



RAPTOR SE

90 CLASS RC HELICOPTER

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/Taya "Raptor 90 SE" helicopter. Mr. Taya, the first F3C Helicopter World Champion, designed this helicopter to be the highest quality model helicopter in the RC hobby industry. The Raptor 90 SE is designed for modelers who love building and flying model helicopters. Only the highest quality materials are used. With the Raptor, the pilot can really appreciate the pleasure of flying in 3-dimensional space. Its docile handling is ideally suited for beginners. The stable hover and agility also make it the top choice for contest fliers and extreme 3-D pilots. The Raptor requires the least amount of assembly of any helicopter kit. High performance Thunder Tiger PRO 90H ring engine and muffler are recommended. The helicopter and engine are both manufactured by Thunder Tiger using the latest technology and exceed the stringent internationally recognized ISO-9001 manufacturing standard. We have incorporated all the state-of-the-art technology into the designing and making of this helicopter. We believe you will enjoy this model for a long time. We have made no compromise in designing or manufacturing this model.

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-Hiller 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 designed 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

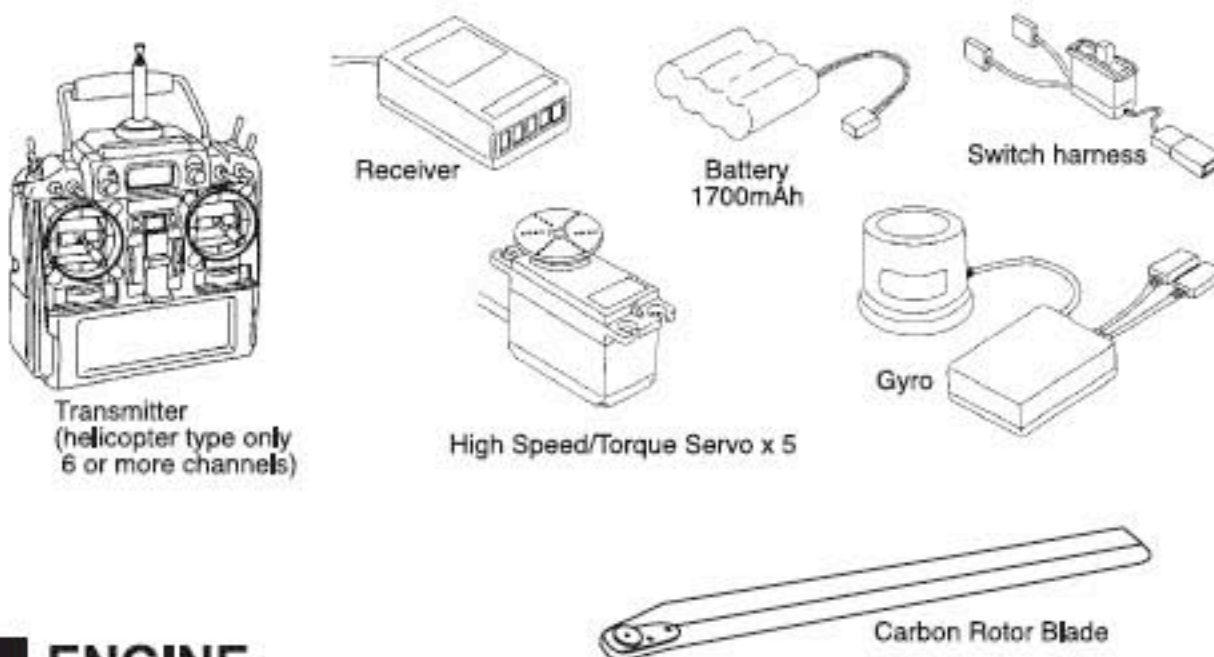
The Raptor 90 SE is designed with a constant drive tail rotor system to permit full tail rotor control during autorotations. Backward autos, pirouette autos and 180 autos are all within your reach now. It has the same aluminum torque tube system as the Thunder Tiger/Taya Imperio helicopter. This allows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

3D CAD Design

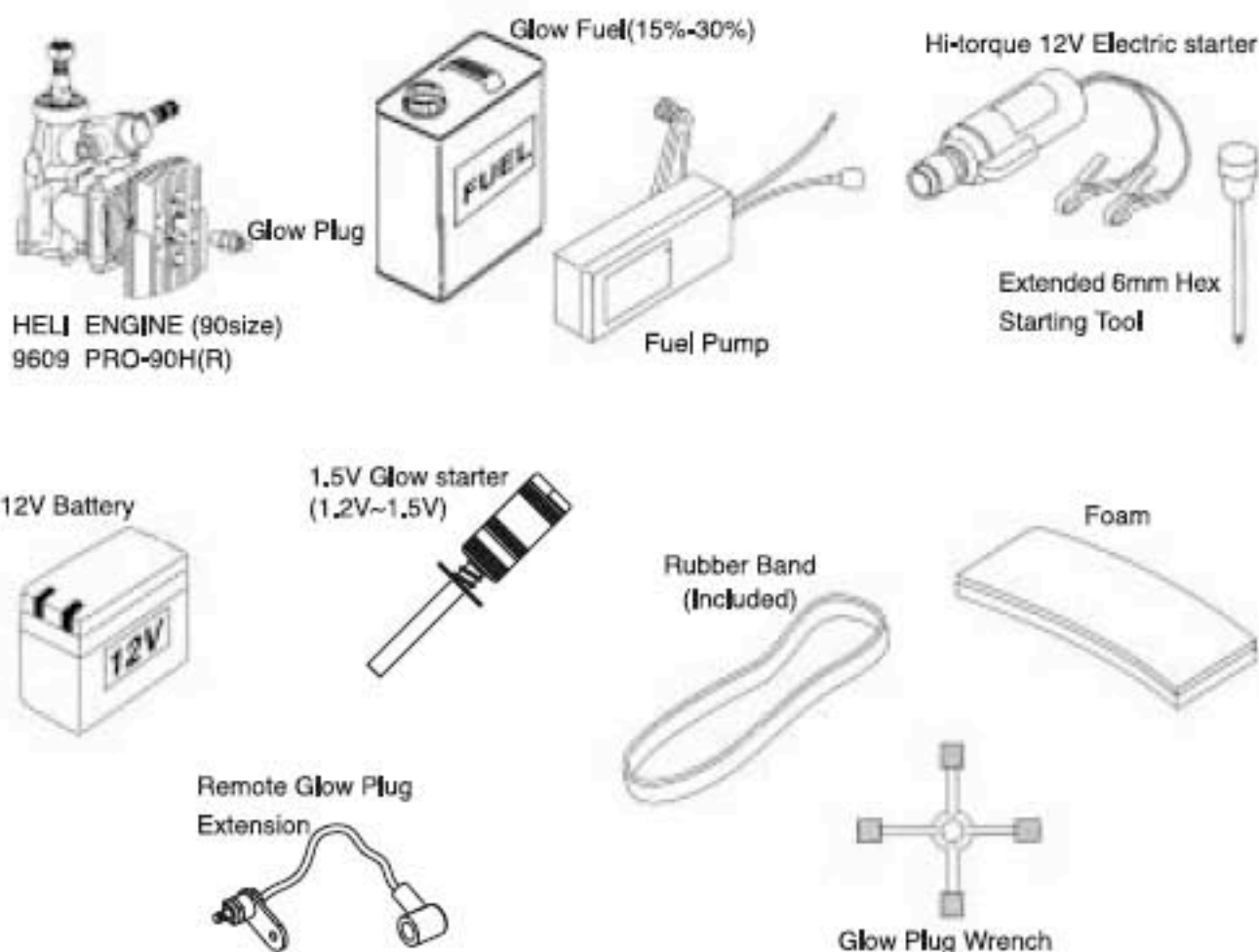
We used the latest 3D Computer Aided Design to design and manufacture the Raptor 90 SE. Our high-tech CAD program allows simulation of all moving parts to ensure no interference. The analysis automatically analyze the weight, the mass distribution, and inertia to help us pursue a design that will provide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

OTHER ITEMS REQUIRED

RADIO SET



ENGINE



Engine System

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

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

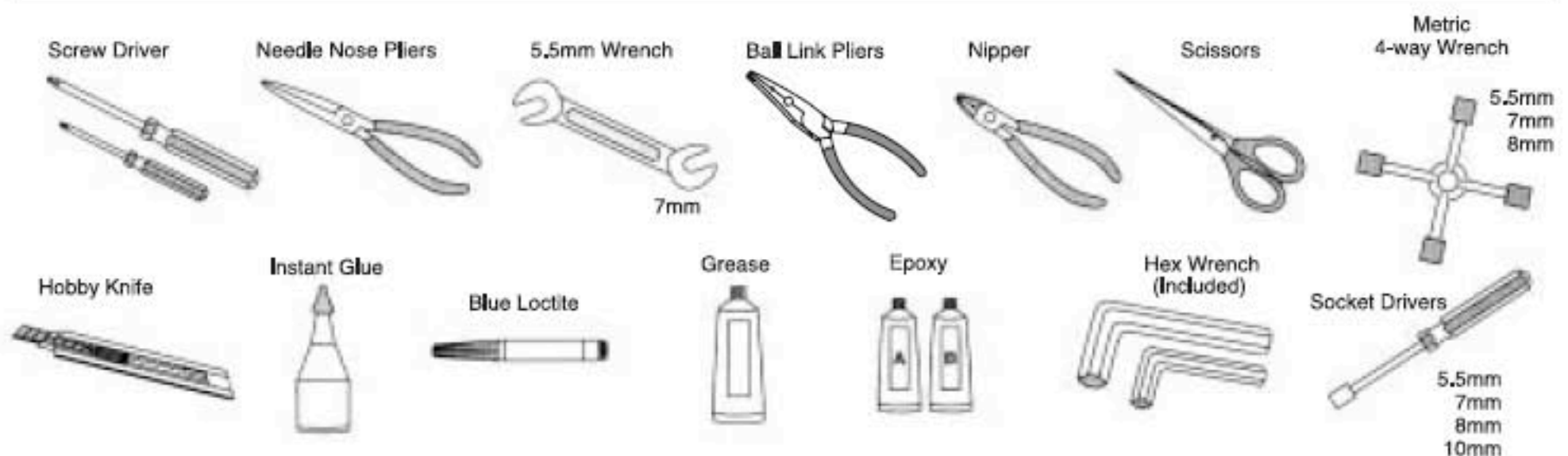
Rotor Blades

It is extremely 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, their blade length should be between 680 and 710 mm. Blade weight should be between 170 and 200 grams. Thunder Tiger 710mm Carbon Main Rotor Blades (P/N TTR 3821) is recommended.

