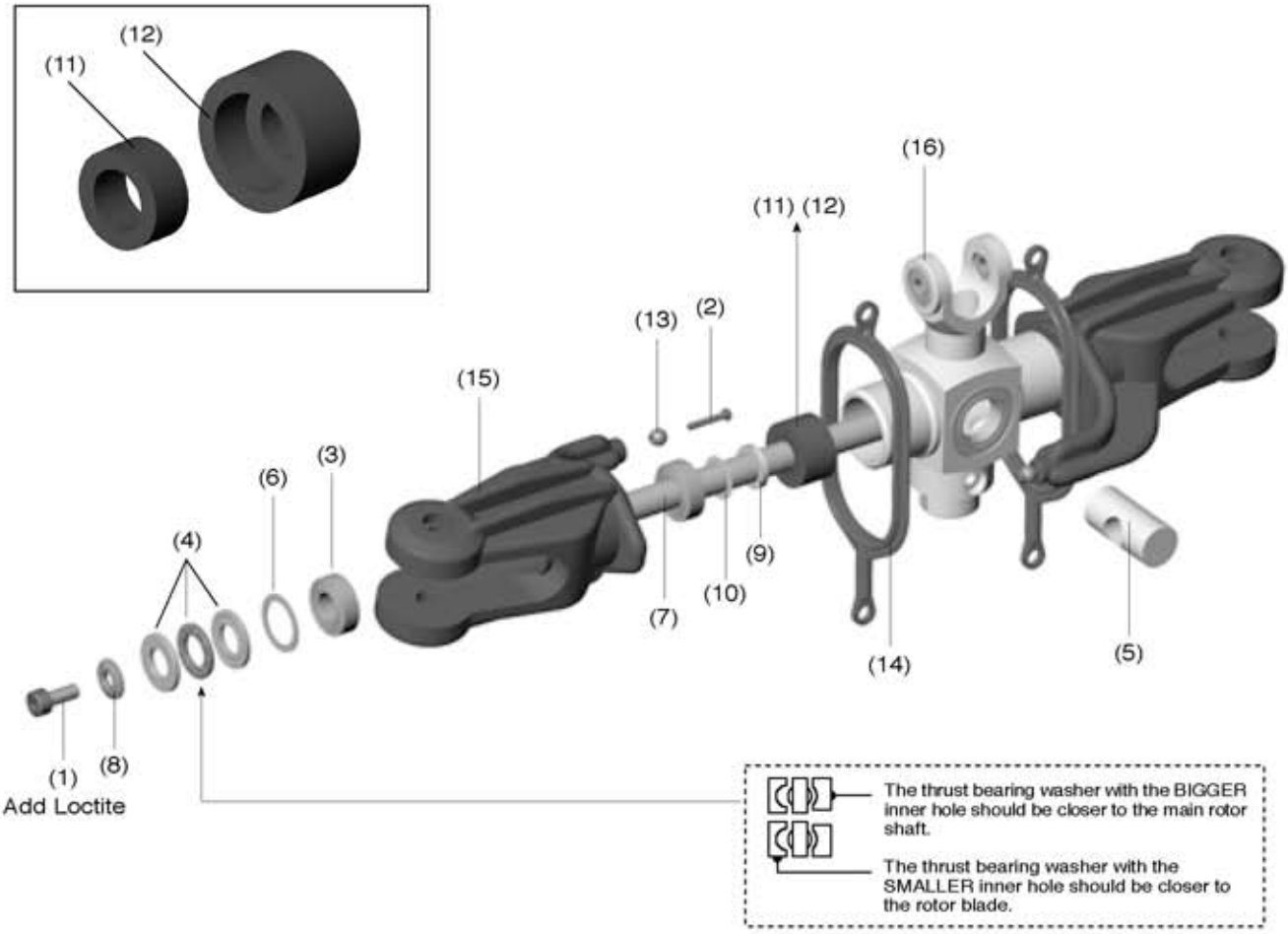
For 3D flying, it is recommended to use lower flybar ratio setting.

2-1-2 Metal Main Rotor Hub Subassembly

No.	Material No.	Description	Qty.
1	HMC4-10B	Socket Screw M4x10	2
2	HMJ2-12N	Self-Tapping Screw M2x12	2
3	HMV1680	BRG d8xD16x5	4
4	HMX0816	Thrust Bearing d8xD16x5	2
5	BK0330	Main Rotor Hub Pin	1
6	BK0325	Thrust Washer	2
7	BK0326	Spindle	1
8	BK0435	Washer	2

No.	Material No.	Description	Qty.
9	BK0477	Washer	2
10	BK0703	Flap Damper Washer 0.4mm	6
11	BK0874	Inner Damper	2
12	BK0875	Outer Dampper	2
13	BK0075	Ling Ball φ 4.8	2
14	BK0664	Flybar Control Rod	2
15	BK0319	Main Rotor Pitch Housing	2
16	BV0548-1	Metal Main Rutor Hub	1

Insert the aluminum Main Rotor Hub Pin and the Flap Dampers. (might need to apply silicone grease for easy installation). Push the No.7 Feathering Spindle into the dampers and the rotor hub. Add No. 14 Flybar Control Rod. Slide both finished Main Rotor Grip onto the feathering spindle and the secure with two M4x10 bolts and washers according to the drawing. Use two Allen wrenches to tighten the two M4x10 bolts simultaneously.

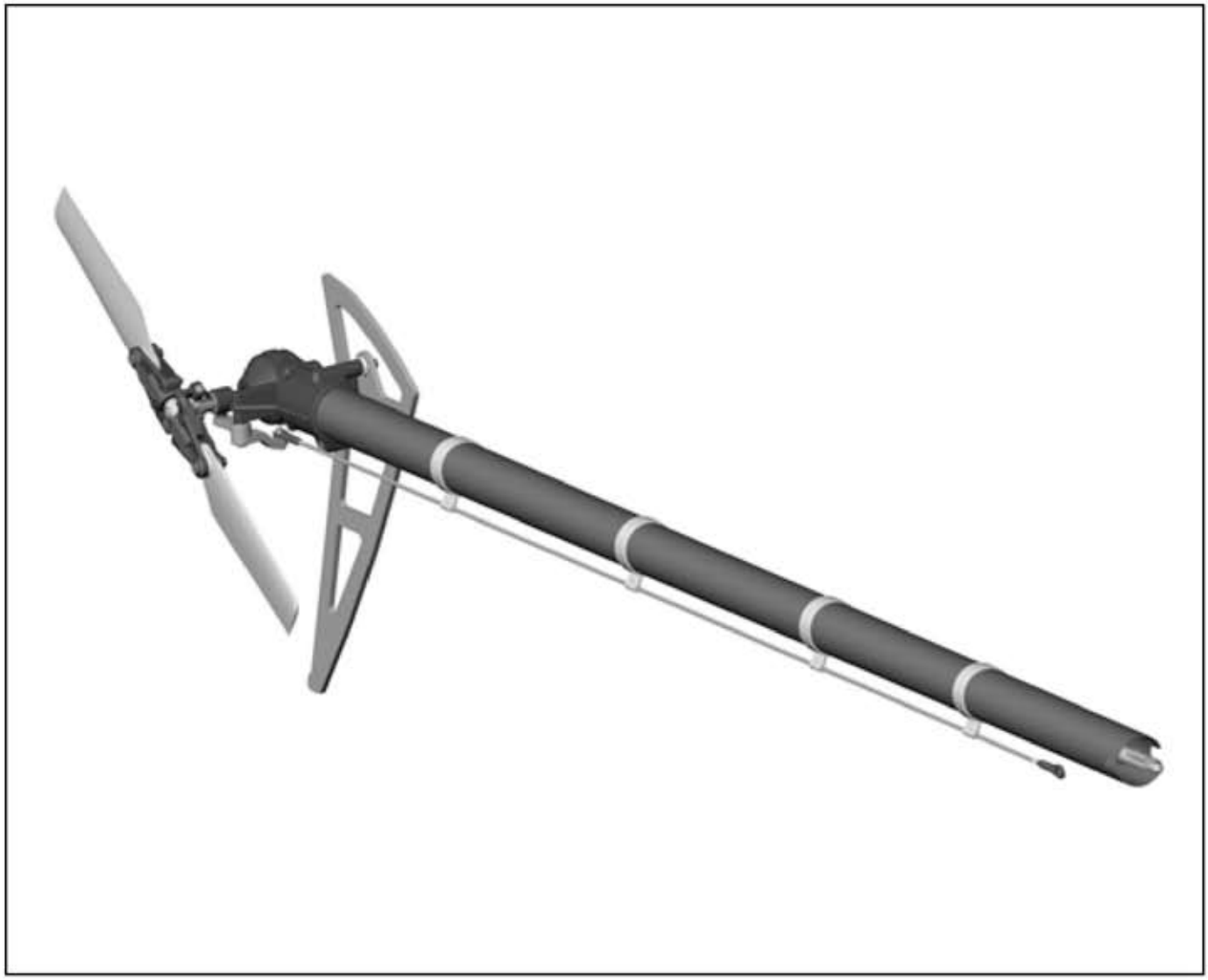


Important Note:

The Raptor 90 3D kits come with non-linear flap damper for aggressive 3D flying. You may choose to experiment adding from one up to three 0.4mm thick shim (No.10) washers between the washer (No.8) and bearing to further stiffen the main rotor flapping. Stiffing the main rotor head will speed up the cyclic transient response, but may cause the helicopter fuselage to oscillate at around 1600 RPM. This oscillation characteristic exists for all helicopters with hard 3D flap dampers. The inner dampers should be replaced periodically if a lot of 3D flying has been done. When the dampers are worn, the main rotor blades can flap excessively during some 3D maneuvers and risk touching the tail boom.

3

TAIL ASSEMBLY



3-1 Tail Assembly

BAG G

No.	Material No.	Description	Qty.
1	HMC3-30B	Socket Screw M3x30	2
2	HMC3-14B	Socket Screw M3x14	2
3	HMM3Z	Locknut M3	4
4	BK0086	Ball Link 4.8x20	2
5	BK0278	Machined Washer	2
6	BK0403	Rod Guide	4
7	BK0404	Tail Rotor Blade	2

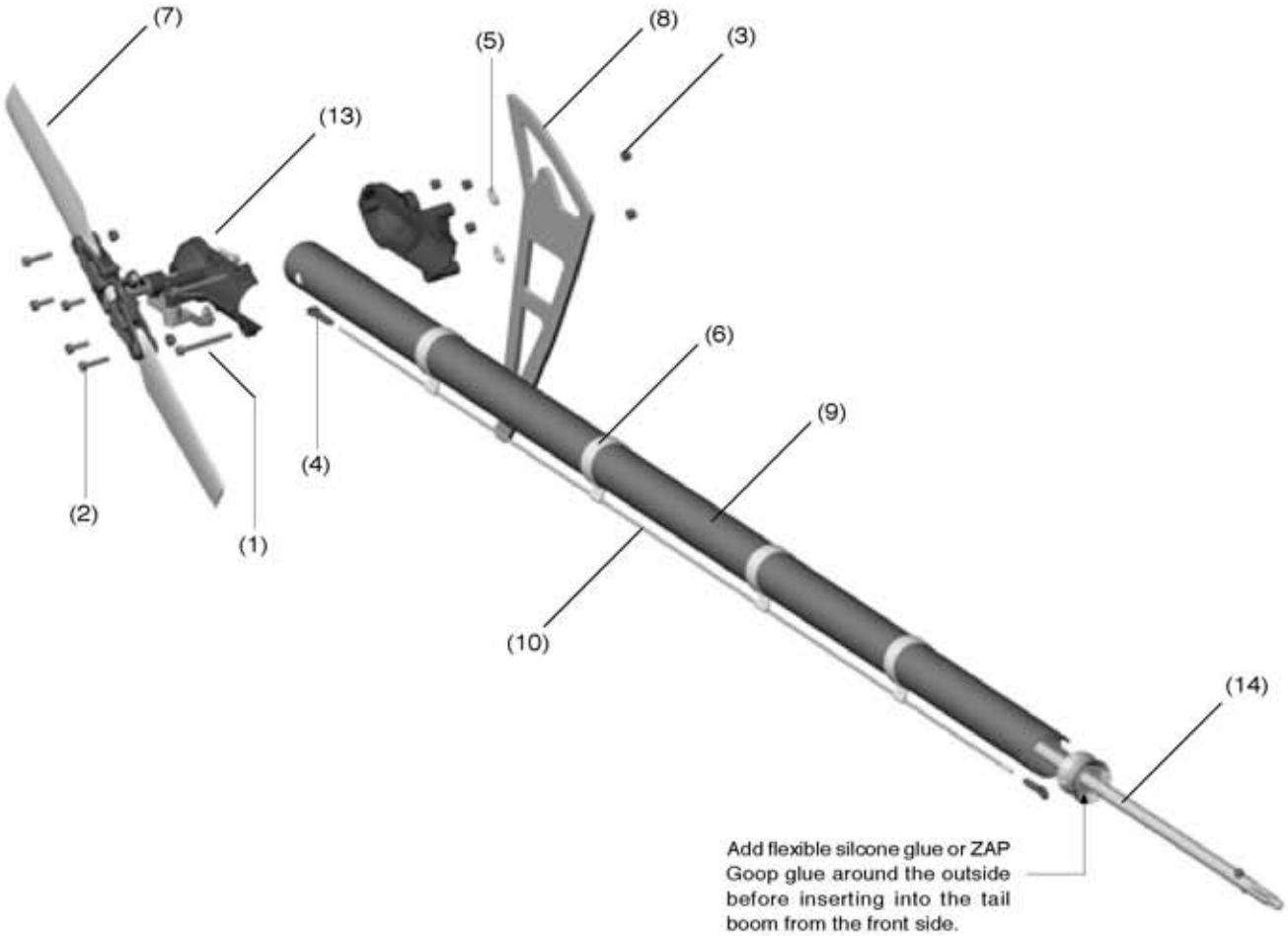
No.	Material No.	Description	Qty.
8	BK0877	3D Vertical Fin	1
9	BK0650	Tail Boom	1
10	BK0707	Rear Servo Rod	1
11	BK0347	Tail Push Rod A	1
12	BK0653	Tail Push Rod B	1
13	3-1-1	Tail Transmission Subassembly	1
14	3-1-3	Tail Drive Shaft Subassembly	1

Assemble the tail transmission subassembly according to 3-1-1 and 3-1-2 first. And the tail drive shaft subassembly according to 3-1-3.But do not close the two halves of the tail transmission tightly. You will do this when you are ready to install the gearbox onto the tail boom.

When installing the tail transmission, make sure the housings match the hole on to the tail boom. Add Carbon Vertical Fin with machined washer and Locknut, then tighten the five 3 mm bolts. Add carbon Vertical Fin with Pom washer and Locknut.

Before inserting the finished tail drive shaft assembly into the tail boom, add some flexible silicone glue or ZAP Goop glue around the outside of the tail drive bearing housing. This will prevent the bearing housing from spinning inside the tail boom.

Slide four No. 6 Rod Guides onto the tail boom. Do not glue them onto the tail boom yet. Add a tiny drop of CA glue to the pushrod guide after you finish building the entire helicopter. Before adding glue, make sure the tail pushrod is hooked up to the servo and the rod travels in a straight line and moves very smoothly.



3-1-1 Tail Transmission Subassembly

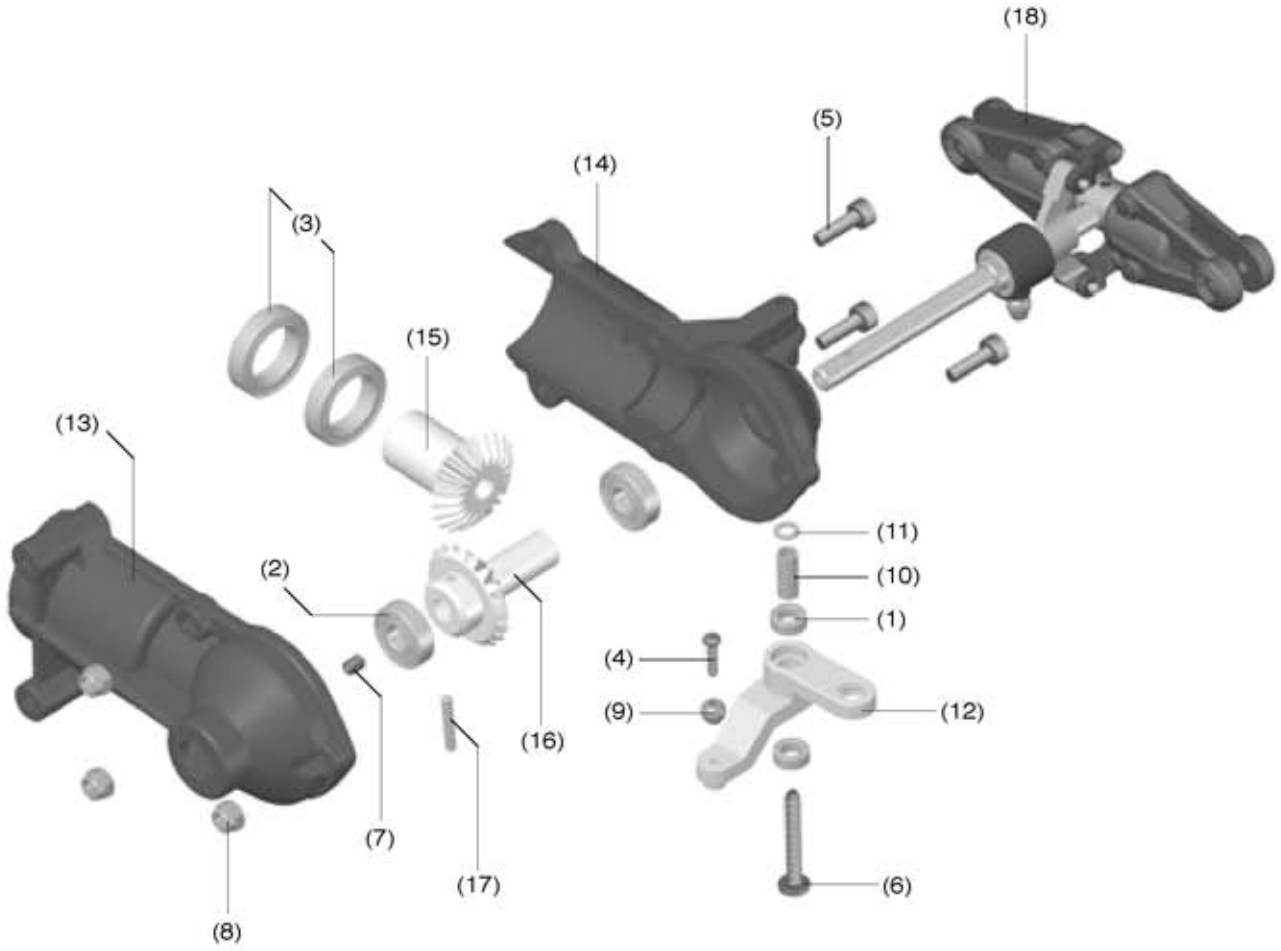
No.	Material No.	Description	Qty.
1	HMV740ZZ	BRG d4xD7x2.5	2
2	HMV1350	BRG d5xD13x4	2
3	HMV6701ZZY	BRG d12xD18x4	2
4	HMJ2-8N	Self-Tapping Screw M2x8	1
5	HMC3-10B	Socket Screw M3x10	3
6	HMJ3-20N	Self-Tapping Screw M3x20	1
7	HME3-4B	Set Screw M3x4	1
8	HMM3Z	Locknut M3	3
9	BK0075	Link Ball 4.8	1

No.	Material No.	Description	Qty.
10	BK0076	Collar d3xD4x10	1
11	BK0088	Washer d3xD5x0.5	1
12	BK0346	Tail Pitch Control Lever	1
13	BK0370	Tail Case L	1
14	BK0371	Tail Case R	1
15	BK0372	Tail Input Bevel Gear	1
16	BK0373	Tail Output Bevel Gear	1
17	HMY2-12	Pin 2x12	1
18	3-1-2	Tail Rotor Subassembly	1

Install bearings No. 2 and No.3 into the Tail Cases. Install No. 16 Tail Bevel Gear onto the Tail Shaft. Gently tap the No. 17 Pin into the Bevel Gear and Tail Shaft. Then secure the pin with a No. 7 Set Screw with Loctite.

After installing the M3x4 set screws, try pushing on the 2x12 pin with a small Allen wrench to make sure the set screw has locked the pin in place securely. Before closing the two halves of the Tail Cases, please check the gear mesh between gears No. 15 and No. 16. If the gears mesh too tight, then a 5 mm i.d. washer should be added to move the gear No. 16 further out. If there exists too much freeplay, then a 5 mm i.d. washer to push gear No. 16 closer to gear No. 15.

Install the No. 12 Tail Pitch Control Lever as shown with No. 6 Self-Tapping Screw, No. 10 Collar, and No. 11 Washer, with two No. 1 Bearings. Attach a No. 9 Link Ball with a No. 4 Screw. Upon finishing Step 3-1-1, make sure there are no extra parts left on your workbench.



3-1-2 Tail Rotor Subassembly

No.	Material No.	Description	Qty.
1	HMC2510B	Socket Screw M2.5x10	4
2	HME3-3B	Set Screw M3x3	2
3	HMM25	Locknut M2.5	4
4	HSE2-10B	Self-Tapping Screw M2x10	2
5	HMJ2-8N	Self-Tapping Screw M2x8	1
6	HMM3Z	Locknut M3	2
7	HMS15	E Ring	4
8	HMV1050ZZ	BRG d5xD10x4	4
9	HMV1060ZZY	BRG d6xD10X3	2
10	BK0026	Tail Pitch Control Link	2

No.	Material No.	Description	Qty.
11	BK0027	Tail Pitch Control Slider	1
12	BK0075	Link Ball 4.8	1
13	BK0082	Collar d2xD3x4	2
14	BK0302-1	Tail Pitch Housing A	2
15	BK0303-1	Tail Pitch Housing B	2
16	BK0821	SUS Tail Rotor Hub	1
17	BK0345	Tail Pitch Control Slide Bushing	1
18	BK0374	Tail Shaft	1
19	BK0545	Metal Tail Pitch Control Fork	1
20	BK0546	Pin 2mm	2

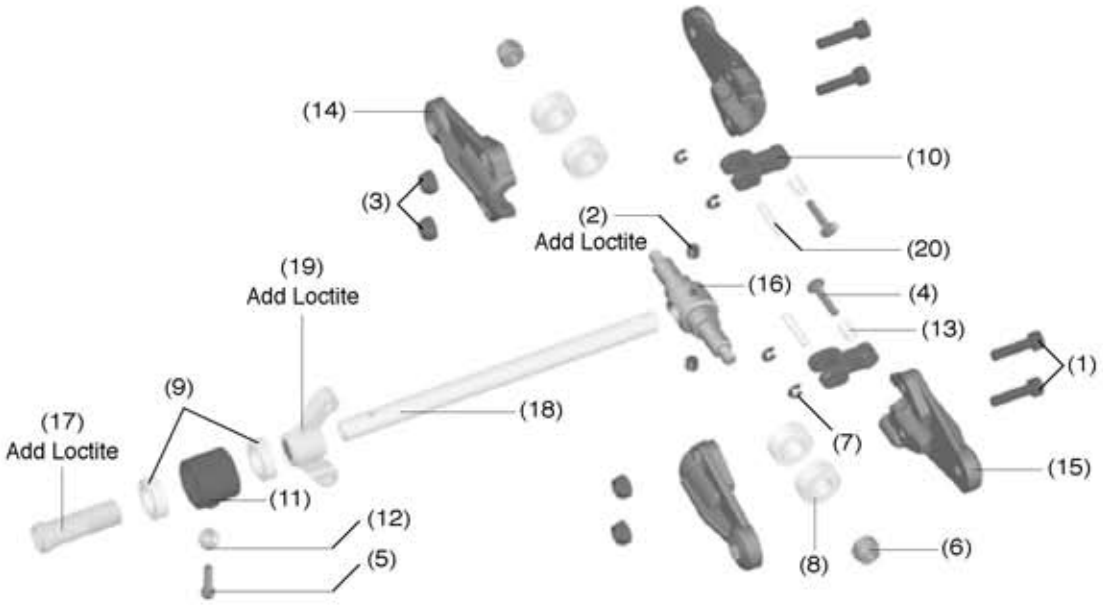
Assemble the Tail Pitch Control Slider and Pitch Control Fork according to the drawing as follows. Insert No. 9 Bearings into No. 11 Tail Pitch Control Slider. Add a tiny drop of Loctite on the "outside" surface of No. 17 Tail Pitch Control Bushing, then slide it into the two bearings in the No. 11 Tail Pitch Control Slider. Thread the No. 19 Metal Pitch Control Fork onto the brass bushing until the bushing does not have any in and out play, but the pitch fork should still be able to spin freely in the bearings. Add a No. 12 Link Ball with a No. 5 Screw. Then slide the finished pitch slider onto the tail shaft.

Now assemble the Tail Blade Grip System. First install the No. 16 Tail Rotor Hub onto the No. 18 Tail Rotor Shaft. The hub will be almost flush with the end of the tail rotor shaft. Secure the hub to the shaft by using two No. 2 M3x3 set screws. Add a tiny drop of Loctite on the set screw before threading them into the hub. If too much Loctite is used then it will be impossible to remove the set screws for service in the future. A tiny drop of Loctite is sufficient to prevent them from vibrating out. Put a tiny drop of Loctite on the inside surface of No. 8 Bearings. Then slide two No. 8 bearings onto each end of the tail rotor hub. Add the No. 6 3mm locknut.

Now add the two pieces plastic Tail Pitch Housings.

Install No. 10 Tail Pitch Control Links, No. 13 Collars, and No. 3 Screws according to the drawing.

Attach the Tail Pitch Control Links No. 10 to the Pitch Fork using the small pins, No. 20 with E-Ring No. 7.

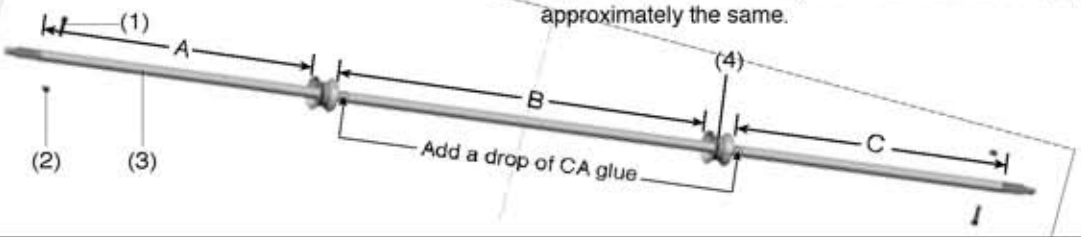


3-1-3 Tail Drive Shaft Subassembly

No.	Material No.	Description	Qty.
1	HMC2512B	M2.5x12 Socket Screw	2
2	HMM25	M2.5 Locknut	2
3	BV0651	Tail Drive Shaft	1
4	BV0423	Tail Drive Shaft BRG	2

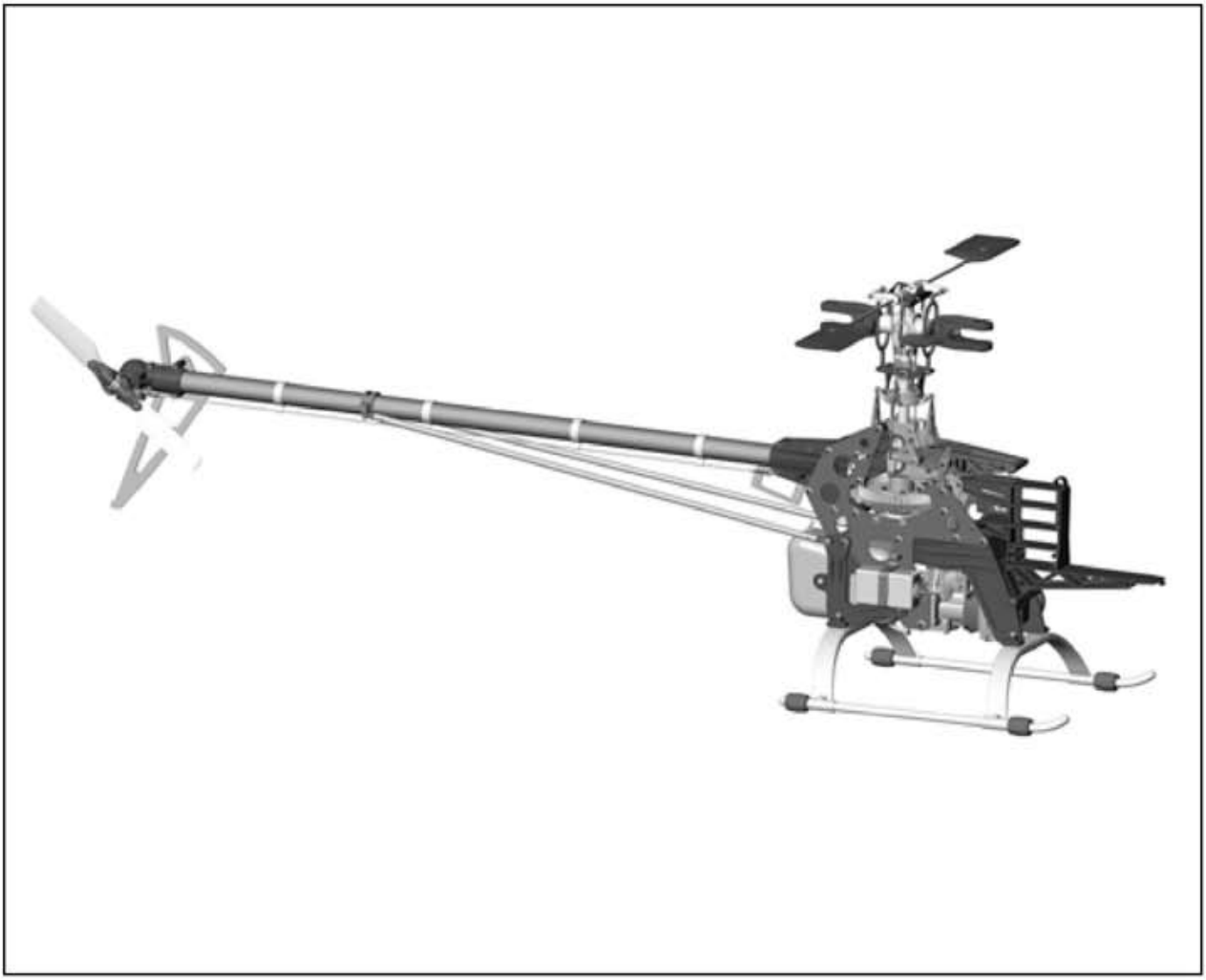
First slide the two support bearings over the torque tube. The two bearings should be evenly spaced. Add a drop of thin CA glue on the torque tube next to where the bearings are. Then quickly slide the bearings over the CA glue. This will hold the bearings in place.

- Space the two bearings so the distances A,B,C are approximately the same.



4

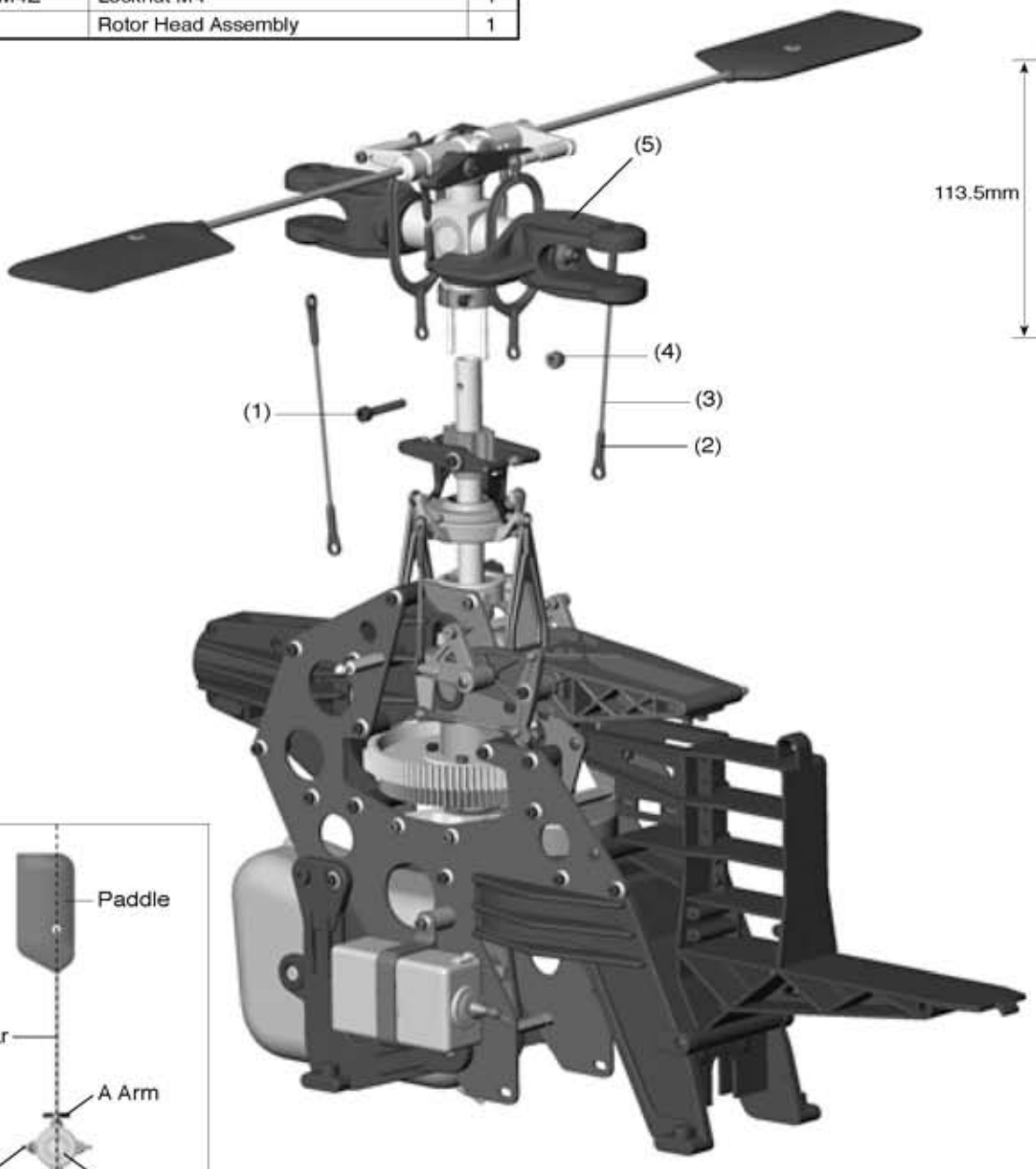
FINAL ASSEMBLY

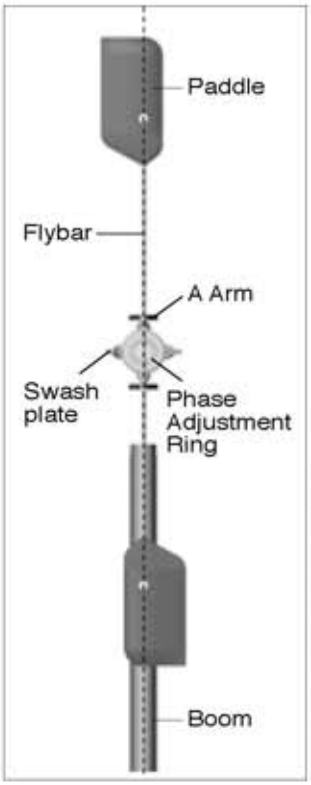


4-1 Installation of Rotor Head BAG H

No.	Material No.	Description	Qty.
1	BK0617	Bolt M4x25	1
2	BK0086	Ball Link 4.8x20	4
3	BK0318	Link Rod 2.3x95	2
4	HMM4Z	Locknut M4	1
5	2-1	Rotor Head Assembly	1

Congratulation, we are almost done. Install the finished main rotor head onto the 12 mm rotor main shaft. Secure it with a M4x20 Bolt and M4 Locknut. Make up two 113.5 mm long pushrods and attach them to the Bell-Hiller mixing arm.



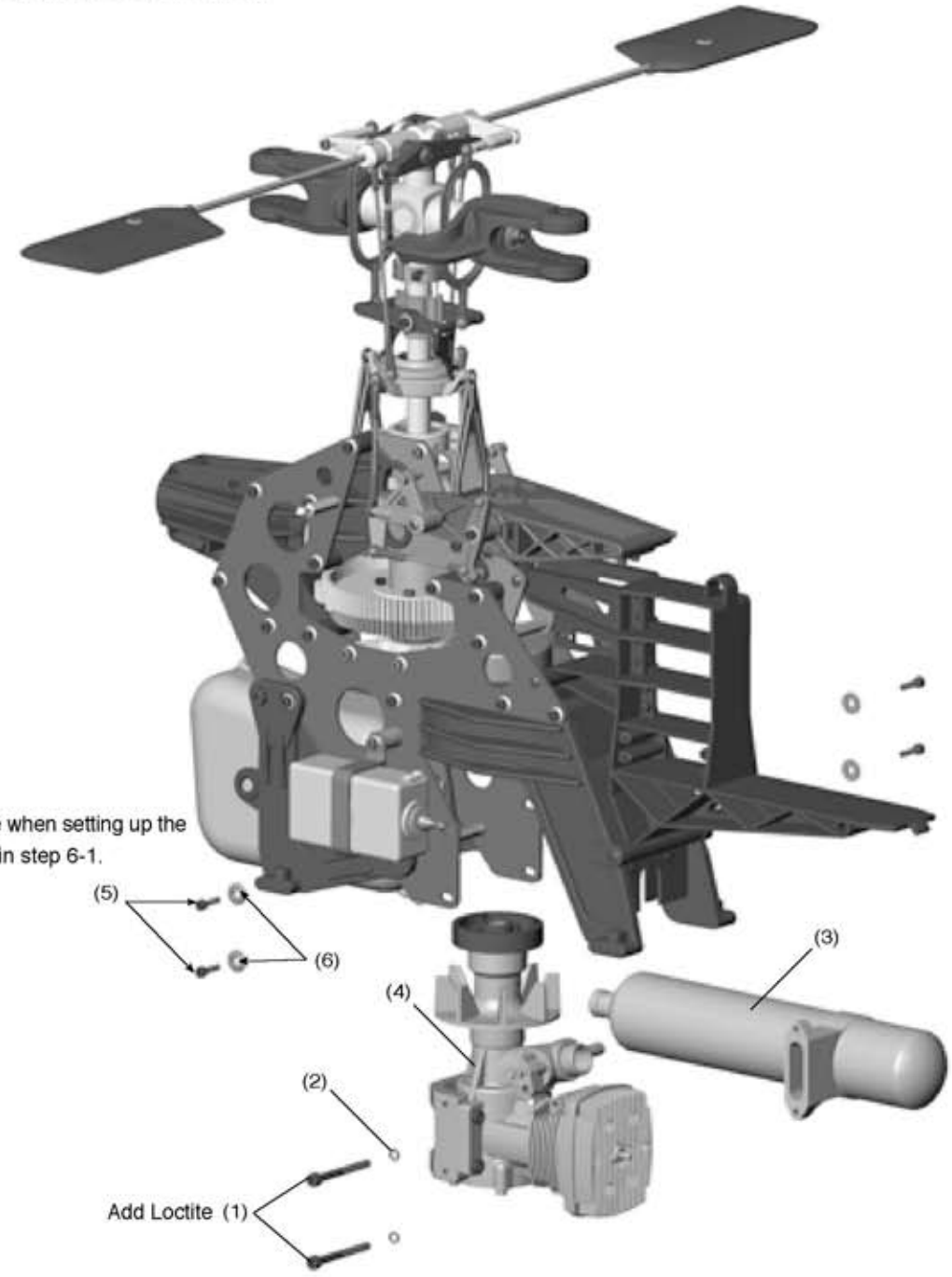


Tip: When setting up the phase adjustment ring, the flybar and the tail boom can be the reference. When the flybar and the tail boom are centered, the inner balls of swashplate should be aligned with the outer balls. Tighten the socket screw on the phase ring at this moment.
NOTE: Improper alignment will cause unwanted mixing.