Starter System

The Raptor 90 engine is started by using a RC airplane electric starter with a 6 mm shaft extension. The 6 mm starter extension is available from Thunder Tiger, part number TTR 3801. Use a strong high torque 12 volt electric starter that is designed for model use.

TOOLS REQUIRED FOR ASSEMBLY



Tools for Assembly

The Raptor 90 SE 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 SE. 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 special 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.

Warnings

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. It is best to seek help and guidance from other accomplished model helicopter pilots to ensure quick and successful learning. 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 that's nearest to you, please contact AMA at:

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

We also encourage start subscribing to different radio control helicopter magazines to 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. It still needs a helicopter radio control system, a 90-size 2-stroke engine, and a muffler.
- 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 study 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 go out of 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 check to make sure that your radio frequency is not used before flight. If someone else is flying on the same frequency as your radio, then do not turn on your transmitter. Otherwise, you can cause a crash and even bodily and property damages.
- Please monitor the fuel level during flight so you do not run out of fuel during flight.
- 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 immediately after running the engine because they are very hot and can cause burn.
- Do not use this model for anything other than hobby.

WARNING – The following describes damage that can happen to the model.

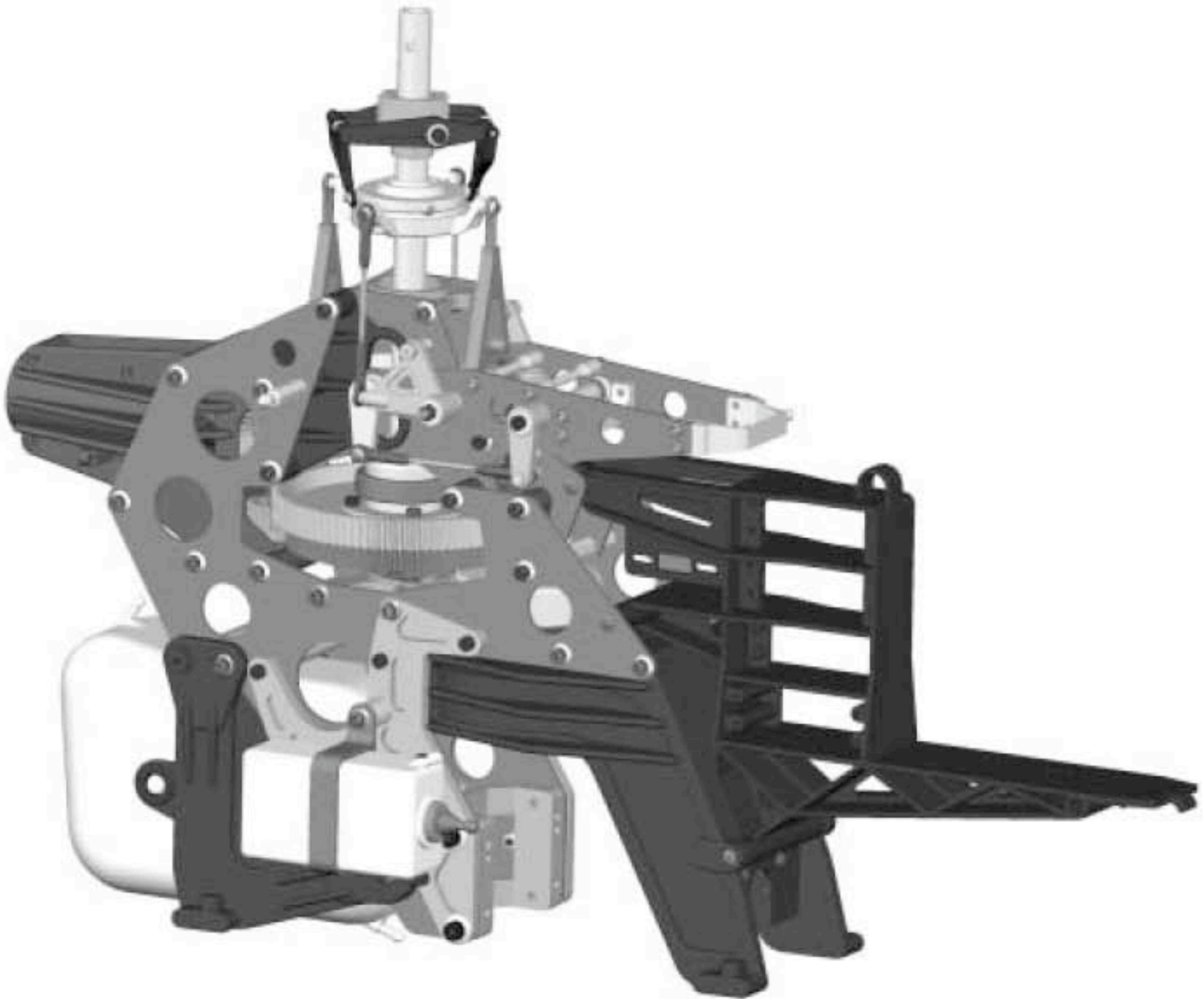
- Do not leave the model in a car for a long time. The heat in the summer or the cold in the winter and the humidity can cause damage to the model.
- Be careful and watch the sharp edges and corners on the model.

BUILDING HINT – The instruction is divided into six assembly chapters:

Main Frame, Rotor Head, Tail Rotor, Final Assembly, Radio Installation, and Settings in each chapter, there are many major assembly steps. Please follow the instruction to do each "Subassembly" first, then combine the subassemblies into a major assembly.

1

MAIN FRAME ASSEMBLY



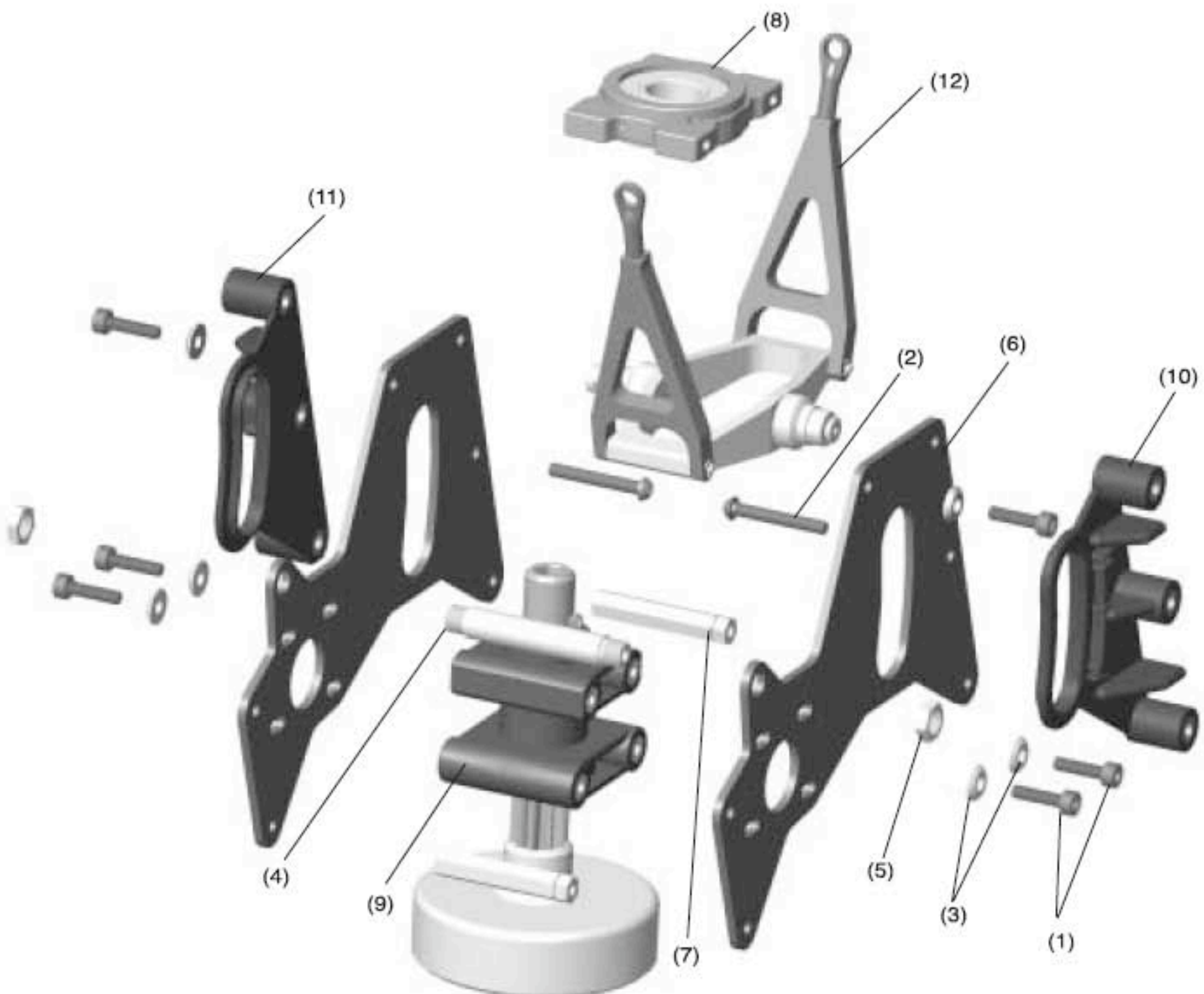
For the kit, parts are bagged according to each major assembly and are labeled "Bag A, Bag B, etc." The heading for each assembly indicates which bag to open. As a good practice, only open up the bag that you need for the particular assembly. Check the parts in that bag against the parts list shown for 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