4-2 Installation of Engine

No.	Material No.	Description	Qty.
1	HMC4-42B	Muffler Bolt M4x42	2
2	HMT4B	Spring Washer	2
3	********	Muffler (90)	1
4	4-2-1	Engine Subassembly	1
5	HMC4-12B	Socket Screw M4x12	4
6	BK0435	Washer d4xD11xW1.7	4

Attach the engine into the side frames, with four M4x12 bolts and four washers, but do not tighten until Section 6-1.
Install the muffler after you have building the entire helicopter.
Always add Loctite on the muffler bolts.

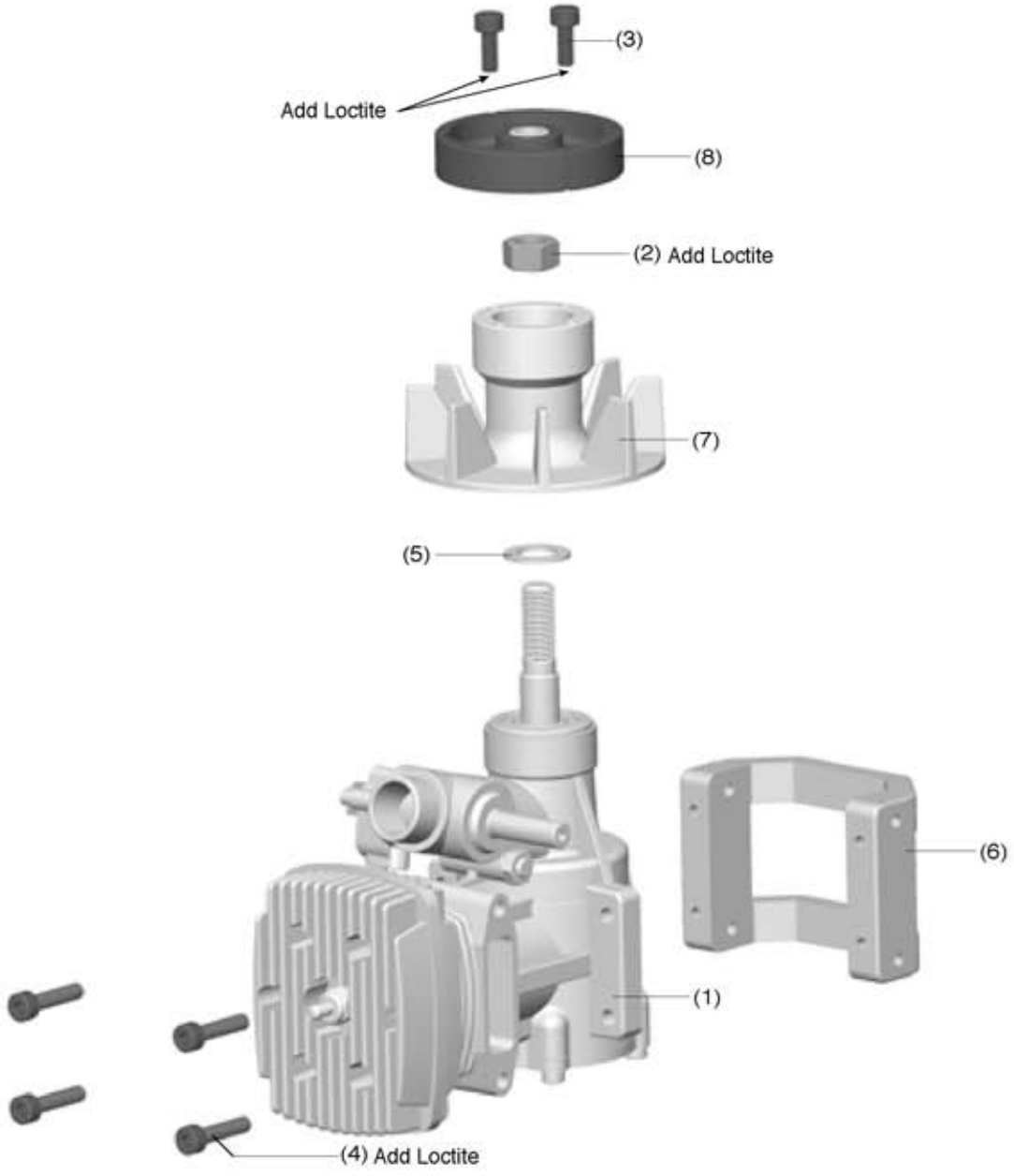


4-2-1 Engine Subassembly

No.	Material No.	Description	Qty.
1	********	90 Class Heli Engine	1
2	********	Nut (Comes With the Engine)	1
3	HMC4-8B	Socket Screw M4x8	2
4	HMC4-18B	Socket Screw M4x18	4

No.	Material No.	Description	Qty.
5	HMO10	Washer d9.5xD16x1	1
6	BK0349	Engine Mount	1
7	BK0380	Cooling Fan	1
8	BV0521	Heavy Duty Clutch	1

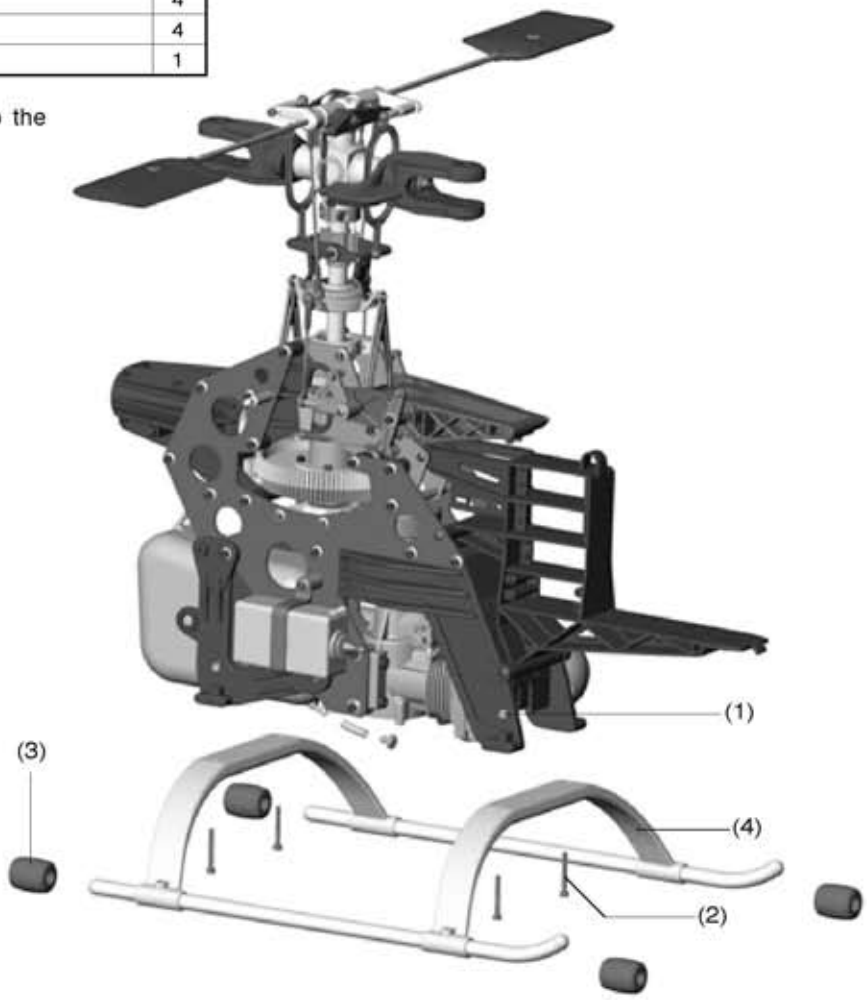
Attach the engine mount to the engine using four 4mm bolts and Loctite.
The cooling fan hub is threaded to fit the OS, TT or Webra only. Place the washer that came with your engine onto the engine crankshaft first. Then screw the fan hub onto the engine. Add a tiny drop of Loctite on the engine nut. Do not use too much Loctite. Tighten the engine nut using a socket head wrench while grabbing the fan with a towel. The nut should be tighten securely. For 50-size or bigger engines, we do not recommend using a piston locking tool on the glow plug hole because that may damage the engine. Attach the No. 8 Heavy Duty Clutch to the fan hub. Add a drop of Loctite on the threads of the M4x8 bolts. The threads on the aluminum cooling fan hub are for the TT 70H, OS 61 SX, OS 61LX, OS 70H, TT 90H, OS 91 or Webra 91 engines. If YS 61, 80 or 91 engines are used, the fan hub must be re-tapped by the modeler to M8x1mm thread size or purchase a optional plastic fan hub with threads for the YS engine(PV0198YS) or the metal fan for the YS (PV0293YS).



4-3 Installation of Landing Skid

No.	Material No.	Description	Qty.
1	HMM3Z	Locknut M3	4
2	HMC3-25B	Socket Screw M3x25	4
3	BK0820BL	Landing Skid Damper	4
4	4-3-1	Skid Subassembly	1

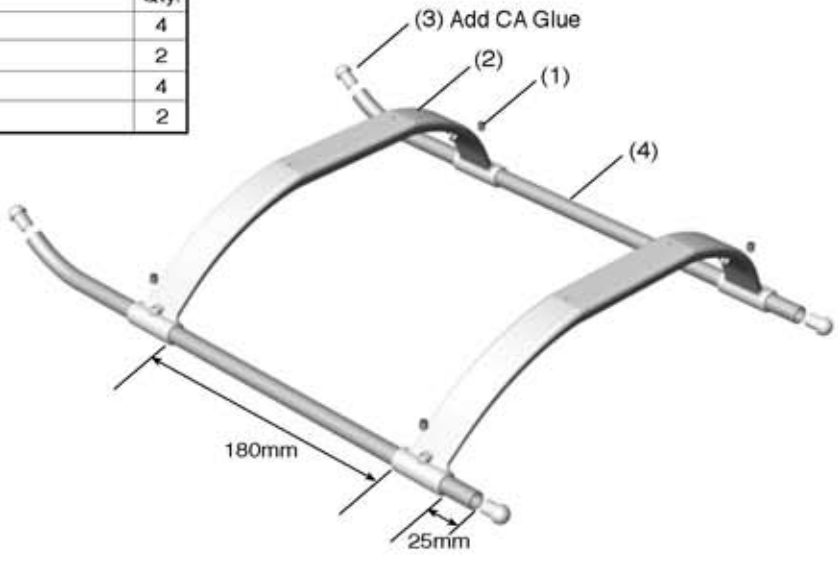
Make up the landing gear according to the drawing.



4-3-1 Skid Subassembly

No.	Material No.	Description	Qty.
1	HME4-5B	Set Screw M4x5	4
2	BK0397	Skid Brace	2
3	BK0398	Skid Pipe End Cap	4
4	BK0668	Skid Pipe	2

Before installing the plastic end caps, please add a drop of slow, thick CA glue on the rim of the end caps and on the inside edge of the aluminum skid.

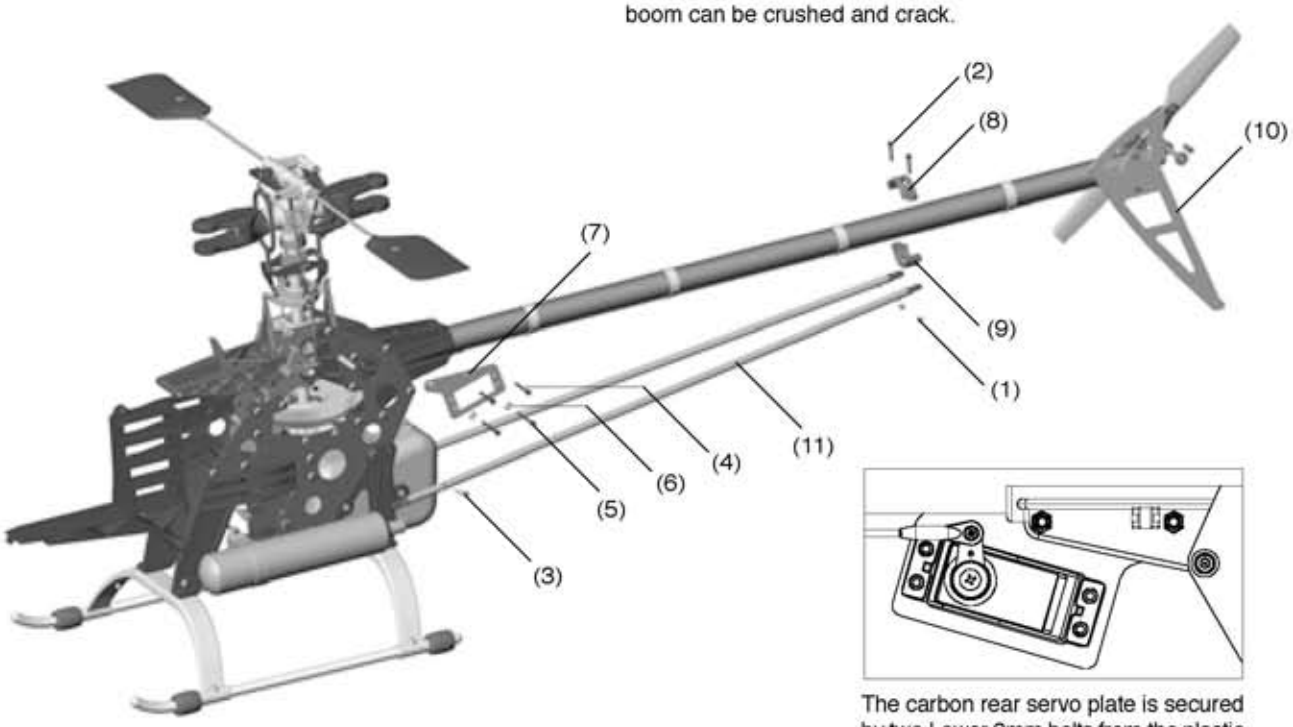


4-4 Installation of Tail Assembly

No.	Material No.	Description	Qty.
1	HMM3Z	Locknut M3	6
2	HMC3-16B	Socket Screw M3x16	2
3	HMC3-20B	Socket Screw M3x20	2
4	HMC3-25B	Socket Screw M3x25	2
5	HMC3-30B	Socket Screw M3x30	2
6	BK0087	Washer d3xD8x1.4	4

No.	Material No.	Description	Qty.
7	BK0539	Carbon Rear Servo Plate	1
8	BK0878	Bracket (Top)	1
9	BK0879	Bracket (Bottom)	1
10	3-1	Tail Assembly	1
11	4-4-1	Tail Support Subassembly	2

Slide the finished tail boom into the helicopter. The four bolts on the helicopter must be loose in order to insert the tail boom. Make sure the tail drive shaft is inserted into the front receptacle properly. Check this by turning the main rotor head. Secure the tail boom by tightening the four screws on the helicopter. Visually check from the rear of the helicopter to make sure the tail rotor output shaft is perpendicular to the main rotor shaft. Add the tail boom supports. Do not over tighten the BK0531 metal bracket and the two M3x8 socket bolts, or the carbon tail boom can be crushed and crack.

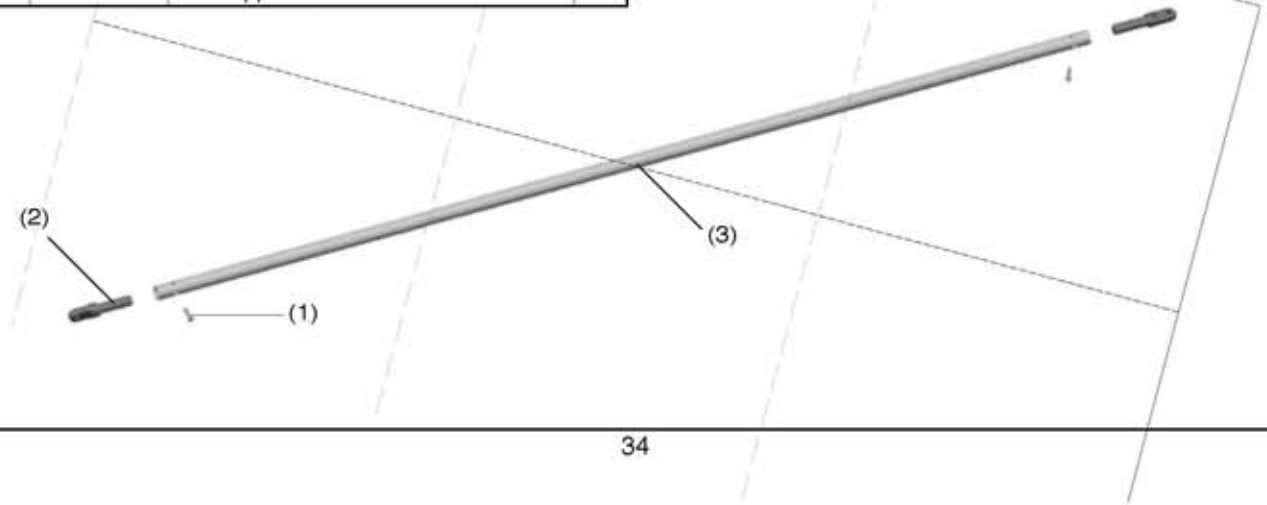


The carbon rear servo plate is secured by two Lower 3mm bolts from the plastic tail boom bracket.

4-4-1 Tail Support Subassembly

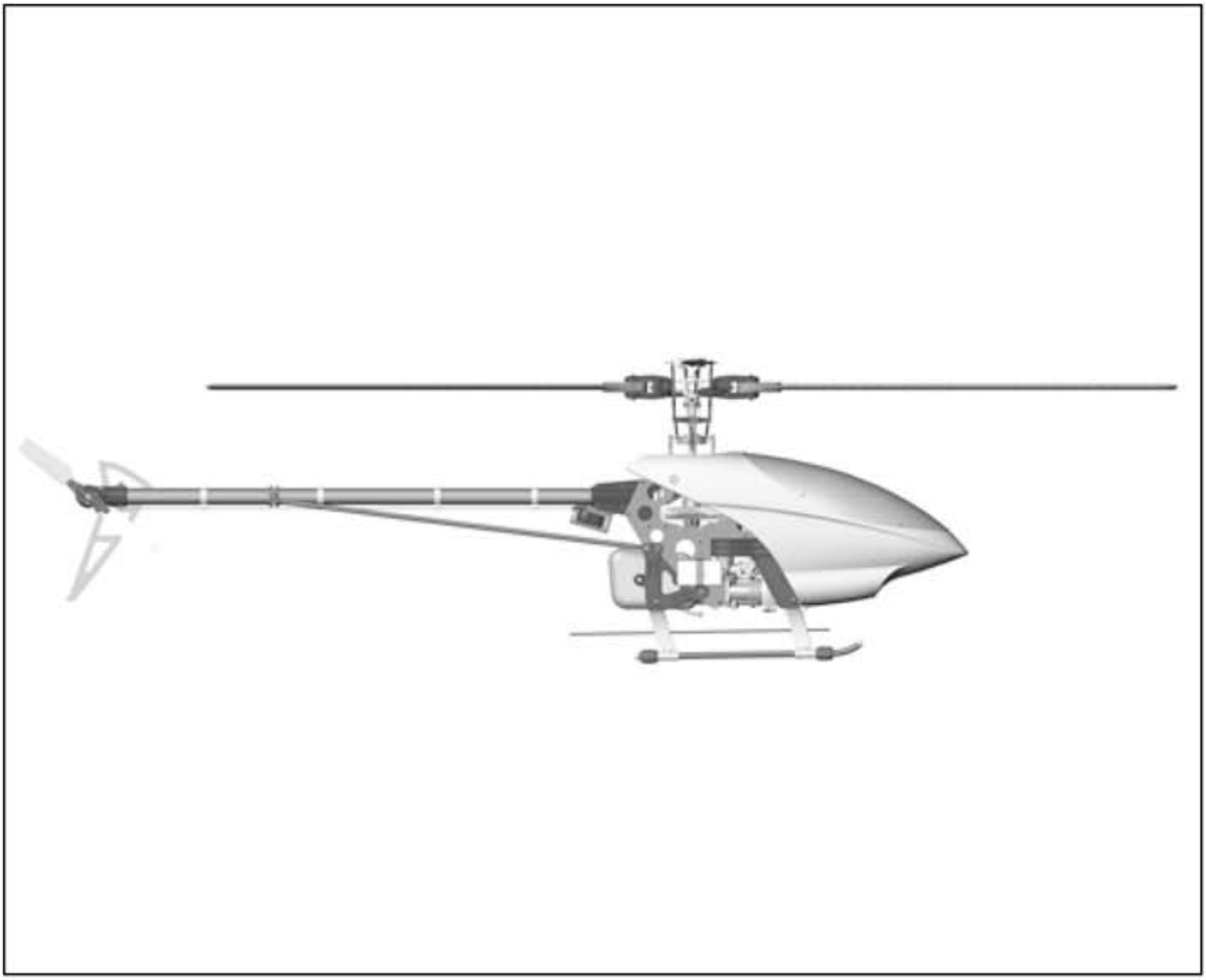
No.	Material No.	Description	Qty.
1	HMJ2-8N	Self-Tapping Screw M2x8	4
2	BK0447	Tail Support Rod End	4
3	BK0669	Tail Support Rod	2

Secure the two ends to the rod with Epoxy, making sure the two metal ends are perpendicular to each other.



5

INSTALLATION OF PERIPHERAL EQUIPMENT

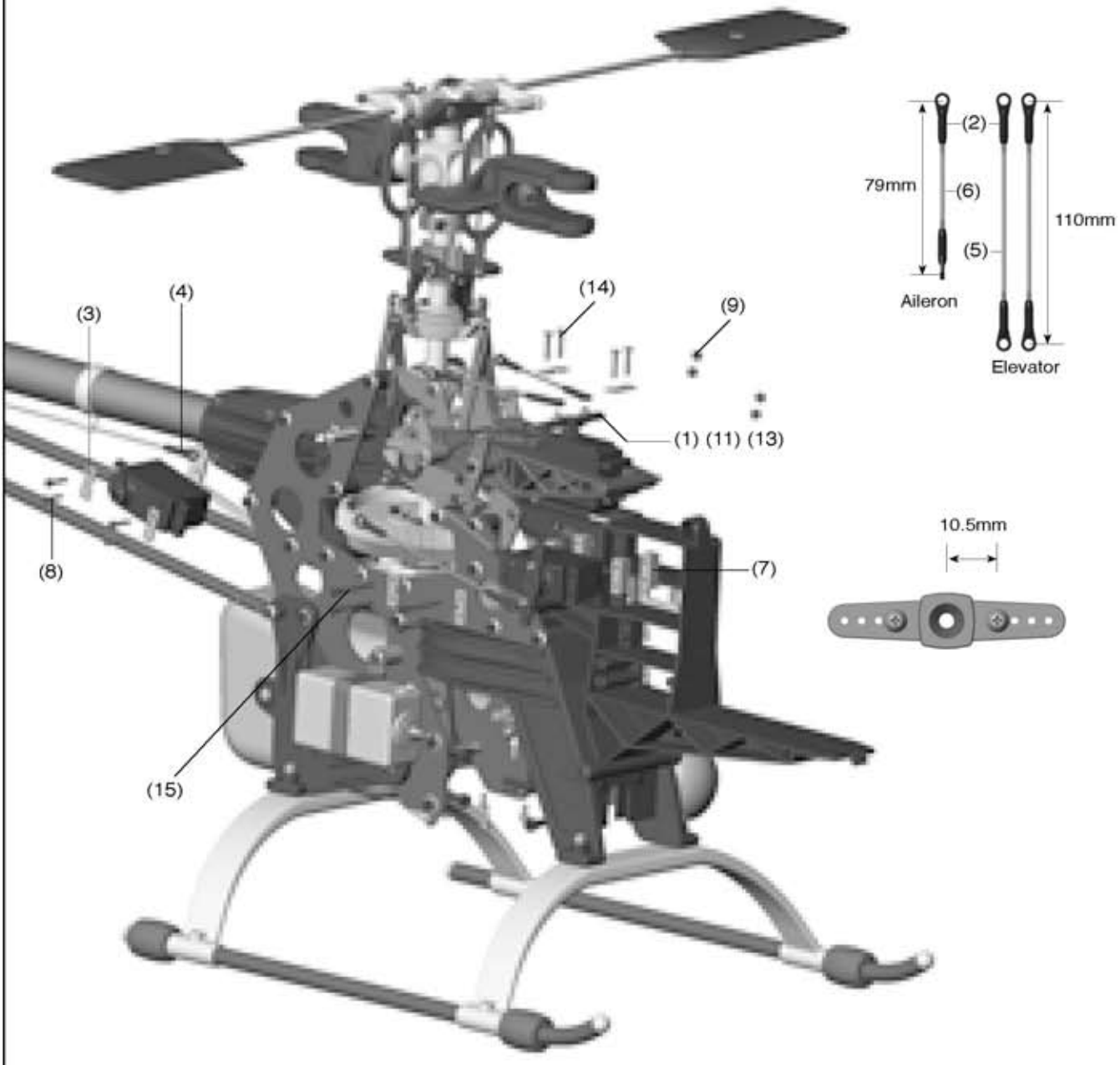


5-1 Installation of Servo-Part 1 BAG I

No.	Material No.	Description	Qty.
1	BK0075	Link Ball φ4.8	5
2	BK0086	Ball Link 4.8x20	8
3	BK0104	Servo Mounting Plate	6
4	BK0105	Rod Joint	1
5	BK0318	Link Rod 2.3x95	2
6	BK0436	Link Rod 2.3x55	2
7	BK0833	Servo Block	4
8	HMC2516B	Socket Screw M2.5x16	4

No.	Material No.	Description	Qty.
9	HMM25	Lock Nut M2.5	4
10	BK0347	Tail Push Rod A	5
11	HML2	Nut	5
12	HME4-5B	Set Screw	2
13	HMF2-8N	Phillips Machine Screw M2x8	5
14	HSE2614N	Selt-Tapping Screw	4
15	HSE2630N	Selt-Tapping Screw	4

Install the servos and make up the pushrods according to the drawings. The distance between the steel ball and the center of servo arm are shown in the drawing. Use them as a guide. These distances are used in conjunction with the servo travels (ATV or End point) set to 100% for all the channels in the transmitter. Tune them later on to suit your personal flying style.
Attach the rudder servo to the rear mounted carbon plate with four 2.6mm bolts and four M2.6 locknut.



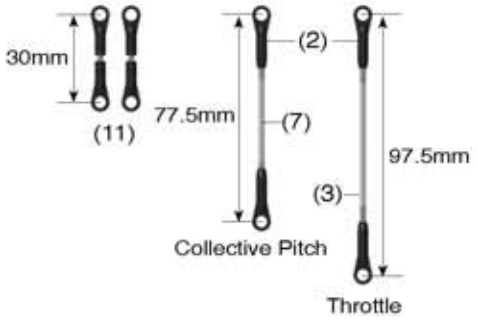
5-2 Installation of Servo-Part 2 BAG I

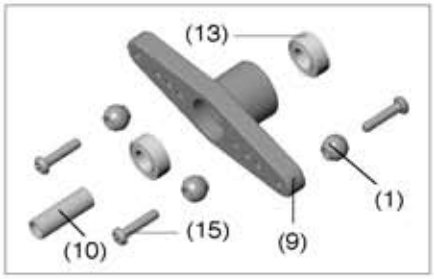
No.	Material No.	Description	Qty.
1	BK0075	Link Ball φ4.8	7
2	BK0086	Ball Link 4.8x20	4
3	BK0095	Link Rod 2.3x76	1
4	BK0104	Servo Mounting Plate	4
5	BK0833	Servo Block	2
6	BK0834	Pitch Lever Fixed Plate	1
7	BK0839	Link Rod 2.3x30	1
8	BK0881	Washer	1
9	BK0883	Pitch Push Pull Lever	1

No.	Material No.	Description	Qty.
10	BK0884	Collar, d3xD4xW12	1
11	BV0085	Pitch Link Rod	2
12	HMC3-20B	Socket Screw M3x20	1
13	HMV840ZZY	Bearing d4xD8xW3	2
14	HMF2-8N	Philip Maching Screw M2x8	4
15	HMJ2-8N	Selt-Tapping Screw M2x8	3
16	HML2	Nut	4
17	HSE2614N	Selt-Tapping Screw M2.6x14	8
18	HSE2620N	Selt-Tapping Screw M2.6x20	4

Make up the throttle and collective control pushrods according to the drawing. Use the outermost hole on the carburetor throttle control arm. Attach the steel ball on the throttle servo arm at approximately the same distance as the steel ball on the throttle arm.

Make up the throttle at 97.5mm long first, and then adjust the pushrod length and throttle servo ATV or Endpoint so full throttle stick command will open the carburetor barrel fully. And full low stick and low throttle trim will close the carburetor barrel completely.





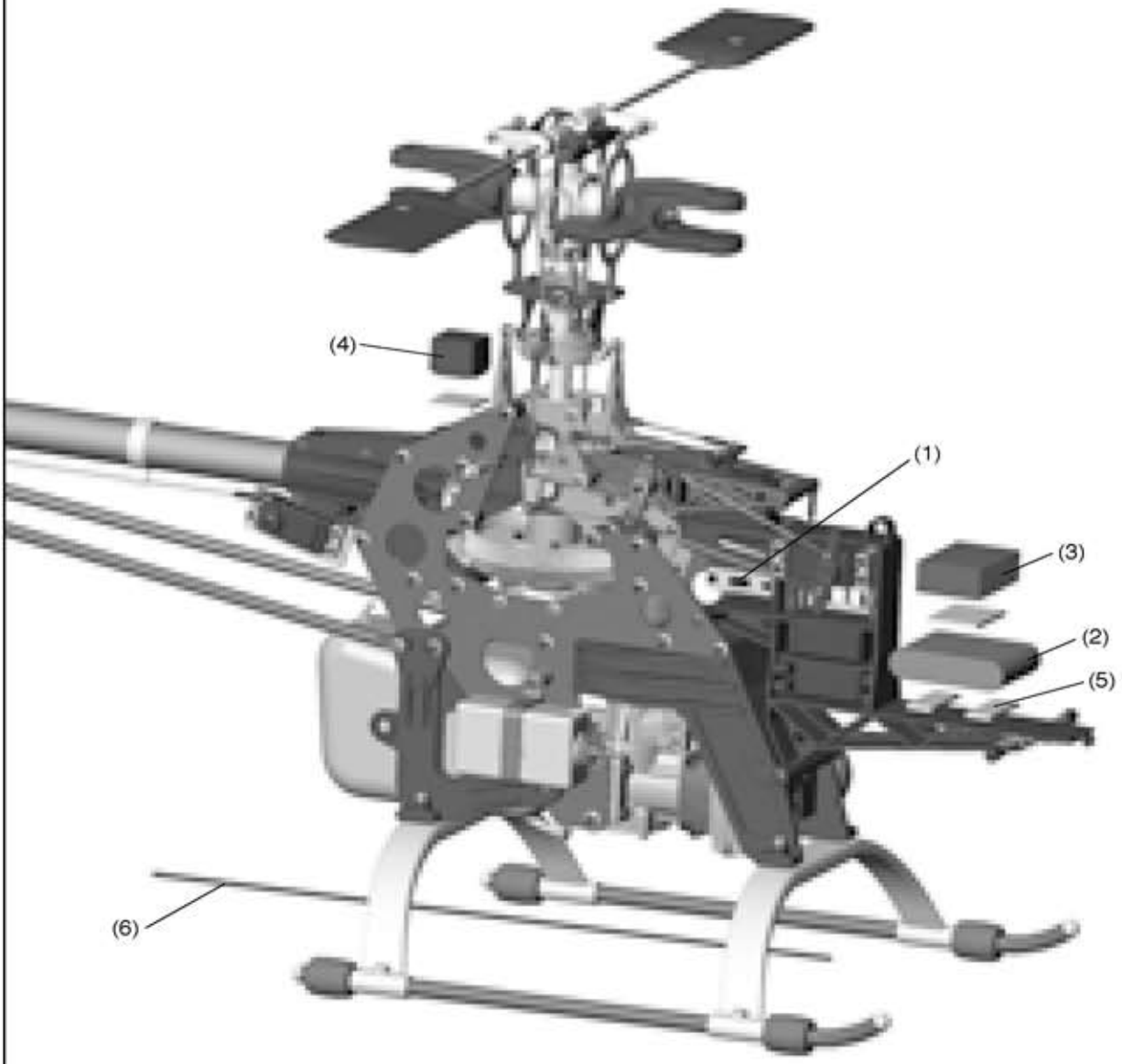
Pitch push-pull subassembly

5-3 Installation of Receiver & Gyro

No.	Material No.	Description	Qty.
1	****	Switch	1
2	****	Receiver Battery	1
3	****	Receiver	1

No.	Material No.	Description	Qty.
4	****	Gyro	
5	BK0106	Foam	2
6	BE1052	Antenna Pipe	1

Install the receiver and receiver battery. Even though the receiver and battery can be attached to the helicopter tray by using double sided foam tape, but it is better to wrap the receiver and battery separately using half inch or 10 mm thick foam. Then secure them to the tray using six to eight rubberbands, or Velcro bands.

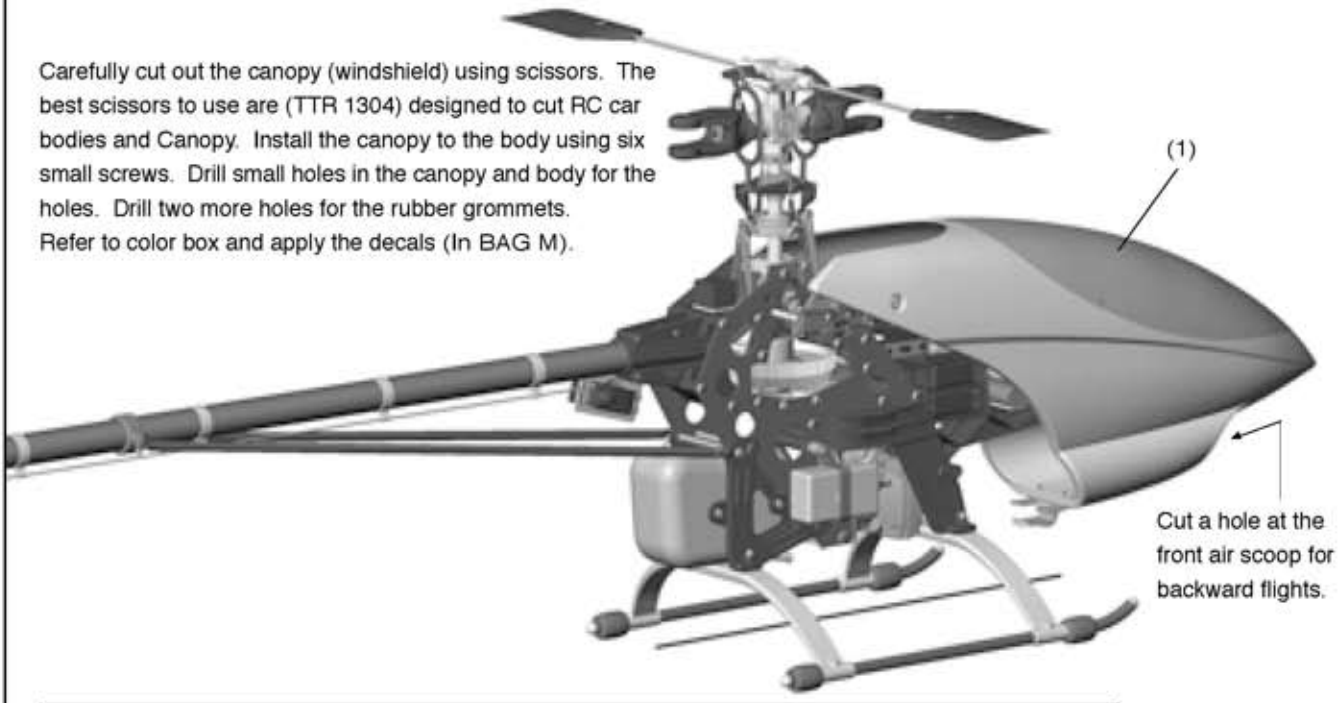


The optional Thunder Tiger Remote Glow Plug Adaptor (#3803) is recommended as shown, making starting easy without the removal of your canopy.

5-4 Installation of Body BAG J

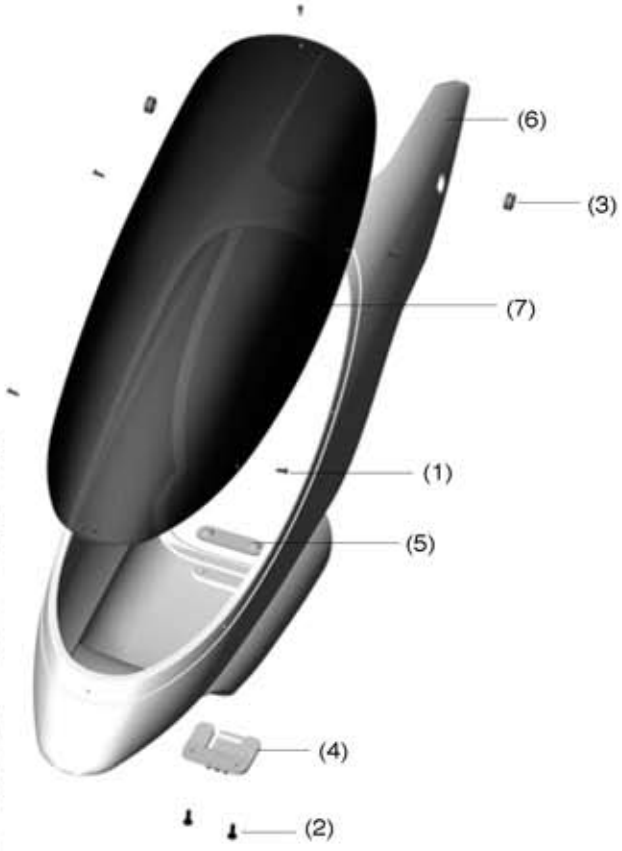
No.	Material No.	Description	Qty.
1	5-4-1	Body Subassembly	1

Carefully cut out the canopy (windshield) using scissors. The best scissors to use are (TTR 1304) designed to cut RC car bodies and Canopy. Install the canopy to the body using six small screws. Drill small holes in the canopy and body for the holes. Drill two more holes for the rubber grommets. Refer to color box and apply the decals (In BAG M).