Carbon Upper Frame Assembly BAG A

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMC3-12B	Socket Screw M3x12	6	7	BK0659	Frame Spacer M	2
2	HSA3-22	Button Head Socket Screw M3x22	2	8	1-1-1	Metal Upper BRG Block Subassembly	1
3	BK0087	Washer d3xD8x1.4	6	9	1-1-2	Pinion Gear Subassembly	1
4	BK0393	Pitch Frame Cross Member	1	10	1-1-3	Pitch Guide L Subassembly	1
5	BK0394	Pitch Frame Cross Member Nut	2	11	1-1-4	Pitch Guide R Subassembly	1
6	BK0467	Carbon Upper Frame	2	12	1-1-5	Elevator Control Arm Subassembly	1

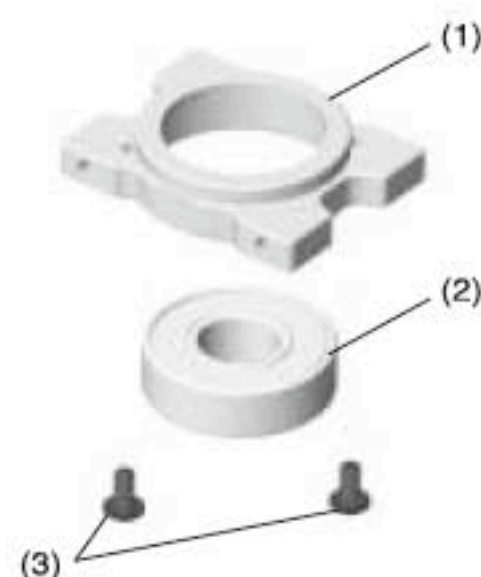
Assemble the carbon upper main frames by starting with the two Upper Carbon Frames. The Upper BRG Subassembly and Clutch/Pinion Gear Subassembly must be assembled first according to Figure 1-1-1 and 1-1-2. Next insert three hex-shape frame spacers into the plastic Pitch Guide according to Figure 1-1-3 and 1-1-4. Assemble the Elevator Control Arm subassembly according to 1-1-5. Insert it in between the two Upper Frames. The metal Elevator Control Arm is not symmetrical. The side with the longer protruding round knob should be on the right side of the helicopter. Then attach the other subassemblies to the Upper Carbon Frames. In Figure 1-1, note that the two button head bolts (No. 2) are inserted and remain loose until later when they are used to secure the Body Fitting Pins in Step 1-3. Locate Hex Wrenches in BAG L which you will use in 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 the screw 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, then heat up the head of the screw or bolt with the tip of a hot soldering iron which will help soften the cured Loctite.



1-1-1 Metal Upper BRG Block Subassembly

No.	Material No.	Description	Qty.
1	BK0488	Metal Upper BRG Block	1
2	HMV6001Z	BRG d12xD28x8	1
3	HSA3-6B	Button Head Socket Screw M3x6	2

The metal upper BRG Block assembled from the factory. Replace the bearing with part no. PV0470 if bearing is failed.



1-1-2 Pinion Gear Subassembly

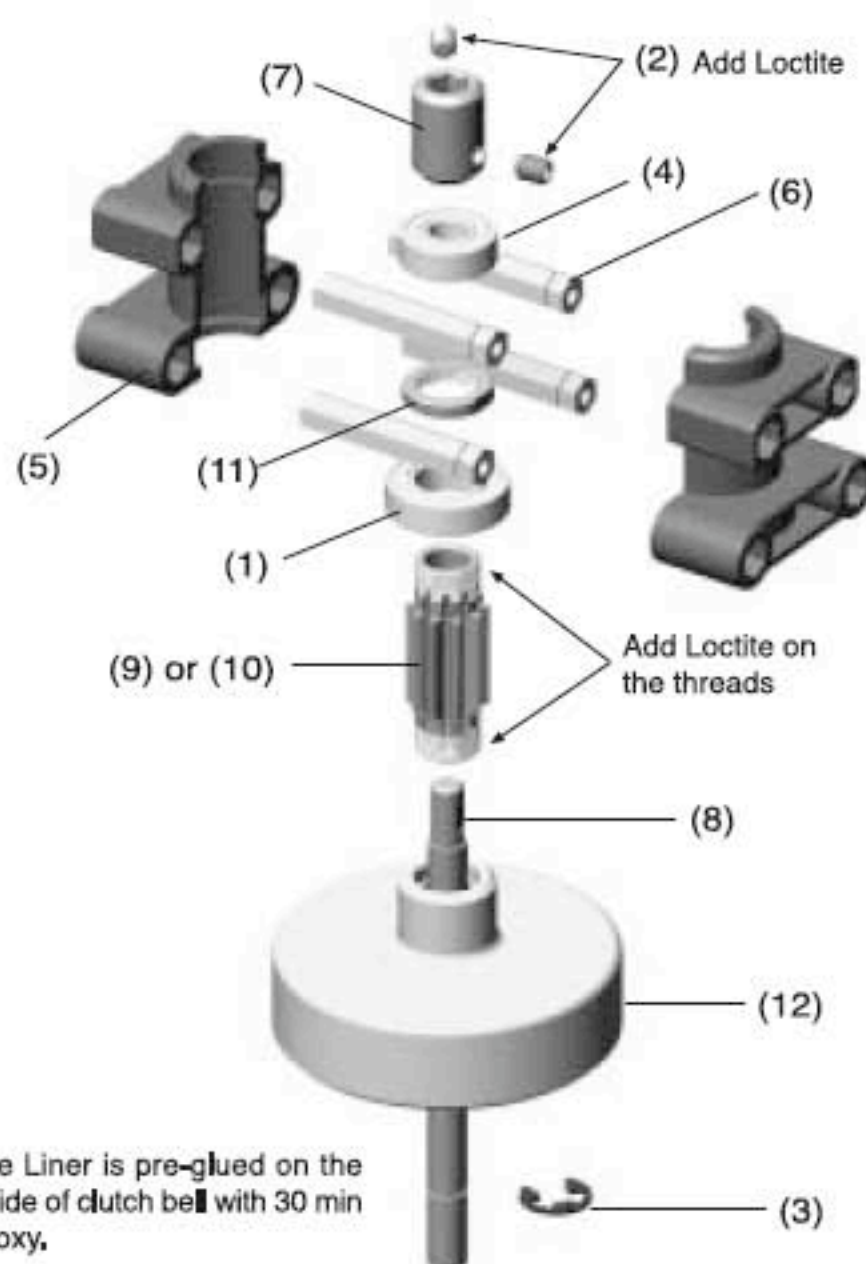
No.	Material No.	Description	Qty.
1	HMV6800	BRG d10xD19x5	1
2	HME4-5B	Set Screw M4x5	2
3	HMS5	E Ring M5x8	1
4	HMV696Z	BRG d6xD15x5	1
5	BK0388	Clutch BRG Case	2
6	BK0659	Frame Space M	4
7	BK0594	Starter Coupling	1
8	BK0592	Starter Shaft	1
9	BK0422	Drive Pinion 11T	1
10	BK0423	Drive Pinion 12T	1
11	BK0366	Pinion Gear Nut	1
12	BV0522-1	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:

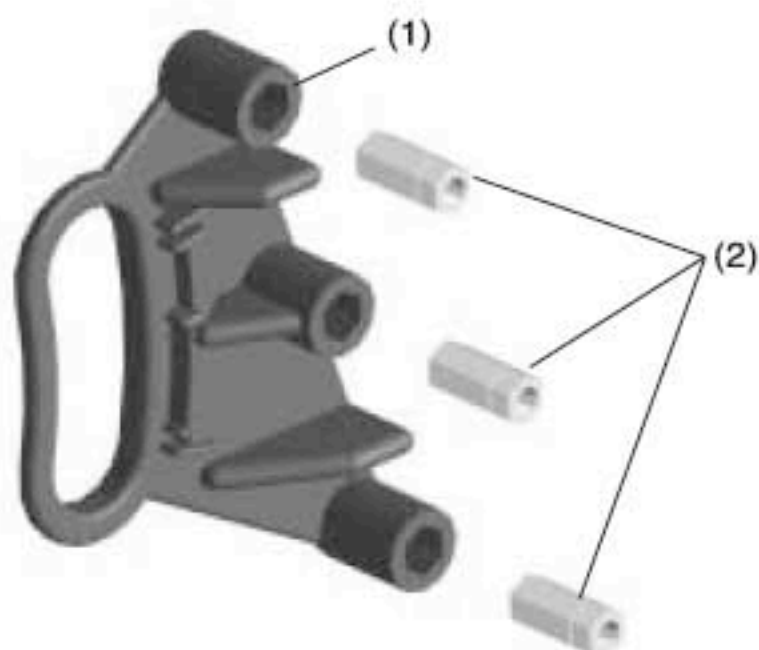
Please see the section 1-6 for pinion gear selection to suit your flying performance.

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



The Liner is pre-glued on the inside of clutch bell with 30 min epoxy.

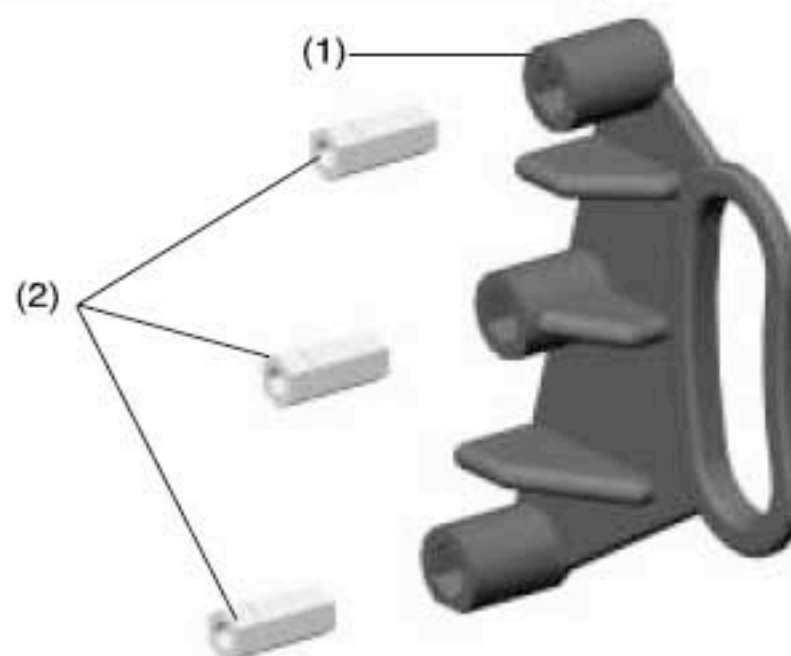
1-1-3 Pitch Guide L Subassembly



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

1-1-4 Pitch Guide R Subassembly

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

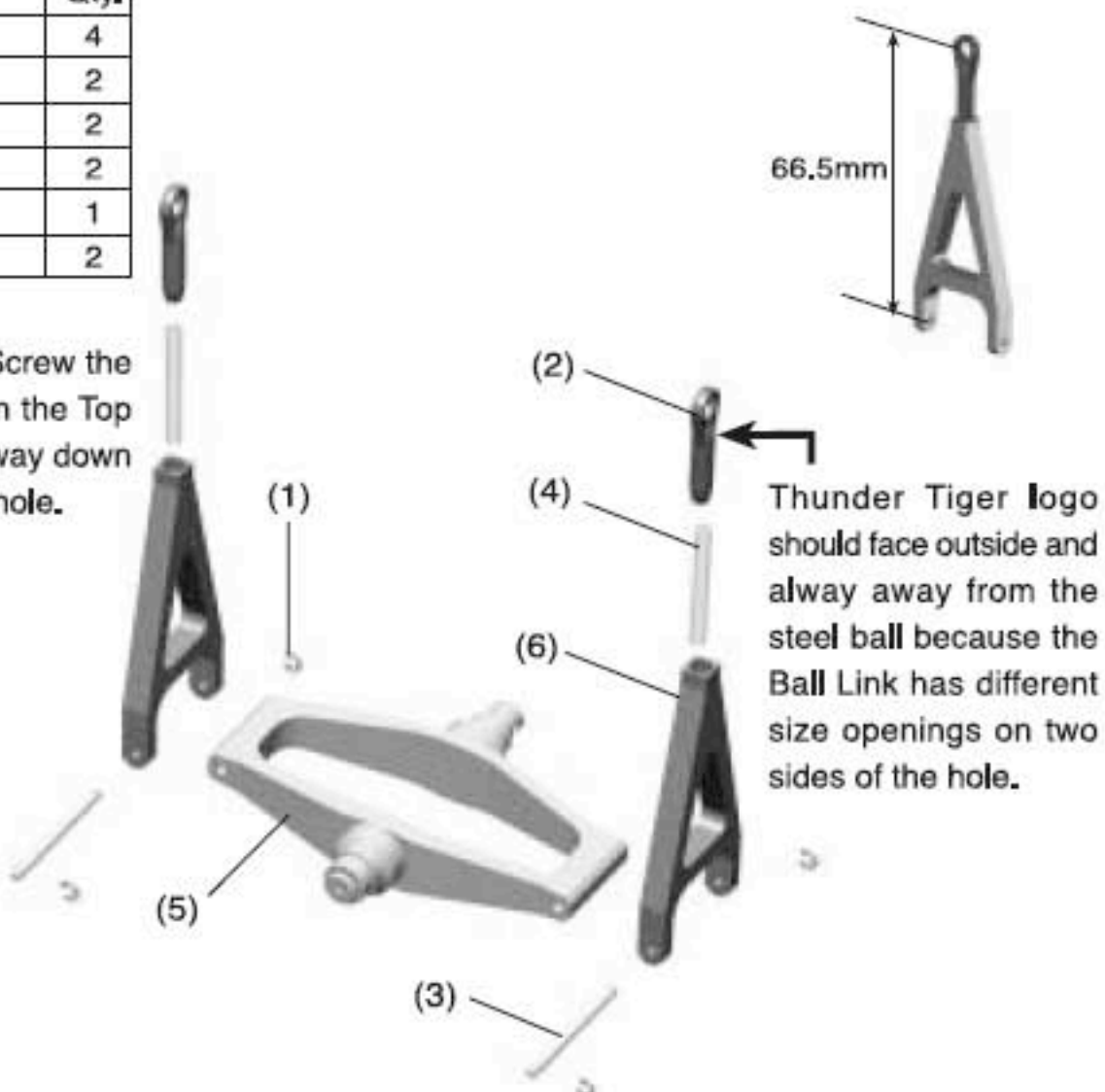


1-1-5 Elevator Control Arm Subassembly

No.	Material No.	Description	Qty.
1	HMS15	E Ring	4
2	BK0086	Ball Link 4.8x20	2
3	BK0270	Elevator Link Shaft	2
4	BK0292	Link Rod 2.3xL24	2
5	BK0455	Metal Elevator Control Arm	1
6	BK0459	Machined Elevator Arm Link	2

Locate Elevator Control Arm in Bag D.

Scwew the 2.3mm link rod into the black A Arm first. Screw the rod until the 2.3mm rod become flash with opening on the Top side of the A Arm. Then screw on the Ball Link all the way down until the Ball Link reaches the bottom of the recessed hole.