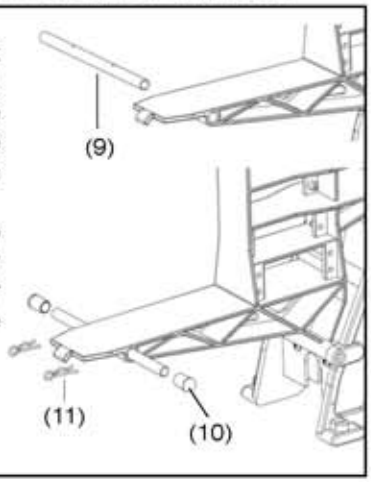
5-4-1 Body Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-6B	M2x6 Self-Tapping Screw	6
2	HSE3-12B	M3x12 Self-Tapping Screw	2
3	BK0102	d3xD6x11Grommet	2
4	BK0098	Body Clip A	1
5	BK0099#	Body Clip B	1
6	BK0429	Body	1
7	BK0428	Canopy	1
8	JV0186	Decal	1
9	BK0473	Body Support	1
10	BK0474	Rubber CAP	2
11	HNLR6	R Pin	2



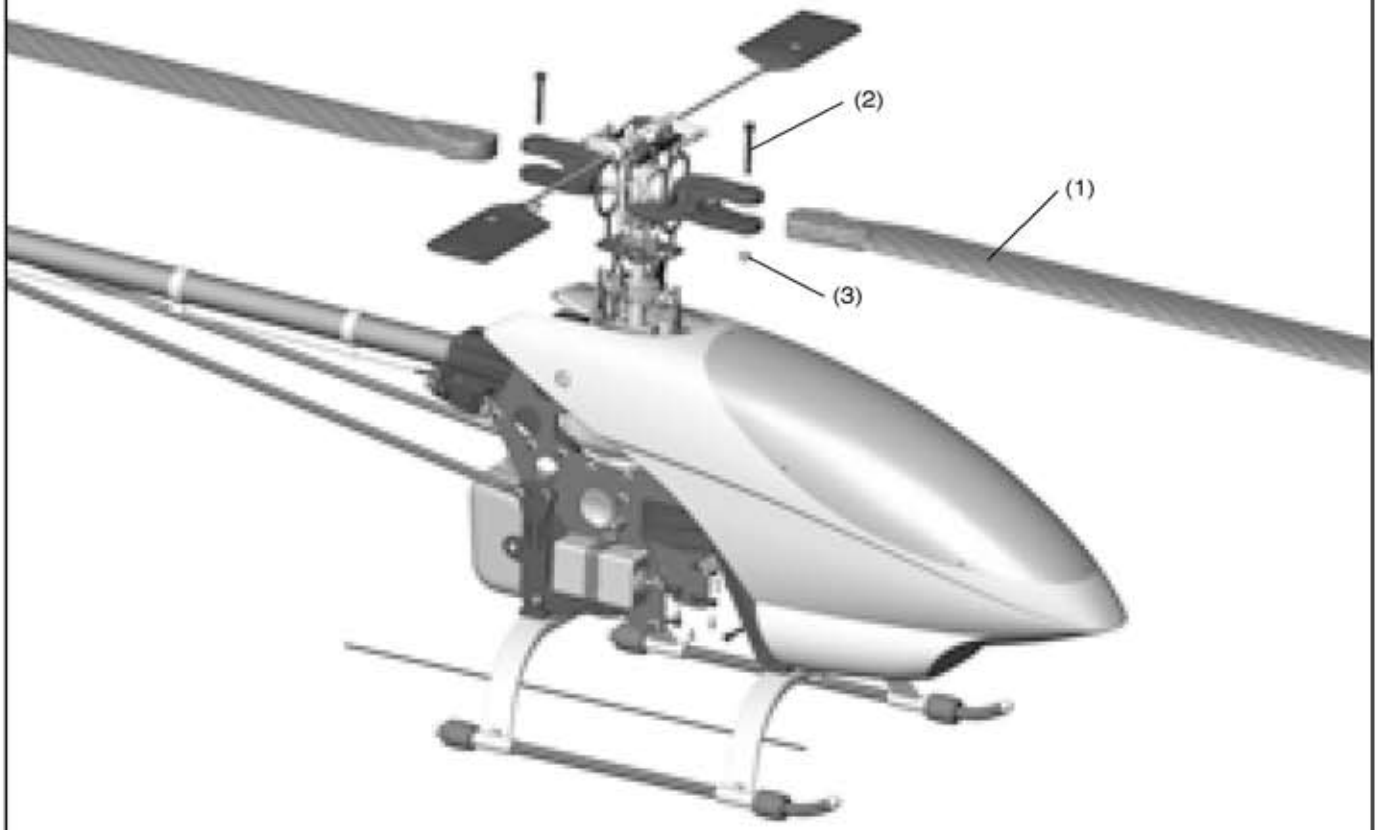
BODY SUPPORT INSTALLATION

Insert the aluminum support tube through the servo frame. Insert the "R" pins through the two holes in the support tube to prevent the tube from moving in the servo frame. Install two rubber ends onto the support tube. The rubber ends will dampen shake or vibration generated by the engine.



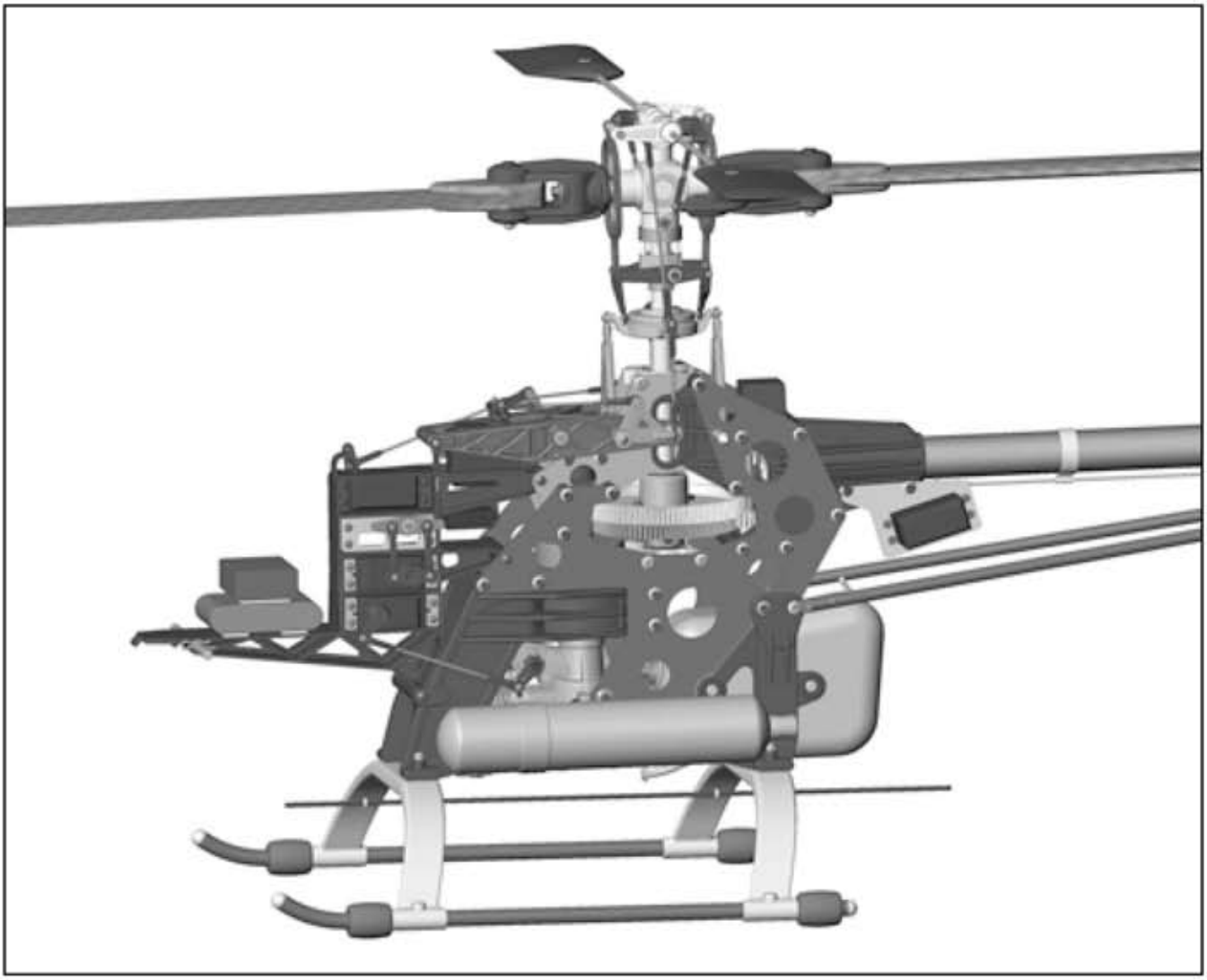
5-5 Installation of Rotor Blades BAG K

No.	Material No.	Description	Qty.
1	*****	Main Rotor Blade	2
2	BK0446	Rotor Bolt M5x35	2
3	HMM5Z	Locknut M5	2



6

SETTINGS

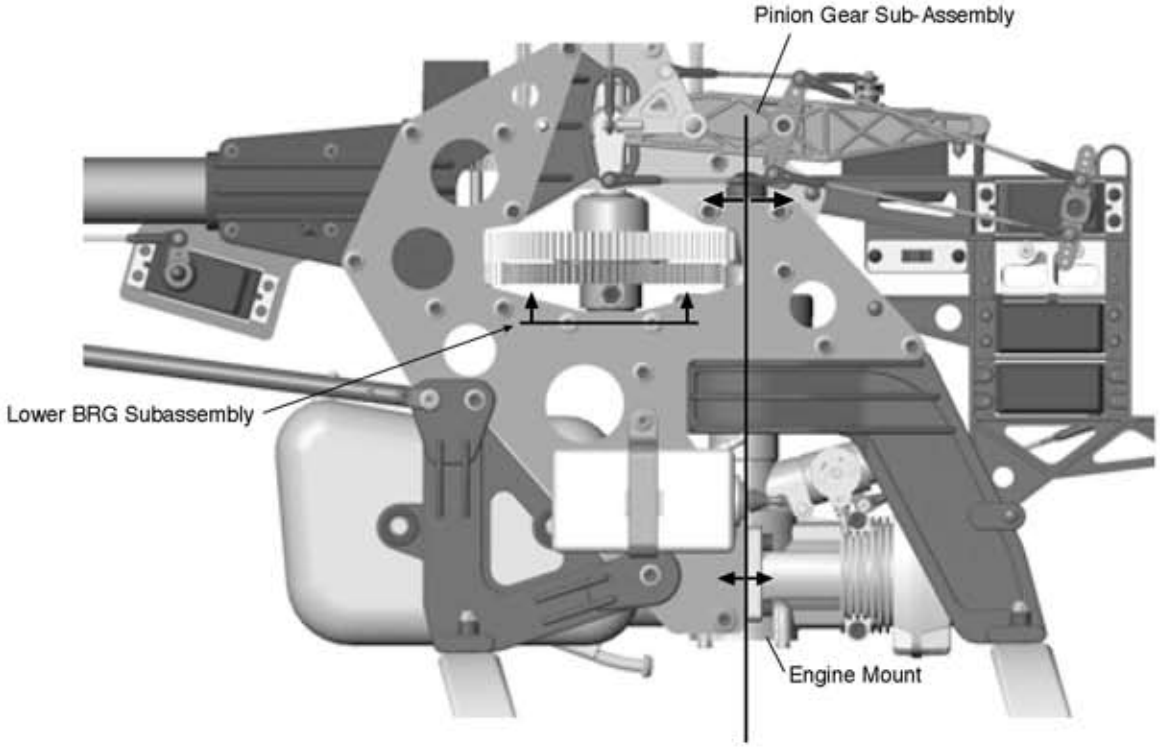


6-1 Setting up Gear Backlash

First, try to move the 12mm main rotor shaft up and down, it should not have any free play. If it can be moved up and down, loosen the 4 bolts holding the lower bearing block and move it upward to eliminate the free play. Move pinion gear subassembly and engine mount side to side until the gears can be turned smoothly and freely with a minimum of backlash.

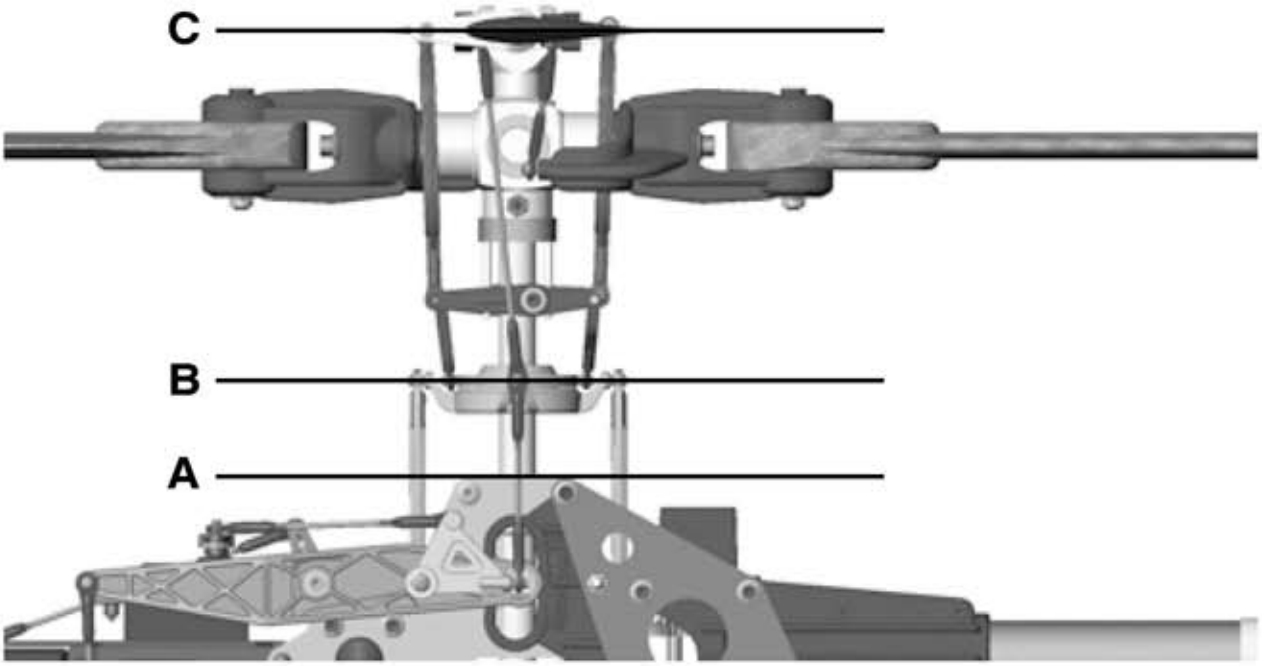
The Raptor 90 3D is designed to accept a diverse gear ratio to suit different flying needs. Currently the main gear is available with 91,93,94 and 95 teeth. The clutch pinion is available with 10,11 and 12 teeth. This gives the pilot a choice of twelve different gear ratios ranging from 7.6 to 9.5 to one. When a 90 class engine is used for 3D flying, we recommend the 11 teeth pinion and 91 teeth main gear first which give 8.27:1 ratio.

The side frame on the Raptor 90 3D have elongated slots for the engine mounting bolts and for the engine starting shaft support bearing block. Loosen all bolts for the engine mount and for the start shaft bearing block. Shift the engine and engine shaft bearing block forward and back until there is a good gear mesh between the main gear and the clutch pinion. Spin the main gear by hand to check if the gear turns smoothly. It is critical that the engine crankshaft and starting shaft is perfectly straight and vertical as shown in the figure of 6-1. Otherwise, the clutch linear and bearings will wear rapidly and there will be excessive vibration. When you are satisfied with the alignment, remove some of the bolts and add Loctite, then tighten all bolts again.



6-2 Setting up of Stabilizer Paddles

A // B // C



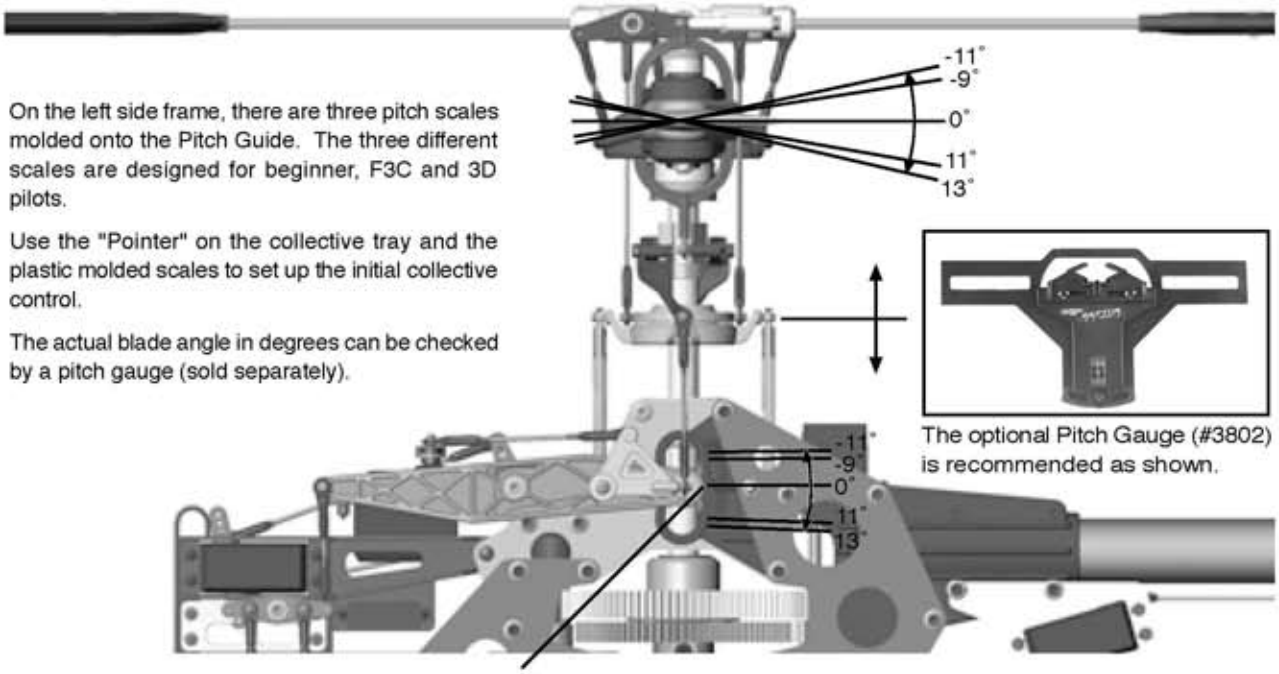
Always make sure the flybar paddles, swashplate, and top of metal frame are parallel.

6-3 Setting up of Blade Pitch Angle

On the left side frame, there are three pitch scales molded onto the Pitch Guide. The three different scales are designed for beginner, F3C and 3D pilots.

Use the "Pointer" on the collective tray and the plastic molded scales to set up the initial collective control.

The actual blade angle in degrees can be checked by a pitch gauge (sold separately).



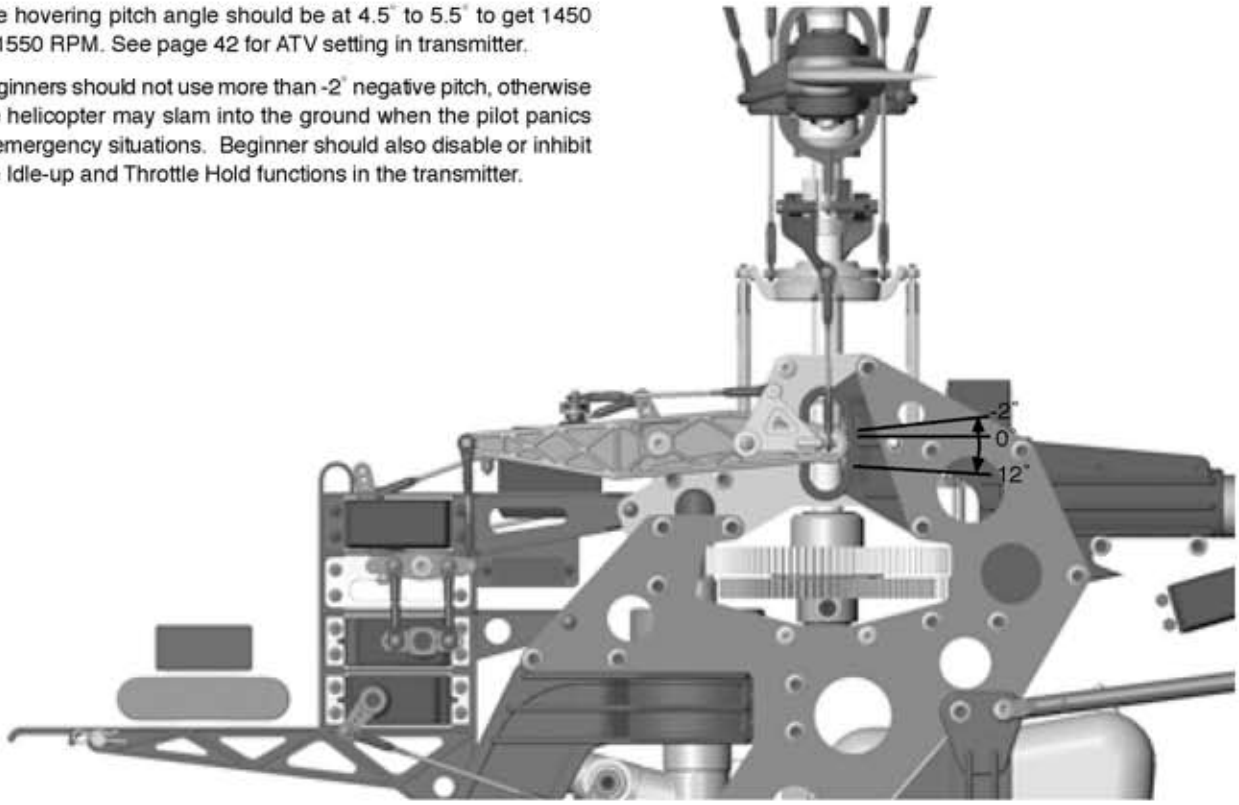
The optional Pitch Gauge (#3802) is recommended as shown.