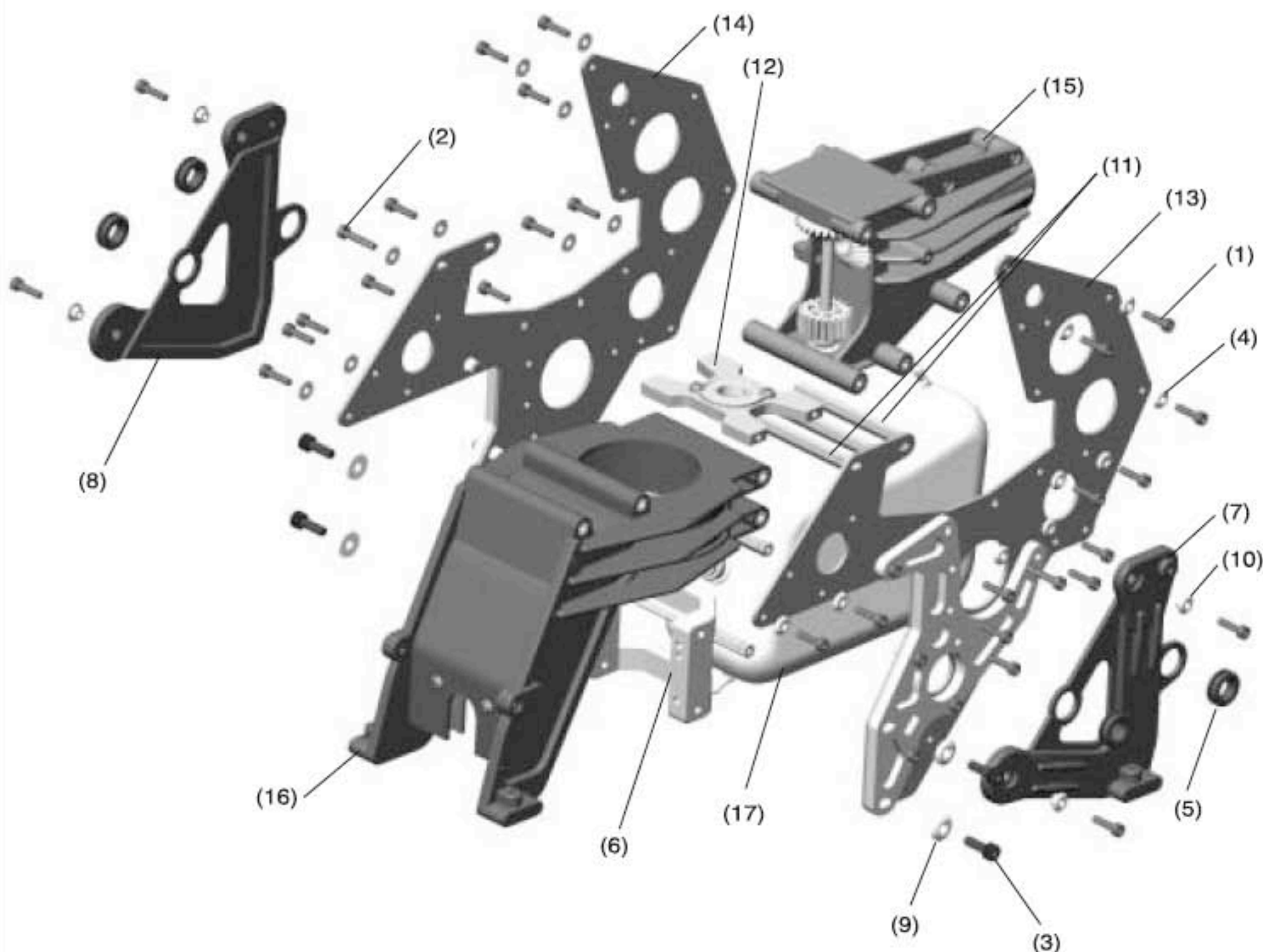
1-2

Carbon Lower Frame Assembly

BAG B

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMC3-12B	Socket Screw M3x12	27	10	BK0629	Washer	4
2	HMC3-16B	Socket Screw M3x16	2	11	BK0660	Frame Spacer L	5
3	HMC4-18B	Socket Screw M4x18	4	12	1-2-1	Metal Lower BRG Block Subassembly	1
4	BK0087	Washer d3xD8x1.4	18	13	1-2-2	Metal Sideframe Stiffener L Subassembly	1
5	BK0274	Tank Rubber Grommets	4	14	1-2-3	Metal Sideframe Stiffener R Subassembly	1
6	BK0349	Engine Mount	1	15	1-2-4	Tail Drive Unit Subassembly	1
7	BK0380	Rear Frame L	1	16	1-2-5	Cooling Fan Casing Subassembly	1
8	BK0381	Rear Frame R	1	17	1-2-6	Fuel Tank Subassembly	1
9	BK0435	Washer d4xD11x1.7	4				

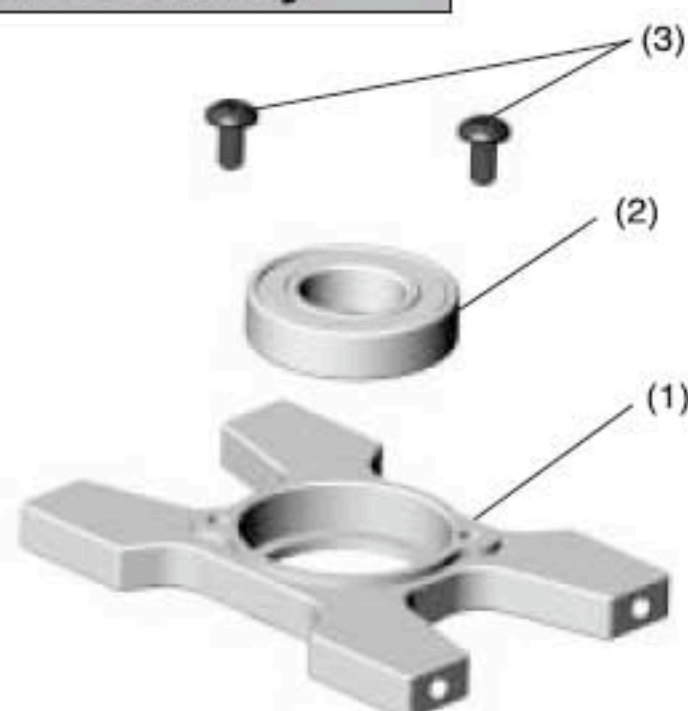
Please complete subassembly steps 1-2-1 through 1-2-6 first. Then attach the subassemblies to the two Lower Carbon Frames. Note that the Lower BRG Subassembly is installed with the bearing open side facing up. Please add a small drop of Loctite on every bolt before screwing it into the aluminum hex spacer but 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 Metal Lower BRG Block Subassembly

No.	Material No.	Description	Qty.
1	BK0489	Metal Lower BRG Block	1
2	HMV6901ZZ	BRG d12xD24x6	1
3	HSA3-6B	Button Head Socket Screw M3x6	2

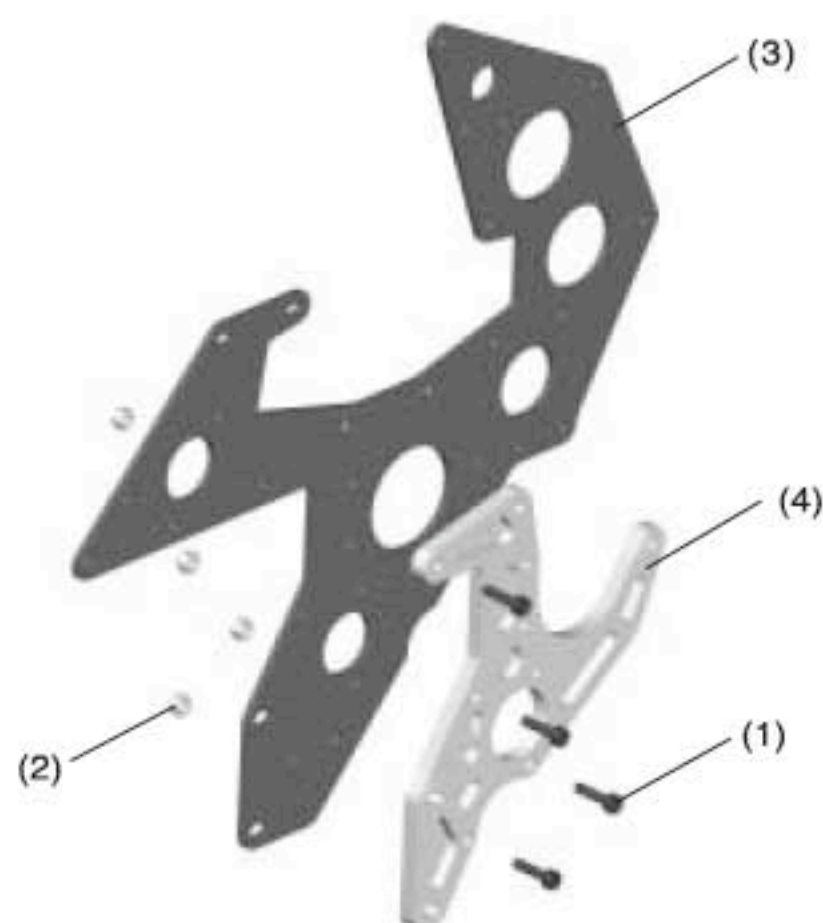
The metal upper BRG Block assembled from the factory. Replace the bearing with part no. PV0470 if bearing is failed.



1-2-2 Metal Sideframe Stiffener L Subassembly

No.	Material No.	Description	Qty.
1	HMC3-12B	Socket Screw M3x12	4
2	HMM3Z	Locknut M3	4
3	BK0468	Carbon Lower Frame	1
4	BK0507	Metal Sideframe Stiffener (Left)	1

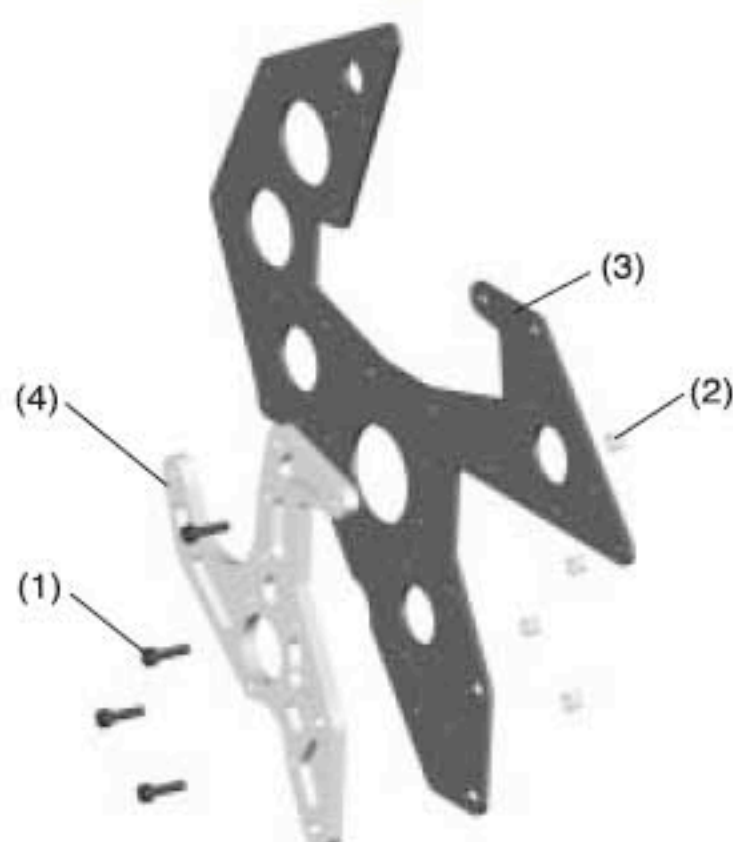
Attach the Metal Sideframe Stiffener (Left) to the carbon lower frame and tighten the screws and locknuts.



1-2-3 Metal Sideframe Stiffener R Subassembly

No.	Material No.	Description	Qty.
1	HMC3-12B	Socket Screw M3x12	4
2	HMM3Z	Locknut M3	4
3	BK0468	Carbon Lower Frame	1
4	BK0508	Metal Sideframe Stiffener (Right)	1

Do the same procedure to secure the right stiffener to the Carbon Lower Frame.