Note:Recommended rotorspeed is 1450~1550 rpm for hover and 1800~1900 rpm for idle-up aerobatics.

6-3-1 Collective Travel for Hovering

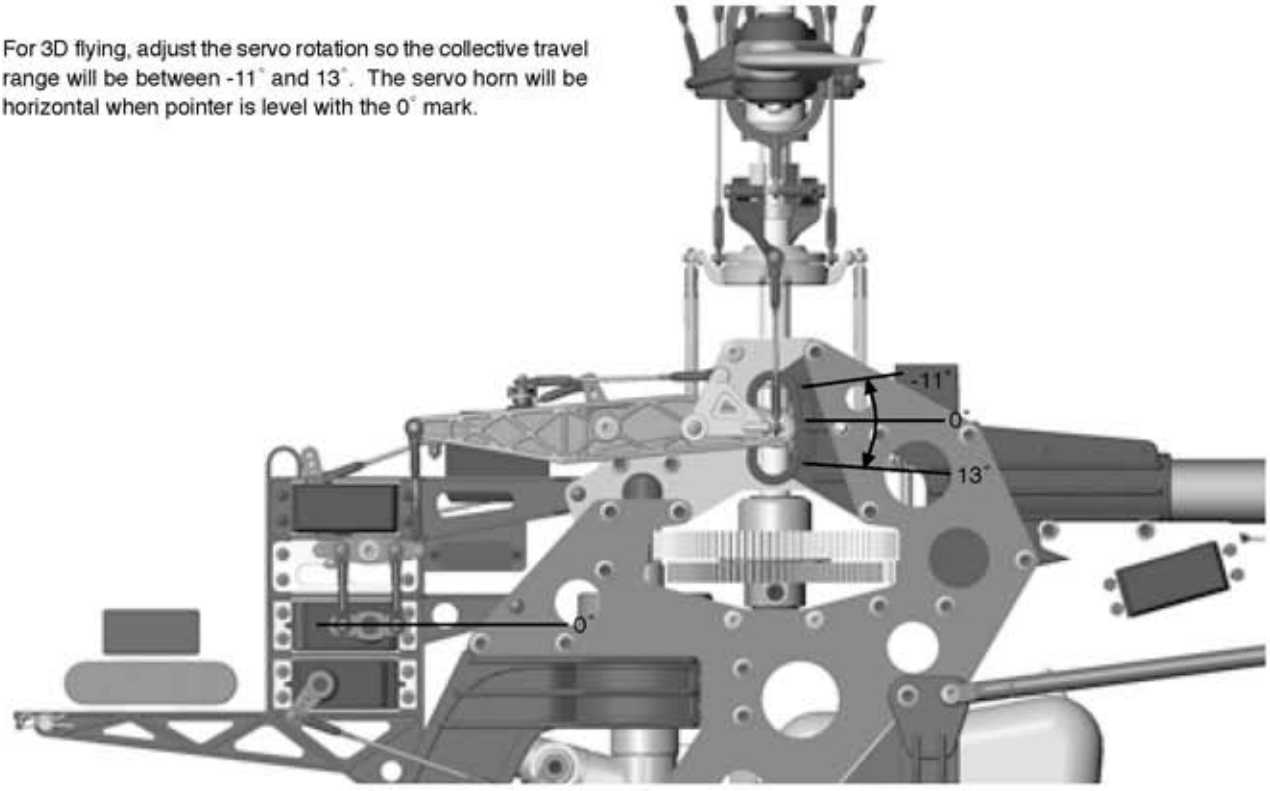
The hovering pitch angle should be at 4.5° to 5.5° to get 1450 to 1550 RPM. See page 42 for ATV setting in transmitter.

Beginners should not use more than -2° negative pitch, otherwise the helicopter may slam into the ground when the pilot panics in emergency situations. Beginner should also disable or inhibit the Idle-up and Throttle Hold functions in the transmitter.

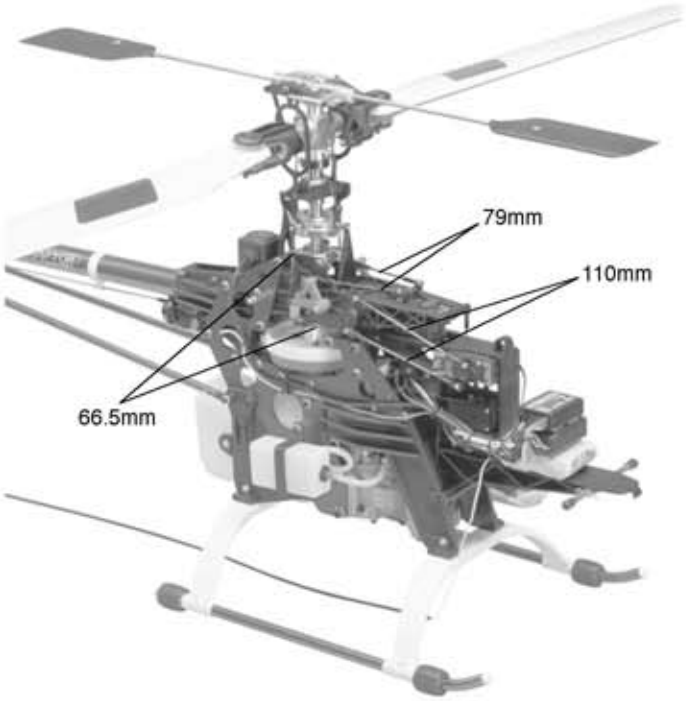


6-3-2 Collective Travel for 3D

For 3D flying, adjust the servo rotation so the collective travel range will be between -11° and 13°. The servo horn will be horizontal when pointer is level with the 0° mark.

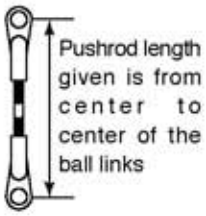


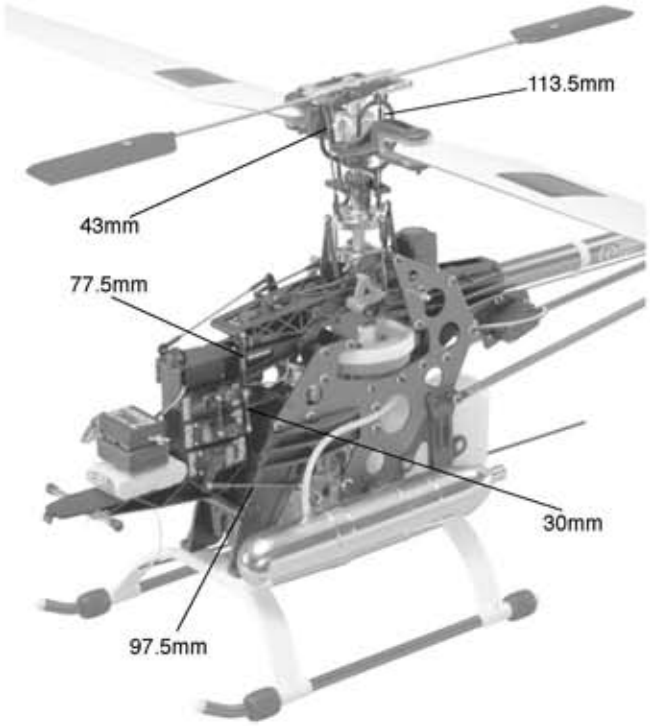
6-3-3 CONFIGURING THE RAPTOR 90 FOR 3D



Use these settings as a start only.

Program the radio values into the transmitter. The EXPO can reduce the control sensitivity near center stick, some radio manufacturer use negative value and some use positive value. Adjust the pushrods to the lengths above. Then fine tune the lengths to get the desired blade angles. Fly the model to fine tune the value.





Beginner Setup

	Aileron	Elevator	Throttle	Rudder	Pitch
ATV	90%	90%	100%	80%	100%
EXPO	30%	30%		30%	

Radio Setting	Low	Pt. 2	Pt. 3	Pt. 4	High
Normal mode Throttle Curve	0	25	50	75	100
Normal mode Pitch Curve	40	55	70	85	96
Blade Angle	-2°	3°	5.5°	9°	12°

3-D Setup

	Aileron	Elevator	Throttle	Rudder	Pitch
ATV	100%	100%	100%	100%	100%
EXPO	25%	25%		30%	

Throttle Curves	Point 1	Point 2	Point 3	Point 4	Point 5
Normal	0	35	50	65	100
Idle Up 1	100	70	55	70	100
Idle Up 2	100	80	70	80	100

Pitch Curves	Point 1	Point 2	Point 3	Point 4	Point 5
Normal	35	INH	60	INH	88
Idle Up 1	8	INH	INH	INH	83
Idle Up 2	7	INH	INH	INH	88
Hold	4	INH	INH	INH	100

Blade Angels	Point 1	Point 2	Point 3	Point 4	Point 5
Normal	-3	INH	3	INH	10
Idle Up 1	-9	INH	INH	INH	9
Idle Up 2	-10	INH	INH	INH	10
Hold	-11	INH	INH	INH	13

Attention

■Always operate or fly a model helicopter in a safe manner and away from crowd, or spectators, or distractions.

■Do not operate model helicopters in rainy or windy condition.

■Check to make sure there is no radio interference before operating a model helicopter.

■Make sure the transmitter and receiver batteries are fully charged before operation.

■Make sure all controls operate properly before flight.

■Model helicopter main and tail rotors operate at high rpm, therefore make sure nothing can come into contact with the rotors during flight.

■Use only model engine fuel. Do not use gasoline, kerosene, or any other substitute.

■Model engine fuel is highly flammable.

■Do not let model engine fuel get in contact with eyes. Do not intake model engine fuel.

■Range check the radio before flying. The servos must operate properly with the transmitter antenna collapsed and at 20 meters away.

■The engine must be in the idle position before starting the engine.

■Make sure the transmitter and receiver are turned on before starting the engine.

■Always maintain a safe distance when operating a model helicopter.

■Do not fly a model helicopter above people or cars.

■Flying requires concentration. Operating a model helicopter for extended time can cause fatigue. Please rest in between flights.

■Do not touch the engine or muffler immediately after the engine was run, because they will be extremely hot.

Warning (Items to watch out after flight)

■Inspect the model helicopter thoroughly to make sure nothing is loosen or damaged.

■Pump out the remaining fuel from the fuel tank.

■Lubricate every moving part with oil to ensure a smooth operation in the future.

Warning (For Storage)

■Keep the model in a cool, dry place. Avoid storage under direct sun light or near heat.

■Add some engine after-run oil through the carburetor, then crank the engine by an electric starter. This help to prevent the engine bearings from rusting. After-run oils are available from hobby shops.

■Please replace any damaged parts if they are discovered during maintenance.

After Flight Checklist

(1) Check every screw and bolt to make sure none has loosened due to vibration.
(2) Check every rotating and movable part to ensure they still move smoothly and normally.
(3) Clean off the exhaust residue from the muffler, engine, and helicopter.
(4) Check all movable parts, such as gears, ball links, belt, etc. for unusual wear.

Trouble Shooting

[1]The engine will not start.

* The engine starting shaft will not turn:
The engine may be flooded with too much fuel. Please remove the glow plug first, then turn the engine with the electric starter until the excess fuel spits out of the glow plug hole.

* The engine turns when the electric starter is applied, but the engine will not start:
(1) Is the glow plug working? Remove the glow plug and does the platinum coil glow red when a 1.5 volt battery is applied to the plug? The glow plug battery may be weak and old.
(2) Is the carburetor needle properly set? Please refer to the engine instruction manual for the proper needle setting.
(3) Does the throttle control arm move properly and in the correct direction according to your transmitter command?

* Engine will start, but quits immediately.
(1) Use the transmitter to increase the throttle carburetor slightly.
(2) Try a new or different type of glow plug. There are different types of glow plugs on the market for different types of fuel and operating conditions. Seek the advice of experienced fliers and also experiment with different types of glow plugs until you find the one that suits your operating condition the best.

*Engine runs, but the helicopter will not lift off.
(1) Check the main rotor blade pitch angle, they should be set at 5.5 to 6 degrees when the transmitter throttle/collective stick is at the center position.
(2) Does the engine throttle arm move properly? The carburetor opening should be fully open when the transmitter throttle/collective stick is moved up. The carburetor opening should be nearly closed when the transmitter throttle/collective stick is moved down. And the opening should be completely closed when the transmitter throttle/collective stick is moved down and the throttle trim is also moved down.
(3) The carburetor needle is not set properly. Close the needle (turn it clockwise) all the way, then open the needle (turn it counter clockwise) 1 and 1/2 turns and try again. If the model still will not lift, then the engine maybe running too rich. The symptom is the engine exhaust has a lot of smoke and the engine coughs and wants to quit when the transmitter throttle/collective stick is moved up, then close the needle 1/8 turn at a time, until the model will lift off. Do not turn the needle too far inward, that will make the engine run too lean and over-heat and damage the engine.

[2] Helicopter problems.

* The helicopter shakes.
(1) Is the blade spindle bent?
(2) Is the flybar bent?
(3) Is the main rotor shaft bent?
(4) Are the two control paddles mounted at the same distance from the rotor shaft, and the paddles are parallel to each other, and in the proper direction?
(5) Is the tail rotor shaft bent? The tail rotor blades mounted properly or damaged?
(6) Are the main rotor blades damaged or mounted in the proper orientation? The blade may require additional balancing. The blade balance can be checked by removing both blades and then use one of the 5mm blade bolt and nut to hold the two blades together like a teeter totter. Then, hold the blade bolt with your thumb and index finger. The two blades should teeter and remain in a level position. If not, then add some tape to the lighter blade near the blade tip until the two blades teeter in a level position. Hobby shops also sell blade balancers that are designed solely for balancing model helicopter blades.

In the event the model has crashed.

Inspect the flybar, rotor shaft and the blade spindle to make sure they are not bent at all. If any item is damaged, it must be replaced by a new part to ensure safe operation. Do not glue any broken or damaged plastic part. Do not repair broken rotor blades. Always inspect the following items immediately:

(a). Engine starting shaft.

(b). All the gears.

(c). Main shaft, flybar and blade feathering spindle.

(d). Tail boom and supports for cracks.

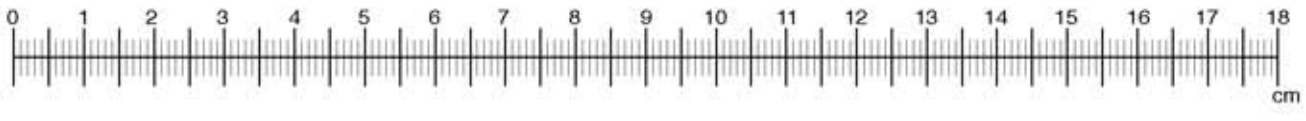
(e). Drive shaft for the tail rotor.

(f). Vertical fins.

(g). Tail rotor shaft and control system.

(h). Main and tail rotor blades.

(i). Main frame.



7

PARTS LIST SECTION

RAPTOR 90 3D EXCLUSIVE PARTS

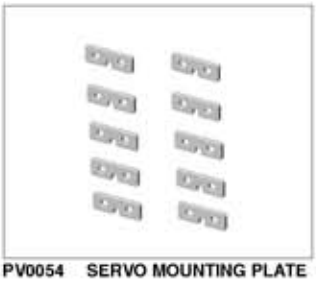
PV0041 BALL LINK

PV0046 BALL BEARING, d8xD12xW3.5

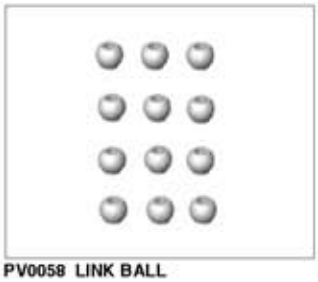
PV0048 BALL BEARING, d4xD8xW3

PV0050 BALL BEARING, d5xD13xW4

PV0052 BALL BEARING, d6xD10xW3



PV0054 SERVO MOUNTING PLATE



PV0058 LINK BALL

PV0062 RUBBER GROMMETS

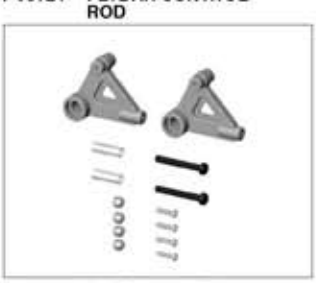
PV0120 MAIN ROTOR GRIP

PV0124 FLYBAR CONTROL ROD

PV0125 THRUST WASHER

PV0126 SPINDLE

PV0132 PITCH CONTROL ARM



PV0134 AILERON LEVER

PV0135 TAIL PITCH CONTROL LEVER

PV0139 ONE WAY CLUTCH SHAFT

PV0140 TAIL DRIVE GEAR

PV0141 ENGINE MOUNT

PV0147 TAIL CASE

PV0148 TAIL ROTOR GRIP

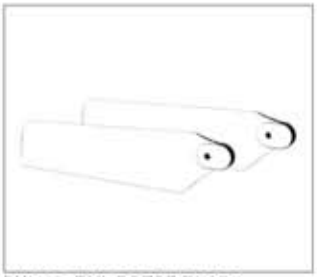
PV0149 TAIL BEVEL GEAR

PV0150 TAIL ROTOR SHAFT

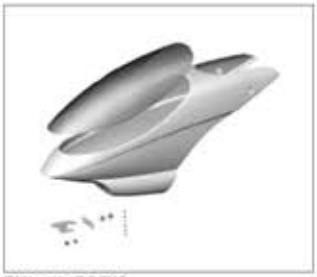
PV0155 PITCH GUIDE COLLAR

PV0157 REAR FRAME

PV0158 TAIL BOOM BRACKET



PV0163 TAIL ROTOR BLADE



PV0171 BODY

PV0172 THRUST BEARING, d8xD16xW5

PV0174 BALL BEARING, d4xD11xW4

PV0175 BALL BEARING, d8xD16xW5

PV0176 BALL BEARING, d4xD7xW2.5

PV0177 ROTOR BOLT

PV0182 BALL BEARING, d6xD13xW5

PV0190 TAIL DRIVE SPUR GEAR

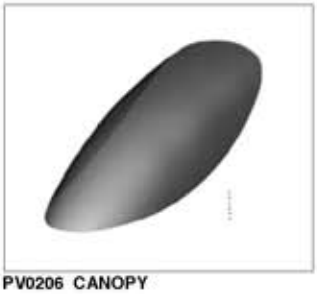
PV0192 PINION GEAR 11T

PV0195 TAIL DRIVE SHAFT BRG

PV0197 TAIL DRIVE SHAFT BEVEL GEAR BRG

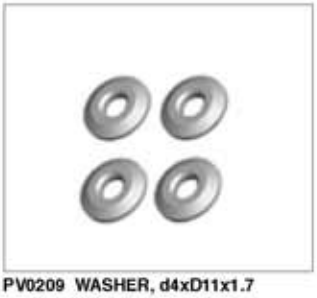
PV0198 COOLING FAN

PV0203 BALL BEARING, d6xD15xW5

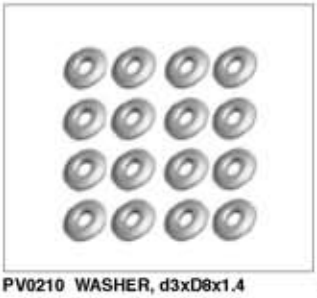


PV0206 CANOPY

PV0208 FUEL TANK RUBBER GROMMET



PV0209 WASHER, d4xD11x1.7



PV0210 WASHER, d3xD8x1.4

PV0239 BODY CLIP

PV0241 ROD GUIDE COLLAR

PV0243 CLUTCH BRG CASE

PV0244 PINION BRG, d10xD19xW5

PV0245 WASHOUT LINK

PV0246 TAIL DRIVE GEAR SHAFT

PV0247 ELEVATOR ARM LINK

PV0248 PITCH ARM CROSS MEMBER

PV0250 ROTOR GRIP SPACER

PV0251 FUEL PLUG

PV0253 ANTENNA PIPE

PV0254 INSTALLATION TOOLS

PV0262 BODY SUPPORT

PV0267 LOCTITE #242

PV0268 LOCTITE #262

PV0269 GREASE (FOR PLASTIC GEAR)

PV0270 GREASE (FOR BEARING)

PV0284 METAL SWASH PLATE

PV0291 METAL WASHOUT BASE

PV0298 MAIN SPUR GEAR 91T

PV0310 FUEL TANK, 550c.c.

PV0321 REAR TAIL SERVO TRAY

PV0322 HEAVY DUTY CLUTCH

PV0334 METAL MAIN ROTOR HUB

PV0350 HARDENED MAIN SHAFT

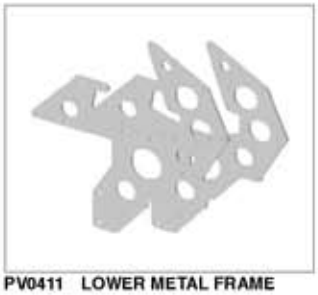
PV0360 STARTER SHAFT

PV0361 STARTER COUPLING

PV0407 TAIL PITCH SLIDER

PV0409 ONE WAY CLUTCH

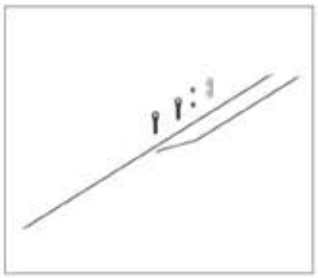
PV0410 UPPER METAL FRAME



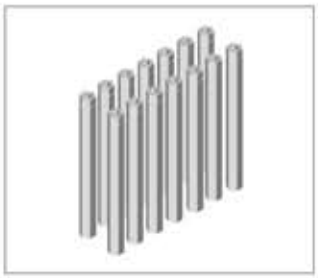
PV0411 LOWER METAL FRAME

PV0412 FAN CASING

PV0414 LANDING SKID



PV0416 TAIL CONTROL ROD



PV0418 FRAME SPACER (L)

PV0419 FRAME SPACER (M)

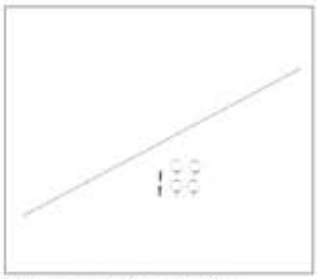
PV0420 FRAME SPACER (S)

PV0421 TAIL DRIVE SHAFT

PV0422 TAIL BOOM

PV0423 TAIL ROD GUIDE

PV0425 TAIL PITCH CONTROL SLIDE BUSHING



PV0453 REAR SERVO ROD

PV0455 SKID PIPE END CAP

PV0466 METAL FORK

PV0469 MAIN SHAFT LOCK RING

PV0497 WASHER

PV0498-L 3D LIGHT PADDLE

PV0499 SUS TAIL ROTOR HUB

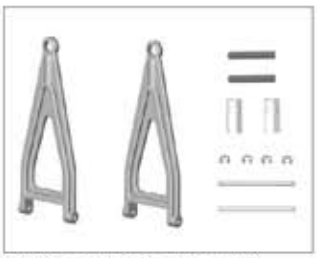
PV0516-L SKID DAMPER(BL)

PV0517 ONEWAY GREASE

PV0526 BALL BEARING, d5XD10XW4

PV0601 MIXING LEVER

PV0602 METAL ELEVATOR PARALLEL LEVER

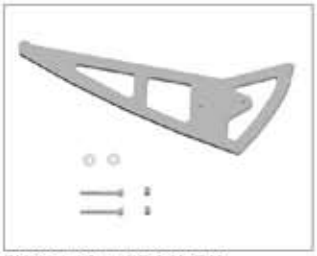


PV0603 ELEVATOR ARM LINK

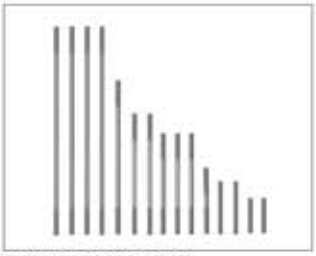
PV0604 METAL ELEVATOR CONTROL ARM

PV0605 PUSH PULL ELEVATOR CONTROL LEVER

PV0606 METAL MAIN SHAFT METAL LOWER BRG



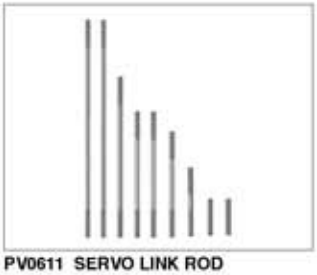
PV0607 3D VERTICAL FIN



PV0608 LINKAGE ROD

PV0609 BALL BEARING, d12XD28XW8

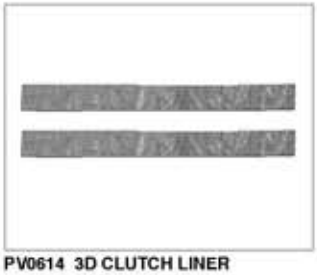
PV0610 FLYBAR SEESAW



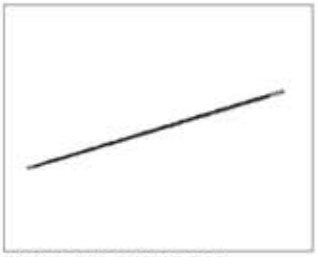
PV0611 SERVO LINK ROD

PV0612 MAIN SHAFT METAL UPPER BRG BLOCK

PV0613 WASHOUT LINK PIN



PV0614 3D CLUTCH LINER



PV0615 SUS FLYBAR ROD

PV0616 METAL FLYBAR CONTROL ARM SET

PV0617 METAL FLYBAR CONTROL ARM

PV0618 METAL FLYBAR CONTROL POST

PV0619 3D DAMPER SET

PV0620 3D INNER DAMPER

PV0621 3D OUTER DAMPER

PV0622 FLYBAR CONTROL LEVER SET

PV0623 FLYBAR CONTROL LEVER

PV0624 3D HEAVY DUTY CLUTCH BELL

PV0625 SERVO FRAME

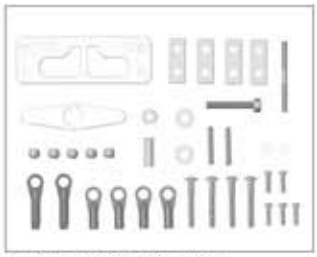
PV0626 TAIL SUPPORT

PV0627 DECAL

PV0628 TAIL SUPPORT BRACKET

PV0631 ELEVTOR LINK SHAFT

PV0632 BODY RETAINING POST



PV0633 PITCH PUSH PULL LEVER SET

3800 BLADE HOLDER

SCREWS

PV0211	M2.6x10 SOCKET SCREW
PV0212	M3x10 SOCKET SCREW
PV0213	M3x12 SOCKET SCREW
PV0214	M3x14 SOCKET SCREW
PV0215	M3x18 SOCKET SCREW
PV0216	M3x25 SOCKET SCREW
PV0217	M3x28 SOCKET SCREW
PV0218	M3x8 SOCKET SCREW
PV0219	M4x10 SOCKET SCREW
PV0220	M4x12 SOCKET SCREW
PV0221	M4x18 SOCKET SCREW
PV0222	M4x25 SOCKET SCREW
PV0223	M4x8 SOCKET SCREW
PV0224	M3x18 SET SCREW
PV0225	M3x4 SET SCREW

PV0226	M4x3 SET SCREW
PV0227	M4x5 SET SCREW
PV0228	M2x8 PHILIP MACHINE SCREW
PV0230	M2x14 SELF-TAPPING SCREW
PV0231	M2x6 SELF-TAPPING SCREW
PV0232	M2x8 SELF-TAPPING SCREW
PV0229	M2x10 SELF-TAPPING SCREW
PV0233	M3x20 SELF-TAPPING SCREW
PV0234	M2 NUT
PV0235	M2.6 LOCKNUT
PV0236	M3 LOCKNUT
PV0237	M4 LOCKNUT
PV0238	M5 LOCKNUT

RAPTOR 90 SE SPARE PARTS LIST

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0041	BALL LINK	BK0086	Ball Link φ4.8x20	12	-
PV0046	ELEVATOR ARM ,BRG	HMV1280ZZY	d8xD12x3 BRG	2	1-5-4
PV0048	BRG:PITCH FRAME & ROTOR HUB SEESAW 4830 / LEVER & PITCH ARM 4870	HMV840ZZY	d4xD8x3 BRG	2	-
PV0050	BRG:FEATHERING 4830/TAIL SHAFT	HMV1350	d5xD13x4 BRG	2	3-1-1
PV0052	TAIL SLIDER BRG	HMV1060ZZY	d6xD10x3 BRG	2	3-1-2
PV0054	SERVO MOUNTING PLATE	BK0104	Sever Mounting Plate	10	5-1,5-2
PV0058	LINK BALL	BK0075	Link Ball φ4.8	12	-
PV0062	BODY MOUNT RUBBER GROMMENTS	BK0102	d3xD6x11 RUBBER Grommet	5	5-4-1
PV0120	MAIN ROTOR GRIP	BK0075	Link Ball φ4.8	2	2-1-2
		BK0319	Main Rotor Pitch Housing	2	2-1-2
		HMJ2-10N	M2X10 Self-Tapping Screw	2	2-1-2
PV0124	FLYBAR CONTROL ROD	BK0344	Flybar Control Rod	2	2-1-1
PV0125	THRUST WASHER	BK0325	Thrust Collar	2	2-1-2
PV0126	SPINDLE	BK0326	Spindle	1	2-1-2
		BK0477	Washer	2	2-1-2
		HMC4-10B	M4x10 Socket Screw	2	2-1-2
PV0132	PITCH CONTROL ARM	BK0075	Link Ball φ4.8	1	1-5-4
		BK0336	Pitch Frame	1	1-5-4
		BK0407	Collar d3xD4x13	2	1-5
		HMC3-10B	M3x10 Socket Screw	1	1-5
		HMC3-25B	M3x25 Socket Screw	1	1-5
		HMJ2-10N	M2x10 Sefl-Tapping Screw	1	1-5-4

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0134	AILERON LEVER	BK0075	Link Ball φ4.8	4	1-5-1
		BK0340	Aileron Control Arm	2	1-5-1
		BK0410	Collar d3xD4x13	2	1-5
		HMJ2-10N	M2x10 Sefl-Tapping Screw	4	1-5-1
		HMJ3-20N	M3x20 Self-Tapping Screw	2	1-5
PV0135	TAIL PITCH CONTROL LEVER	BK0075	Link Ball φ4.8	1	3-1-1
		BK0076	Collar d3xD4x10	1	3-1-1
		BK0088	d3xD5x0.5 Washer	1	3-1-1
		BK0346	Tail Pitch Control Lever	1	3-1-1
		HMJ2-8N	M2x8 Self-Tapping Screw	1	3-1-1
		HMJ3-20N	M3x20 Self-Tapping Screw	1	3-1-1
PV0139	ONE WAY CLUTCH SHAFT	BK0359	One Way Clutch Shaft	1	1-6-2
		HMC4-25B	M4x25 Socket Screw	1	1-6
		HMM4B	M4 Locknut	1	1-6
		HMQ16	Retaining Ring	1	1-6-2
PV0140	TAIL DRIVE GEAR SET	BA1144-1	Washer d8xD5x0.15	4	1-2-1
		BK0362	Tail Drive Bevel Gear A	1	1-2-1
		BK0363	Tail Drive Bevel Gear B	1	1-2-1
		BK0364	Tail Drive Pinion	1	1-2-1
		HME3-4B	M3x4 Set Screw	2	1-2-1
		HMY2-12	Pin φ2x12	2	1-2-1
PV0141	ENGINE MOUNT	BK0349	Engine Mount	1	4-2-1
		BK0435	d4xD11x1.7 Washer	4	4-2
		HMC4-12B	M4x12 Socket Screw	4	4-2
		HMC4-18B	M4x18 Socket Screw	4	4-2-1
PV0147	TAIL CASE	BK0370	Tail Case L	1	3-1-1
		BK0371	Tail Case R	1	3-1-1
		HMC3-10B	M3x10 Socket Screw	3	3-1-1
		HMM3B	M3 Locket	3	3-1-1
PV0148	TAIL ROTOR GRIP	BK0302-1	Tail Pitch Housing A	2	3-1-2
		BK0303-1	Tail pitch Housing B	2	3-1-2
		HMC2510B	M2.6x10 Socket Screw	4	3-1-2
		HMC3-14B	M3x14 Socket Screw	2	3-1
		HMM25	M2.6 Locknut	4	3-1-2
		HMM3B	M3 Locknut	2	3-1
PV0149	TAIL BEVEL GEAR	BA1141-1	Washer d8xD5x0.15	4	3-1-1
		BK0372	Tail Input Bevel Gear	1	3-1-1
		BK0373	Tail Output Bevel Gear	1	3-1-1
		HME3-4B	M3x4 Set Screw	1	3-1-1
		HMY2-12	Pin φ2x12	1	3-1-2
PV0150	TAIL ROTOR SHAFT	BK0374	Tail Shaft	1	3-1-2
		HME3-4B	M3x4 Set Screw	2	3-1-2
		HMY2-12	Pin φ2x12	1	3-1-2
PV0155	PITCH GUIDE COLLAR	BK0384	Pitch Guide Collar L	1	1-1-2
		BK0385	Pitch Guide Collar R	1	1-1-3
PV0157	REAR FRAME SET	BK0380	Rear Frame L	1	1-2
		BK0381	Rear Frame R	1	1-2
		BK0629	Washer	4	1-2
PV0158	TAIL BOOM BRACKET	BK0382	Tail Boom Bracket L	1	1-2-1
		BK0383	Tail Boom Bracket R	1	1-2-1
PV0163	TAIL ROTOR BLADE	BK0404	Tail Rotor Blade	2	3-1
PV0171	BODY	BK0098	Body Clip A	1	5-4-1
		BK0099	Body Clip B	1	5-4-1
		BK0102	d3xD6x11 RUBBER Grommet	2	5-4-1
		BK0428	Canopy	1	5-4-1
		BK0429	Body	1	5-4-1
		HMJ2-6B	M2x6 Self-Tapping Screw	8	5-4-1
		HSE3-12B	M3x12 Self-Tapping Screw	2	5-4-1
PV0172	THRUST BRG	HMX0816	d8xD16x5 Thrust Bearing	2	2-1-2
PV0174	FLY BAR SEESAW BRG	HMV694ZZ	d4xD11x4 BRG	2	2-1-1
PV0175	FEATHERING BRG	HMV1680	d8xD16x5 BRG	2	2-1-2
PV0176	TAIL PITCH CONTROL LEVER BRG	HMV740ZZ	d4xD7x2.5 BRG	2	3-1-1
PV0177	ROTOR BOLT	BK0446	Rotor Bolt	2	5-5
		HMM5Z	M5 Locknut	2	5-5

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0182	CLUTCH BELL BRG	HMV1360Z	d6xD13x5 BRG	2	1-1-1
PV0190	TAIL DRIVE SPUR GEAR	BK0357	Tail Drive Spur Gear 83T	1	1-6-2
		HMC4-25B	M4x25 Socket Screw	1	1-6
		HMM4B	M4 Locknut	1	1-6
PV0192	PINION GEAR 11T(STD)	BK0422	Drive Pinion 11T	1	1-1-1
		BK0366	Pinion Gear Nut	1	1-1-1
PV0195	TAIL DRIVE SHAFT BRG	BV0423	Tail Drive Shaft BRG	1	3-1-3
PV0197	TAIL DRIVE SHAFT BEVEL GEAR BRG	HMV6701Z	d12xD18x4 BRG	2	1-2-1,3-1-1
PV0198	COOLING FAN ASSY	BV0380	Cooling Fan Assy	1	4-2-1
PV0203	STARTER SHAFT BRG	HMV696Z	d6xD15x5 BRG	2	1-1-1
PV0206	CANOPY	BK0428	Canopy	1	5-4-1
		HMJ2-6B	M2x6 Self-Tapping Screw	8	5-4-1
PV0208	FUEL TANK RUBBER GROMMENT	BK0274	Tank Rubber Grommet	4	1-2
PV0209	WASHER,d4xD11xt1.7	BK0435	d4xD11x1.7 Washer	4	-
PV0210	WASHER,d3xD8xt1.4	BK0087	d3xD8x1.4 Washer	16	-
PV0239	BODY CLIP 4830/4870	BK0098	Body Clip A	1	5-4-1
		BK0099	Body Clip B	1	5-4-1
		HSE3-12B	M3x12 Self-Tapping Screw	2	5-4-1
PV0241	ROD GUIDE COLLAR	BK0389	Rod Guide Collar	2	1-3-1
PV0243	CLUTCH BRG CASE	BK0388	Clutch BRG Case	2	1-1-1
PV0244	PINION BRG	HMV6800ZZY	d10xD19x5 BRG	2	1-1-1
PV0245	WASH OUT LINK	BK0343	Wash Out Link	2	1-6-1
PV0246	TAIL DRIVE GEAR SHAFT	BK0365	Tail Drive Gear Shaft	1	1-2-1
		BK0414	Pin φ2x12	2	1-2-1
		HME3-4B	M3x4 Set Screw	2	1-2-1
PV0247	ELEVATOR ARM LINK	BK0663	Elevator Arm Link	2	1-1-4
PV0248	PITCH ARM CROSS MEMBER	BK0393	Pitch Frame Cross Member	1	1-1
		BK0394	Pitch Frame Cross Member Nut	2	1-1
PV0250	ROTOR GRIP SPACER	BK0478	Rotor Grip Spacer	2	5-5
PV0251	FUEL PLUG	BK0445	Fuel Plug	3	1-2-3
PV0253	ANTENNA PIPE 4830/4870	BE1052	Antenna Pipe	2	5-3
PV0254	INSTALLATION SET	BK0106	Two Touch Tape	2	-
		BK0109	Rubber Band 5x320xT1	2	-
		HNI2	HEx Wrench 2m/m	1	-
		HNJ25	HEx Wrench 2.5m/m	1	-
		HNI3	HEx Wrench 3m/m	1	-
		HNI4	HEx Wrench 4m/m	1	-
		HNI5	HEx Wrench 5m/m	1	-
		HNJ-1	Tie Band	3	-
PV0262	BODY SUPPORT	BK0473	Budy Support	1	5-4-1
		BK0474	Rubber Cap	2	5-4-1
		HNLR6	R Pin	2	5-4-1
PV0267	LOCTITE #242			1	-
PV0268	LOCTITE #262			1	-
PV0269	PLASTIC GEAR GREASE			1	-
PV0270	THRUST BEARING GREASE			1	-
PV0284	METAL SWASH PLATE	BV0504	Metal Swash Plate	1	1-6
PV0291	METAL WASHOUT BASE	BK0472	Metal Washout Base	1	1-6-1
		HMC3-12B	M3x12 Socket Screw	2	1-6-1
PV0298	91T MAIN SPUR GEAR	BK0356	Main Gear 91T	1	1-6-2
PV0310	FUEL TANK 550C.C	BV0503	Fuel Tank	1	1-2-3
PV0321	REAR TAIL SERVO TRAY	BK0087	Washer d3xD8xW1.4	2	5-1
		BK0104	Servo Mounting Plate	2	5-1
		BK0539	Carbon Rear Servo Plate	1	5-1
		HMC2516B	M2.5x16 Socket Screw	4	5-1
		HMC3-30B	M3x30 Socket Screw	2	5-1
		HMM25	M2.5 Locknut	4	5-1
		HMM3Z	M3 Locknut	2	5-1
PV0322	HEAVY DUTY CLUTCH	BV0521	Heavy Duty Clutch	1	1-1-1
PV0334	METAL MAIN ROTOR HUB	BV0548	Metal Main Rotor Hub	1	2-1-2
		BV0549	Washout Base Guidance Ring	1	2-1
		HMC3-12B	M3x12 Socket Screw	1	2-1
PV0350	MAIN SHAFT	BK0547	Main Shaft	1	1-6
PV0360	STARTER SHAFT	BK0592	Starter Shaft	1	1-1-1