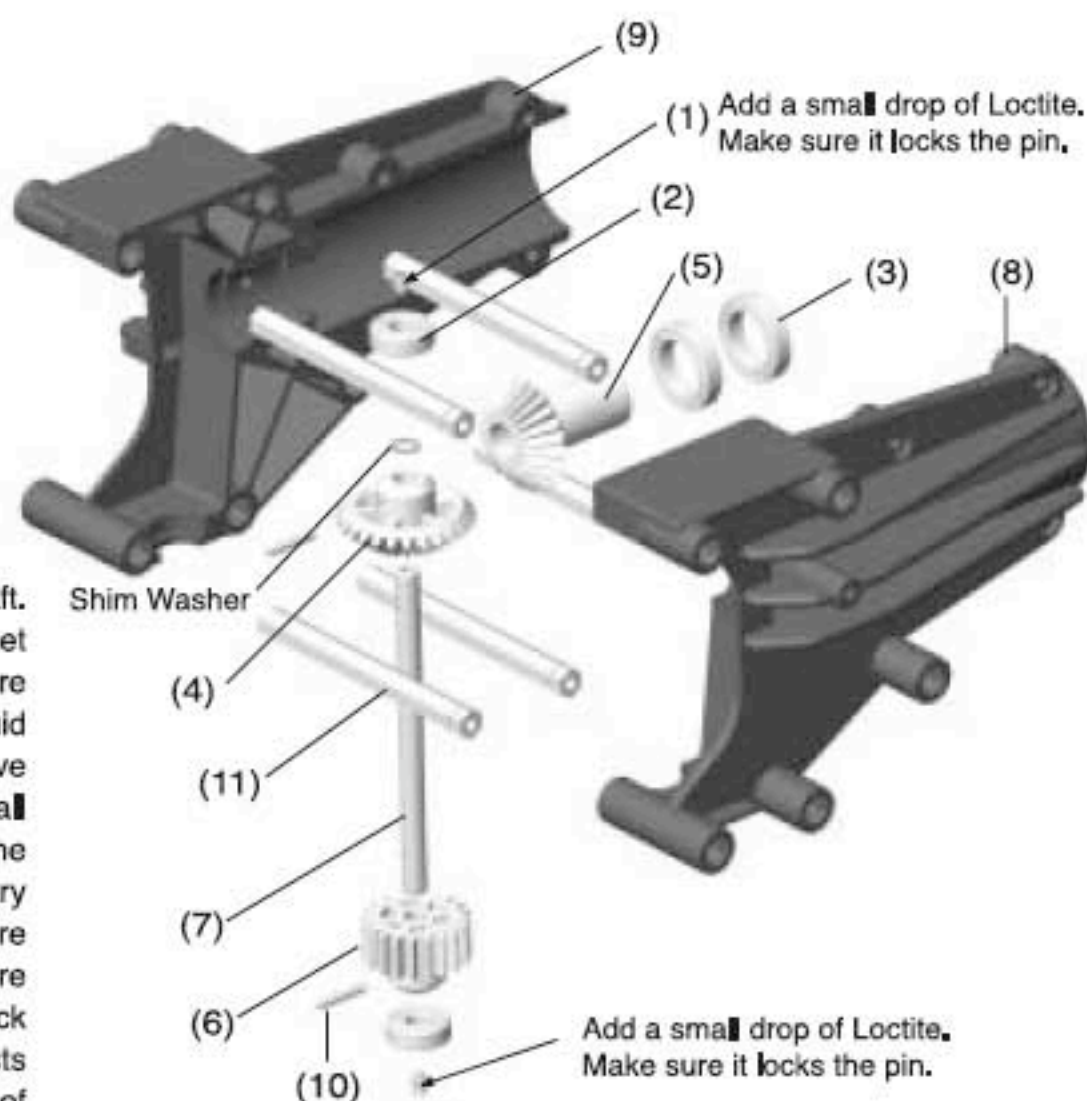


1-2-4 Tail Drive Unit Subassembly

No.	Material No.	Description	Qty.
1	HME3-4B	Set Screw M3x4	2
2	HMV1350	BRG d5xD13x4	2
3	HMV6701Z	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. Install the four ball bearings and the hex shaped Frame Spacers according to the drawing. After installing the two M3x4 set screws (No. 1), try push on the 2x12 pins with a small Allen wrench to make sure the set screws have locked the pins in place securely. 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, then add some 5 mm i.d. washers on top of gear No. 4. (The 5 mm i.d. washers are provided in BAG G).

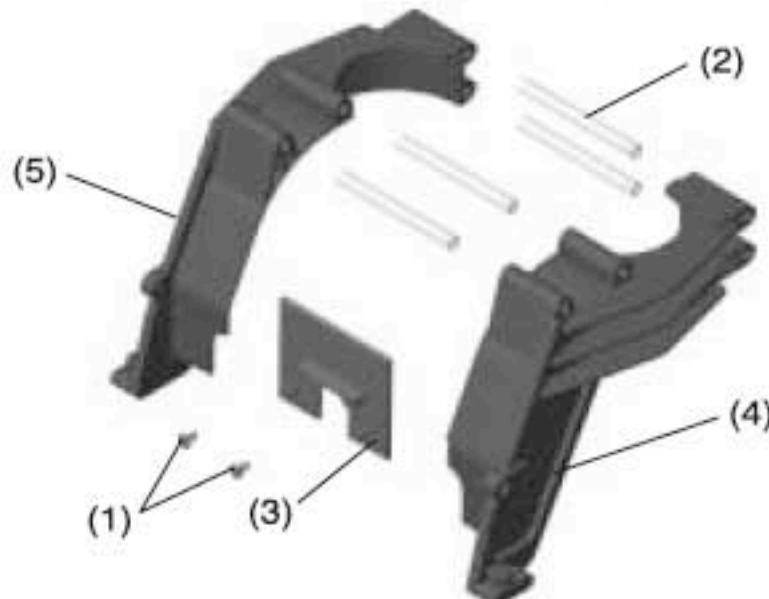


1-2-5 Cooling Fan Casing Subassembly

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 Raptor60 in order to accommodate the full head sink on the O.S 91 C-Spec. engine.

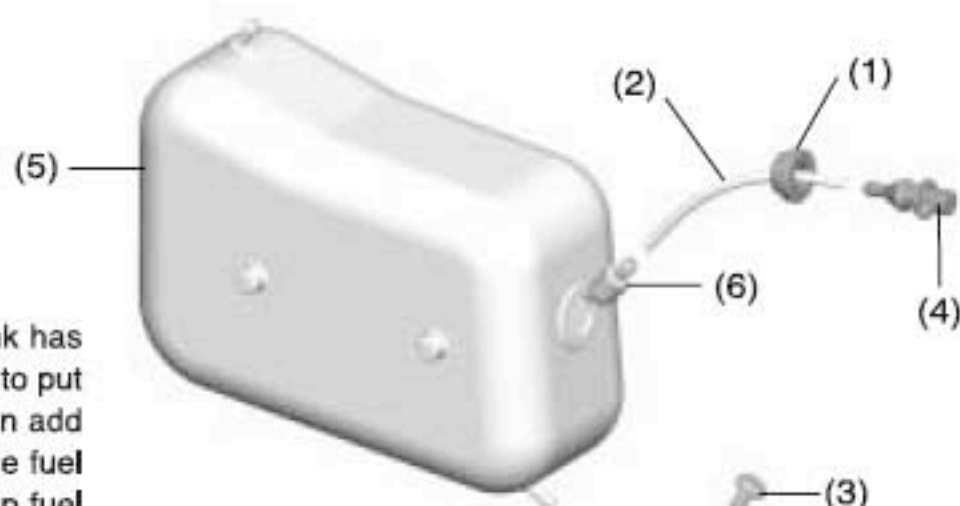
If using T.T 90 or Y.S 91 or Webra 91 engine make sure to install the fan shroud baffle using two self-tapping screws. This will ensure optimal cooling of your engine head.



1-2-6 Fuel Tank Subassembly

No.	Material No.	Description	Qty.
1	BK0062	Fuel Tank Stopper	1
2	BK0374	Silicon Tube (L=105mm)	1
3	BK0445	Fuel Plug	1
4	BK0463	Fuel Tank Nipple	1
5	BK0503	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 and 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.