No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
		HME4-5B	M4x5 Set Screw	2	1-1-1
		HMS5	M5x8 E Ring	1	1-1-1
PV0361	STARTER COUPLING	BK0594	Starter Couling	1	1-1-1
		HME4-5B	M4x5 Set Screw	2	1-1-1
PV0407	TAIL PITCH SLIDER	BK0026	Tail Pitch Control Link	2	3-1-2
		BK0027	Tail Pitch Control Slider	1	3-1-2
		BK0075	Link Ball φ4.8	1	3-1-2
		BK0082	Collar d3xD3x4	2	3-1-2
		HSE2-10B	M2x10 Self-Tapping Screw	2	3-1-2
		HMJ2-8N	M2x8 Self-Tapping Screw	1	3-1-2
PV0409	ONE WAY CLUTCH	BV0368	Autorotation Clutch	1	1-6-2
		HMC3-8B	M3x8 Socket Screw	4	1-6-2
PV0410	UPPER METAL FRAME	BK0375T	Upper Metal Frame	2	1-1
PV0411	LOWER METAL FRAME	BK0376T	Lower Metal Frame	2	1-2
PV0412	FAN CASING SET	BK0665	Fan Casing L	1	1-2-2
		BK0666	Fan Casing R	1	1-2-2
		BK0662	Fan Caseing Plate	1	1-2-2
		HME3-6B	M3x6 Set Screw	2	1-2-2
PV0414	LANDING SKID SET	BK0397	Skid Brace	2	4-3-1
		BK0398	Skid Pipe End Cap	4	4-3-1
		BK0668	Skid Pipe	2	4-3-1
		HMC3-30B	M3x30 Socket Screw	4	4-3
		HME4-5B	M4x5 Set Screw	4	4-3-1
		HMM3Z	M3 Locknut	4	4-3
PV0416	TAIL CONTROL ROD	BK0086	Ball Link φ4.8x20	2	-
		BK0105	Rod Joint	1	-
		BK0347	Tail Control Rod A	1	-
		BK0653	Tail Control Rod B	1	-
		HME4-5B	M4x5 Set Screw	2	-
PV0418	FRAME SPACER (L)	BK0660	Frame Spacer L	14	-
PV0419	FRAME SPACER(M)	BK0659	Frame Spacer M	8	-
PV0420	FRAME SPACER(S)	BK0658	Frame Spacer S	13	-
PV0421	TAIL DRIVE SHAFT SET	BV0651	Tail Drive Shaft Set	1	3-1-3
		HMC2512B	M2.5x12 Sockeet Screw	2	3-1-3
		HMM25	M2.5 Locknut	2	3-1-3
PV0422	TAIL BOOM	BK0650	Tail Boom	1	3-1
PV0423	TAIL ROD GUIDE	BK0403	Rod Guide	4	3-1
PV0425	TAIL PITCH CONTROL SLIDE BUSHING	BK0345	Tail Pitch Control Slide Bushing	1	3-1-2
PV0453	REAR SERVO ROD	BK0086	Ball Link φ4.8x20	2	3-1
		BK0403	Rod Guide	4	3-1
		BK0707	Rear Servo Rod	1	3-1
PV0455	SKID PIPE END CAP	BK0398	Skid Pipe End Cap	8	4-3-1
PV0466	METAL FORK	BK0545	Metal Fork	1	3-1-2
		BK0546	Pin 2mm	2	3-1-2
		HMS15	E Ring	6	3-1-2
PV0469	MAIN SHAFT LOCK RING	BK0234	Lock Ring	1	1-6
		HSA3-6B	M3x6 Button Head Socket Screw	2	1-6
PV0497	WASHER	BK0477	Washer	4	-
PV0498-L	3D LIGHT PADDLE(BL)	BK0406L	Light Paddle Root	2	2-1-1
		BK0416	Paddle Stopper	2	2-1-1
		BK0432L	Light Paddle	2	2-1-1
		HME4-3B	M4x3 Set Screw	4	2-1-1
PV0499	SUS TAIL ROTOR HUB	BK0821	SUS Tail Rotor Hub	1	3-1-2
		HME3-3B	M3x3 Set Screw	2	3-1-2
		HMM3Z	M3 Locknut	2	3-1-2
PV0516-L	SKID DAMPER(BL)	BK0820BL	Landing Skid Damper	4	4-3
PV0526	BALL BEARING	HMV1050ZZ	d5xD10xW4	4	3-1-2
PV0601	MIXING LEVER	BK0075	Link Ball φ4.8	4	2-1-1
		BK0088	Washer d3xD5x0.5	2	2-1-1
		BK0324	Mixing Lever	2	2-1-1
		BK0410	Collar d3xD4x13	2	2-1-1
		HMC3-18B	M3x18 Socket Screw	2	2-1-1
		HMJ2-10N	M2x10 Self-Tapping Screw	4	2-1-1
PV0602	METAL ELEVATOR PARALLEL LEVER	BK0075	Link Ball φ4.8	1	1-5-2

No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
		BK0876	Metal Elevator Parallel Lever	1	1-5-2
		HMY2-12	Pin φ2x10	1	1-5
		HMC2-6B	M2x6 Socket Screw	1	1-5
		HME3-3B	M3x3 Set Screw	1	1-5
		HMF2-8N	M2x8 Philip Machine Screw	1	1-5-2
PV0603	ELEVATOR ARM LINK	BK0663	Elevator Arm Link	2	1-1-4
		BK0880	Elevator Link Shaft	2	1-1-4
		BK0693	Frame Spacer	2	1-1-2,1-1-3
		HME3-185B	Set Screw M3x18.5	2	1-3
		HMS15	E Ring	4	1-1-4
PV0604	METAL ELEVATOR CONTROL ARM	BK0455	Metal Elevator Control Arm	1	1-1-4
		HMS4	E Ring	1	1-1-4
PV0605	PUSH PULL ELEVATOR CONTROL LEVER	BK0075	Link Ball φ4.8	5	1-5-3
		BK0086	Ball Link φ4.8x20	4	1-5-3
		BK0104	Servo Mounting Plate	2	5-1
		BK0318	Link Rod M2.3x95	2	5-1
		BK0088	Washer d3xD5x0.5	1	1-5
		BK0833	Servo Block	4	5-1
		BK0882	Push Pull Elevator Control Lever	1	1-5-3
		BK0410	Collar d3xD4x13	1	1-5-3
		HMV840ZZY	Ball Bearing	2	1-5-3
		HMC3-25B	M3x25 Socket Screw	1	1-5
		HMJ2-8N	M2x8 Self-Tapping Screw	3	1-5-3
		HSE2630N	M2.6x30 Self-Tapping Screw	4	5-1
		HMF2-8N	M2x8 Philip Machine Screw	2	5-1
		HML2	M2 Nut	2	5-1
PV0606	METAL MAIN SHAFT METAL LOWER BRG	BV0870	Metal Lower BRG Block	1	1-2
PV0607	3D VERTICAL FIN	BK0278	Machined Washer	2	3-1
		BK0877	3D Vertical Fin	1	3-1
		HMC3-30B	M3x30 Socket Screw	2	3-1
		HMM3Z	M3 Locknut	2	3-1
PV0608	LINKAGE ROD	BK0318	Link Rod 2.3x95	4	-
		BK0093	Link Rod 2.3x46	3	-
		BK0095	Link Rod 2.3x76	1	-
		BK0292	Link Rod 2.3x24	2	-
		BK0839	Link Rod 2.3x30	1	-
		BK0113	Link Rod 2.3x18	2	-
		BK0436	Link Rod 2.3x55	2	-
PV0609	MAIN SHAFT BRG	HMV6001Z	Ball Bearing, d12xD28xW8	2	-
PV0610	FLYBAR SEESAW	BK0408	Collar d3xD4x5.5	2	2-1
		BV0865	Flybar Seesaw	1	2-1-1
		HMC3-10B	M3x10 Socket Screw	2	2-1
PV0611	SERVO LINK ROD	BK0318	Link Rod 2.3x95	2	-
		BK0095	Link Rod 2.3x46	1	-
		BK0436	Link Rod 2.3x76	2	-
		BK0093	Link Rod 2.3x24	1	-
		BK0839	Link Rod 2.3x30	1	-
		BK0113	Link Rod 2.3x18	2	-
PV0612	MAIN SHAFT METAL UPPER BRG BLOCK	BV0869	Metal Upper BRG Block	1	1-1
PV0613	WASHOUT LINK PIN	BK0487	Pin	2	1-6-1
		HMS15	E Ring	4	1-6-1
PV0614	3D CLUTCH LINER	BK0885	3D Clutch Liner	2	1-1-1
PV0615	SUS FLYBAR ROD	BK0866	SUS Flybar Rod	1	2-1-1
PV0616	METAL FLYBAR CONTROL ARM SET	BK0075	Link Ball φ4.8	2	2-1-1
		BK0633	Metal Flybar Control Frame	2	2-1-1
		BK0871	Metal Flybar Control Arm Post	2	2-1-1
		HMF2-8N	M2x8 Philip Machine Screw	2	2-1-1
		HMC3-10B	M3x10 Socket Screw	2	2-1-1
		HME4-5B	M4x5 Set Screw	2	2-1-1
PV0617	METAL FLYBAR CONTROL ARM	BK0633	Metal Flybar Control Frame	2	2-1-1
		HME4-5B	M4x5 Set Screw	2	2-1-1
PV0618	METAL FLYBAR CONTROL POST	BK0075	Link Ball φ4.8	2	2-1-1
		BK0871	Metal Flybar Control Arm Post	2	2-1-1
		HMF2-8N	M2x8 Philip Machine Screw	2	2-1-1

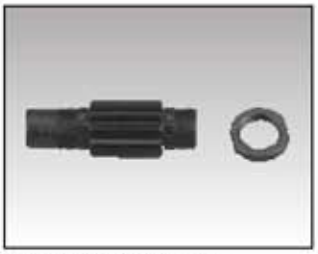
No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
		HMC3-10B	M3x10 Socket Screw	2	2-1-1
PV0619	3D DAMPER SET	BK0874	Inner Damper	2	2-1-2
		BK0875	Outer Damper	2	2-1-2
PV0620	3D INNER DAMPER	BK0874	Inner Damper	2	2-1-2
PV0621	3D OUTER DAMPER	BK0875	Outer Damper	2	2-1-2
PV0622	FLYBAR CONTROL LEVER SET	BK0075	Link Ball φ4.8	2	1-6-1
		BK0342	Flybar Control Lever	2	1-6-1
		BK0343	Washout Link	2	1-6-1
		BK0409	Collar d3xD4xW7	2	1-6-1
		BK0487	Pin	2	1-6-1
		HMS15	E Ring	4	1-6-1
		HMC3-12B	M3x12 Socket Screw	2	1-6-1
		HMJ2-10N	M2x10 Self-Tapping Screw	2	1-6-1
PV0623	FLYBAR CONTROL LEVER	BK0075	Link Ball φ4.8	2	1-6-1
		BK0342	Flybar Control Lever	2	1-6-1
		BK0409	Collar d3xD4xW7	2	1-6-1
		HMC3-12B	M3x12 Socket Screw	2	1-6-1
		HMJ2-10N	M2x10 Self-Tapping Screw	2	1-6-1
PV0624	3D HEAVY DUTY CLUTCH BELL	BV0522-2	3D Heavy Duty Clutch Bell	1	1-1-1
PV0625	SERVO FRAME	BK0667	Servo Frame	1	1-4
		HSE3-12B	M3x12 Self-Tapping Screw	6	1-4
PV0626	TAIL SUPPORT	BK0447	Tail Support Rod End	4	4-4-1
		BK0669	Tail Support Rod	2	4-4-1
		HMJ2-8N	M2x8 Self-Tapping Screw	4	4-4-1
PV0627	DECAL	JV0186	Decal, R90 3D	1	-
PV0628	TAIL SUPPORT BRACKET	BK0878	Bracket (TOP)	1	4-4
		BK0879	Bracket (BOTTOM)	1	4-4
		HMC3-16B	M3x16 Socket Screw	2	4-4
		HMM3Z	M3 Locknut	2	4-4
PV0631	ELEVTOR LINK SHAFT	BK0880	Elevator Link Shaft	2	1-1-4
		HMS15	E Ring	2	1-1-4
		BK0693	Cross Member	2	1-1-2,1-1-3
		HME3-18.5B	M3x18.5 Socket Screw	2	1-3
PV0632	BODY RETAINING POST	BK0103	Body Fitting Post	2	1-3
		BK0693	Cross Member	2	1-1-2,1-1-3
		HME3-18.5B	M3x18.5 Socket Screw	2	1-3
PV0633	PICTCH PUSH PULL LEVER SET	BK0075	Link Ball φ4.8	5	5-2
		BK0085	Ball Link	4	5-2
		BK0086	Ball Link φ4.8x20	2	5-2
		BK0113	Link Rod M2.3x18	2	5-2
		BK0833	Servo Block	2	5-2
		BK0834	Pitch Lever Fixing Plate	1	5-2
		BK0883	Pitch Push Pull Lever	1	5-2
		BK0839	SUS Link Rod M2.3x30	1	5-2
		BK0881	Washer	1	5-2
		BK0884	Collar d3xD4xW12	1	5-2
		HMV840ZZY	Ball Bearing d4xD8xW3	2	5-2
		HSE2620N	M2.6x20 Self-Tapping Screw	4	5-2
		HMC3-20B	M3x20 Socket Screw	1	5-2
		HMJ2-8N	M2x8 Self-Tapping Screw	3	5-2
		HMF2-8N	M2x8 Philip Maching Screw	2	5-2
		HML2	M2 Nut	2	5-2
3800	BLADE HOLDER	BK0116	Blade Holder	1	-

RAPTOR 90 3D OPTIONAL PARTS

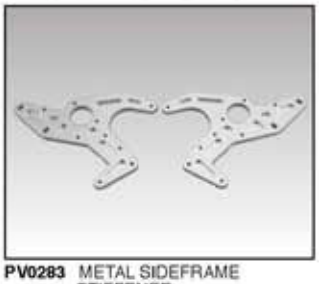
PV0186 MAIN SPUR GEAR 93T

PV0188 MAIN SPUR GEAR 95T

PV0189 MAIN SPUR GEAR 94T

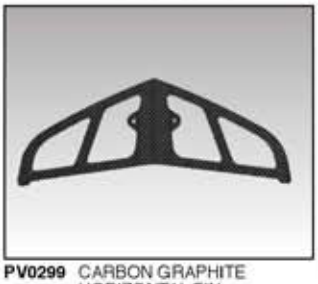


PV0193 PINION GEAR 12T



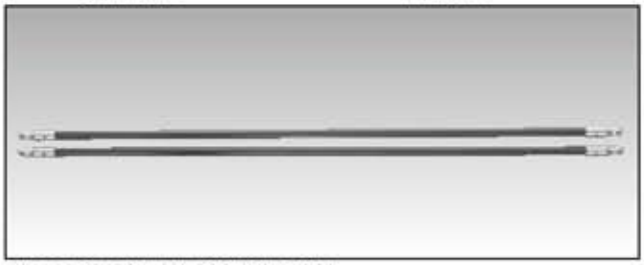
PV0283 METAL SIDEFRAME STIFFENER

PV0286 MACHINED ELEVATOR ARM LINK



PV0299 CARBON GRAPHITE HORIZONTAL FIN

PV0300 CARBON GRAPHITE VERTICAL FIN



PV0306 CARBON TAIL BOOM SUPPORT

PV0315 CARBON UPPER SIDE FRAMES

PV0316 CARBON LOWER SIDE FRAMES

PV0327 CARBON GRAPHITE BASE PLATE

PV0335 METAL MAIN ROTOR GRIP SET

PV0384 WIRE CLAP

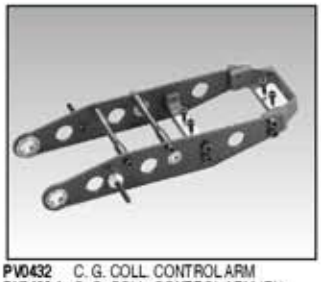
PV0385 ROTOR GRIP PLATE SET

PV0388 HELI THROTTLE LEVER

PV0397 SIM-CARBON CANOPY

PV0430 METAL UPPER BEARING BLOCK
PV0430-L METAL UPPER BEARING BLOCK(BL)

PV0431 METAL LOWER BEARING BLOCK
PV0431-L METAL LOWER BEARING BLOCK(BL)



PV0432 C. G. COLL. CONTROL ARM
PV0432-L C. G. COLL. CONTROL ARM (BL)

PV0433 METAL WASHOUT ASSEMBLY
PV0433-L METAL WASHOUT ASSEMBLY(BL)

PV0434 METAL AILERON LEVER SET
PV0434-L METAL AILERON LEVER SET(BL)

PV0435 METAL COOLING FAN
PV0435YS METAL COOLING FAN, YS

PV0435-L METAL COOLING FAN (BL)
PV0435YS-L METAL COOLING FAN, YS (BL)

PV0436 METAL FLYBAR CONTROL ARM
PV0436-L METAL FLYBAR CONTROL ARM(BL)

PV0438 METAL HORIZ. FIN BRACKET
PV0438-L METAL HORIZ. FIN BRACKET(BL)

PV0457 METAL TAIL PITCH SLIDER

PV0458 METAL BUTTON MAIN ROTOR HUB

PV0459 METAL CLUTCH BRG CASE

PV0461 CARBON TAIL BOOM

PV0462 CARBON DRIVE SHAFT

PV0463 PUSH/PULL ELEVATOR LEVER
PV0463-L PUSH/PULL ELEVATOR LEVER(BL)

PV0466-L METAL TAIL PITCH FORK (BL)

PV0516-W SKID DAMPER(W)
PV0516-Y SKID DAMPER(Y)

PV0629 METAL WASHOUT ARM
PV0629-L METAL WASHOUT ARM(BL)

PV0630 METAL B-H MIXING ARM SET
PV0630-L METAL B-H MIXING ARM SET(BL)

HELICOPTER ACCESSORY

No.2748 12V/7.2Ah SEALED LEAD ACID

No.2675 12V HD-180 STARTER

No.2150 1.8AH GLOW STR-L,110V 2P
No.2151 1.8AH GLOW STR-L,230V 2P
No.2152 1.8AH GLOW STR-L,230V 3P

No.1658 12V FUEL PUMP

No.1263 CARRY MASTER W/ACC.110V
No.1264 CARRY MASTER W/ACC.220V

No.3801 6MM STARTER EXTENSION

No.3802 PRECISION PITCH GAUGE

No.3803 REMOTE GLOW ADAPTER

ELECTRIC R/C HELICOPTER

No.4710 mini Titan E325

No.4730 Raptor E550

No.4750 Raptor E620 SE

ENGINE R/C HELICOPTER

No.4839 Raptor 30 V2

No.4852 Raptor 50 SE

No.4853 Raptor 50 Titan

No.4870 Raptor 60 V2

No.4890 Raptor 90 STD

No.4891 Raptor 90 SE

No.4892 Raptor 90 3D

SCALE BODY

No.3837 MD530

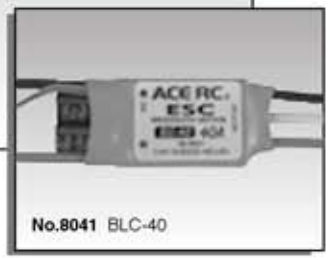
No.3841 AS355N

No.3834 MD500

No.3842 A109

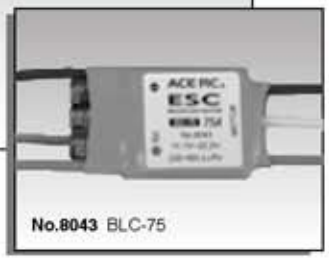
MOTOR AND ESC

No.2381 OBL 29/35-10H



No.8041 BLC-40

No.2379 OBL 43/11-30H



No.8043 BLC-75

No.2380 OBL 49/08-50H

No.8042 BLC-65

ENGINE

No.9604 PRO-39H (R)

No.9605 PRO-50H (R)

No.9606 PRO-70H (R)

No.9609 PRO-90H (R)

SERVO

No.8126 DS1213 DIGITAL SERVO

No.8130 DS0606 DIGITAL RUDDER SERVO

No.8117 C1016 MINI SERVO

No.8131 C0915 MINI RUDDER SERVO

GYRO AND GOVERNOR

No.8070 TG-7000 GYRO

No.8030 ZERO α GOVERNOR

Thunder Tiger

RAPTOR

90 3D Version

MANUAL

ASSEMBLY & MAINTENANCE

"For any instruction revisions or other information concerning this product, go to: www.thundertiger.com."