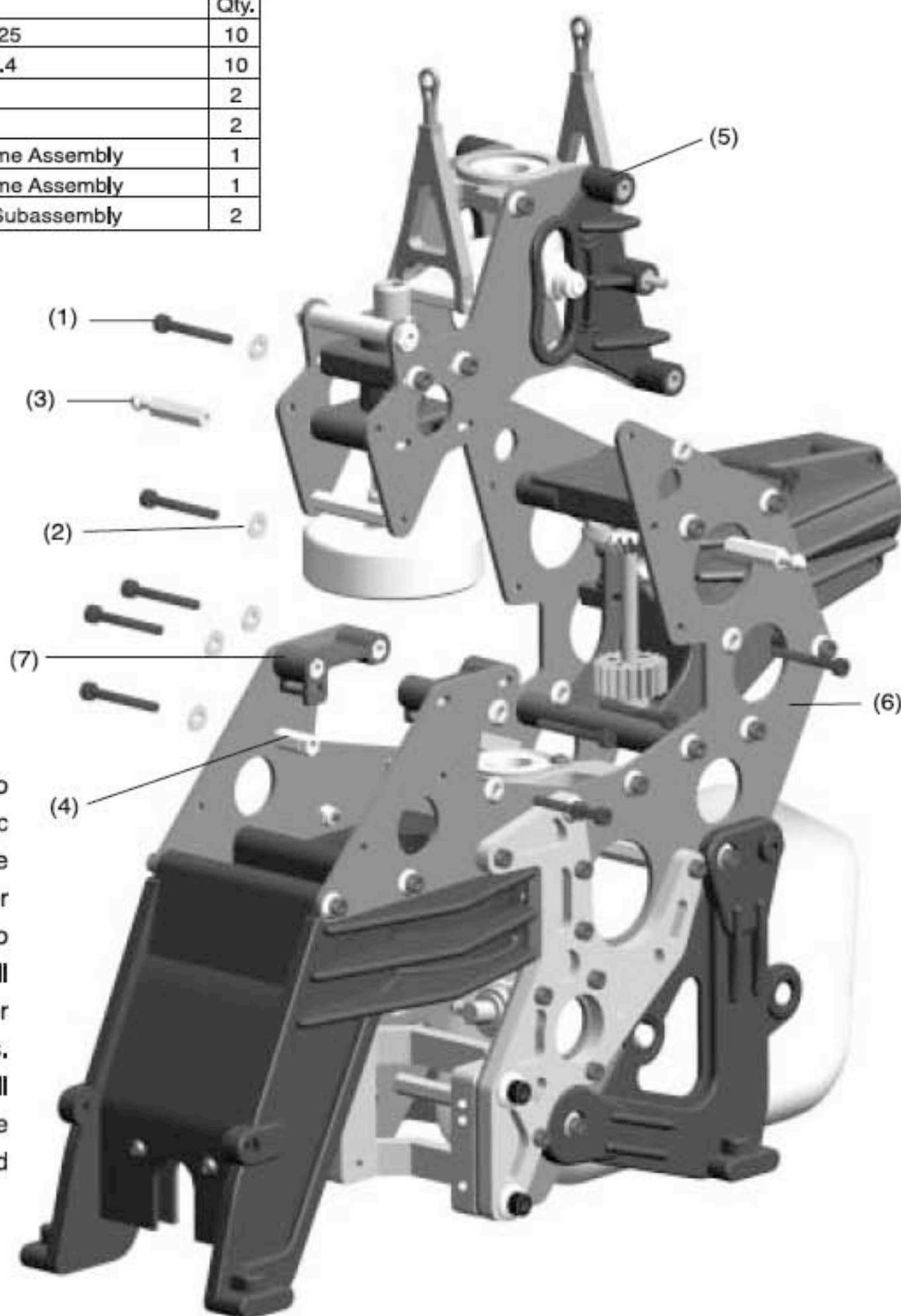


1-3

Carbon Main Frame Assembly

BAG C

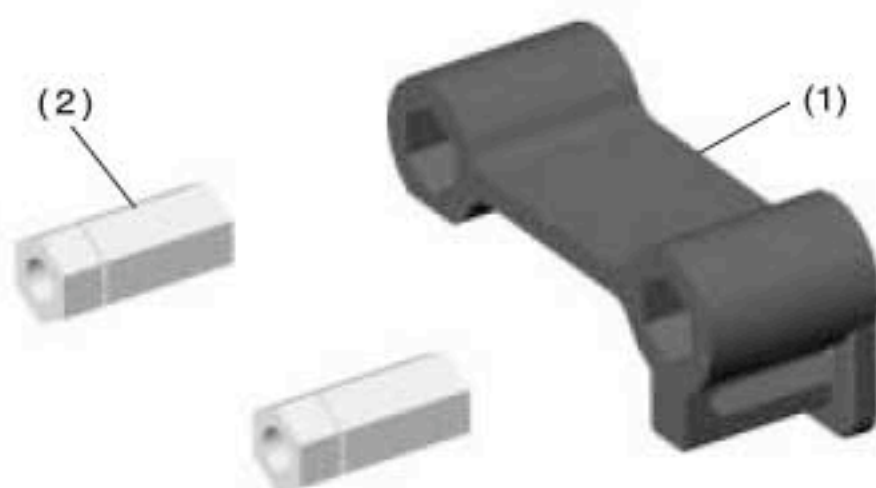
No.	Material No.	Description	Qty.
1	HMC3-25B	Socket Screw M3x25	10
2	BK0087	Washer Dd3xD8x1.4	10
3	BK0103	Body Fitting Post	2
4	BK0658	Frame Spacer S	2
5	1-1	Carbon Upper Frame Assembly	1
6	1-2	Carbon Lower Frame Assembly	1
7	1-3-1	Rod Guide Collar Subassembly	2



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. Do not forget to install the four taper washers (No. 2) under the bolts for the Rod Guide Collars. The two Body Posts (BK0103) 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



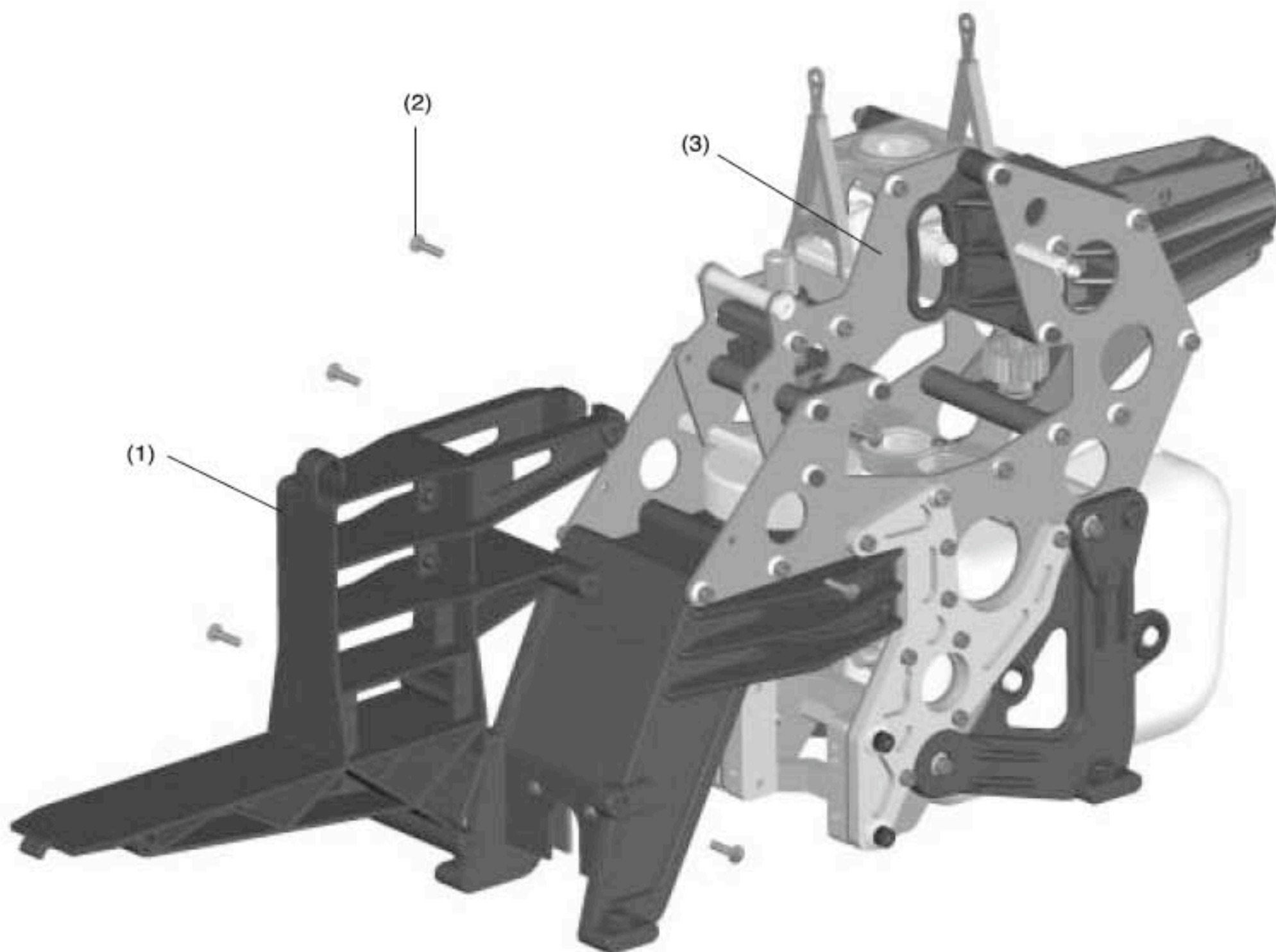
1-4

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 using 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.



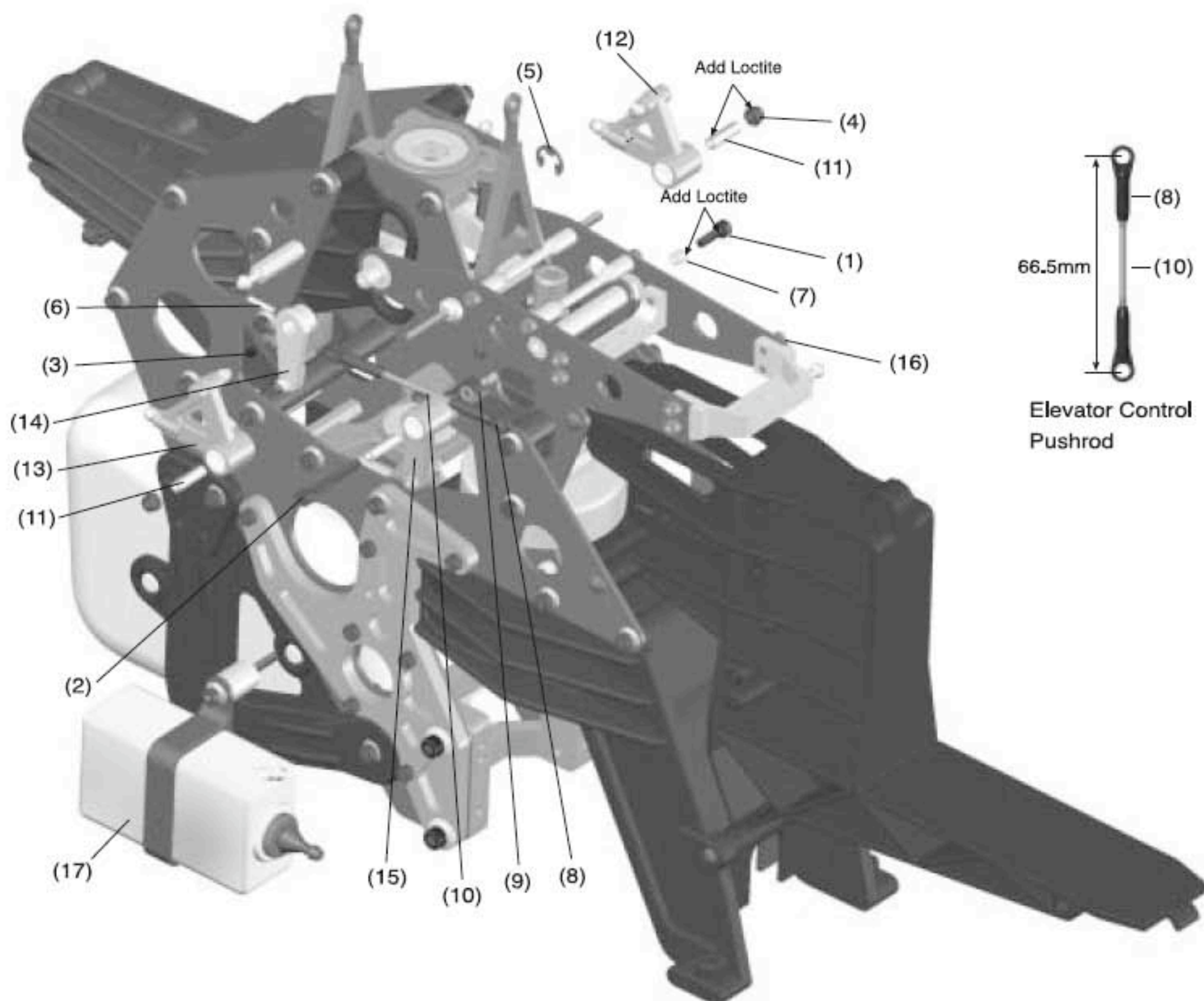
1-5

Installation of Carbon Pitch Frame BAG D

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMC3-10B	Socket Screw M3x10	1	10	BK0093	Link Rod 2x46	1
2	HMC3-25B	Socket Screw M3x25	1	11	BK0410	Collar d3xD4x13	3
3	HME3-3B	Set Screw M3x3	1	12	1-5-1	Aileron Lever Subassembly (L)	1
4	HMM3Z	Locknut M3	2	13	1-5-1	Aileron Lever Subassembly (R)	1
5	HMS4	E Ring	1	14	1-5-2	Metal Elevator Parallel Lever Subassembly	1
6	HMY2-10	Pin 2x10	1	15	1-5-3	Elevator Control Lever Subassembly	1
7	BK0078	Collar d3xD4x4	2	16	1-5-4	Carbon Collective Pitch Control Frame Subassembly	1
8	BK0086	Ball link 4.8x20	2	17	1-5-5	Header Tank Subassembly	1
9	BK0088	Washer d3xD5x0.5	1				

Please complete subassemblies 1-5-1 through 1-5-5 first, then add them to the Main Frame. Then fit the Carbon Control Frame Subassembly. First, insert Items No. 5 E Ring on the left side and No. 15 Elevator Control Lever with No. 6 Pin for the right side. Then install parts (1) and (7) on the left and Elevator Control Lever to the right using Loctite on the 3mm bolts and Loctite on the metal Collars. The entire Carbon control tray can shift left or right, but once the 3mms are tighten and Loctite is dried, the tray will not shift left or right. The carbon tray should sit in the center of the Frame and not too far forward the left or right. Adjust the two bolts (No. 1 and No. 2) so the Pitch Control Frame can rock freely but without excessive play. Finally, add the two plastic Aileron Levers and the 66.5 mm elevator pushrod. (Refer to Page 54 for actual measurement.)

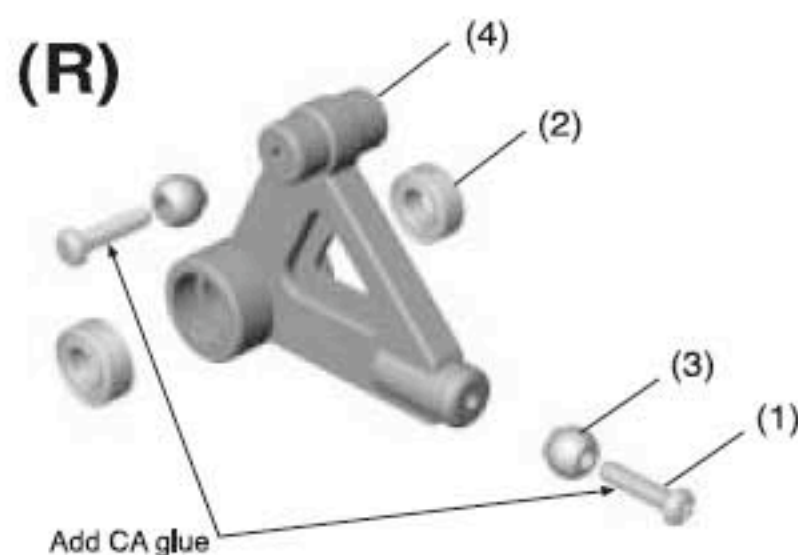
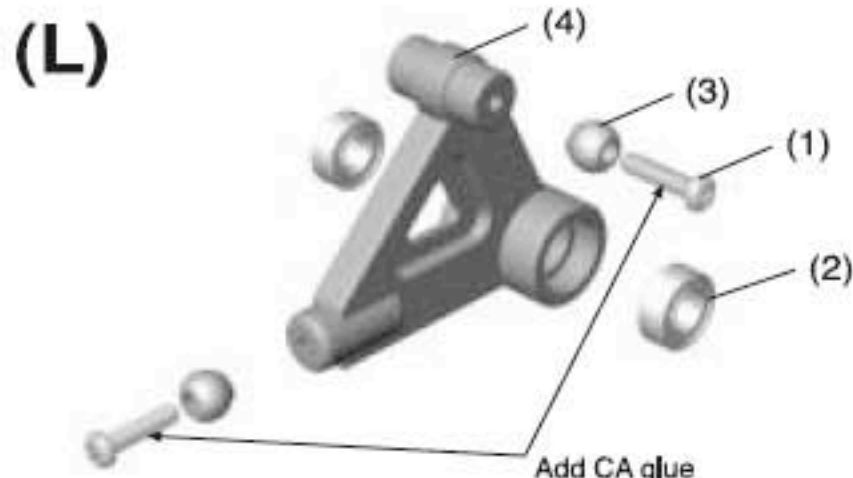
Before installing the Aileron Levers (No. 12 and No. 13), please add a small drop of Loctite on the M3x25 bolts and on the outside of the collar d3xD4x13 (No. 11).



1-5-1 Aileron Lever Subassembly

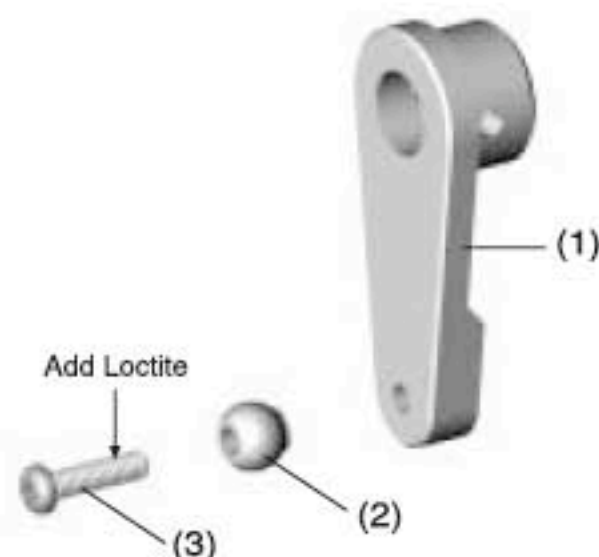
No.	Material No.	Description	Qty.
1	HMJ2-10N	Self-Tapping Screw M2x10	2
2	HMV840ZZ	BRG d4xD8X3	2
3	BK0075	Link Ball 4.8	2
4	BK0340	Aileron Control Arm	1

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.



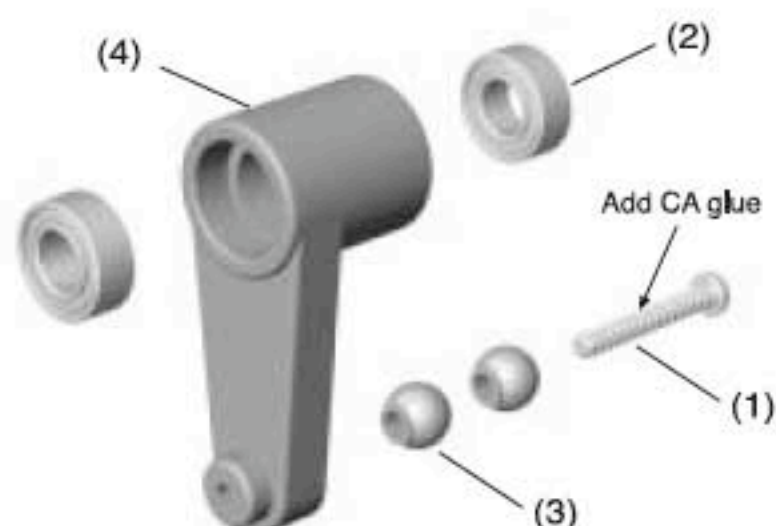
1-5-2 Metal Elevator Parallel Lever Subassembly

No.	Material No.	Description	Qty.
1	BK0456	Metal Elevator Arm Parallel Lever	1
2	BK0075	Link Ball 4.8	1
3	HMF2-8N	Philip Machine Screw M2x8	1



1-5-3 Elevator Control Lever Subassembly

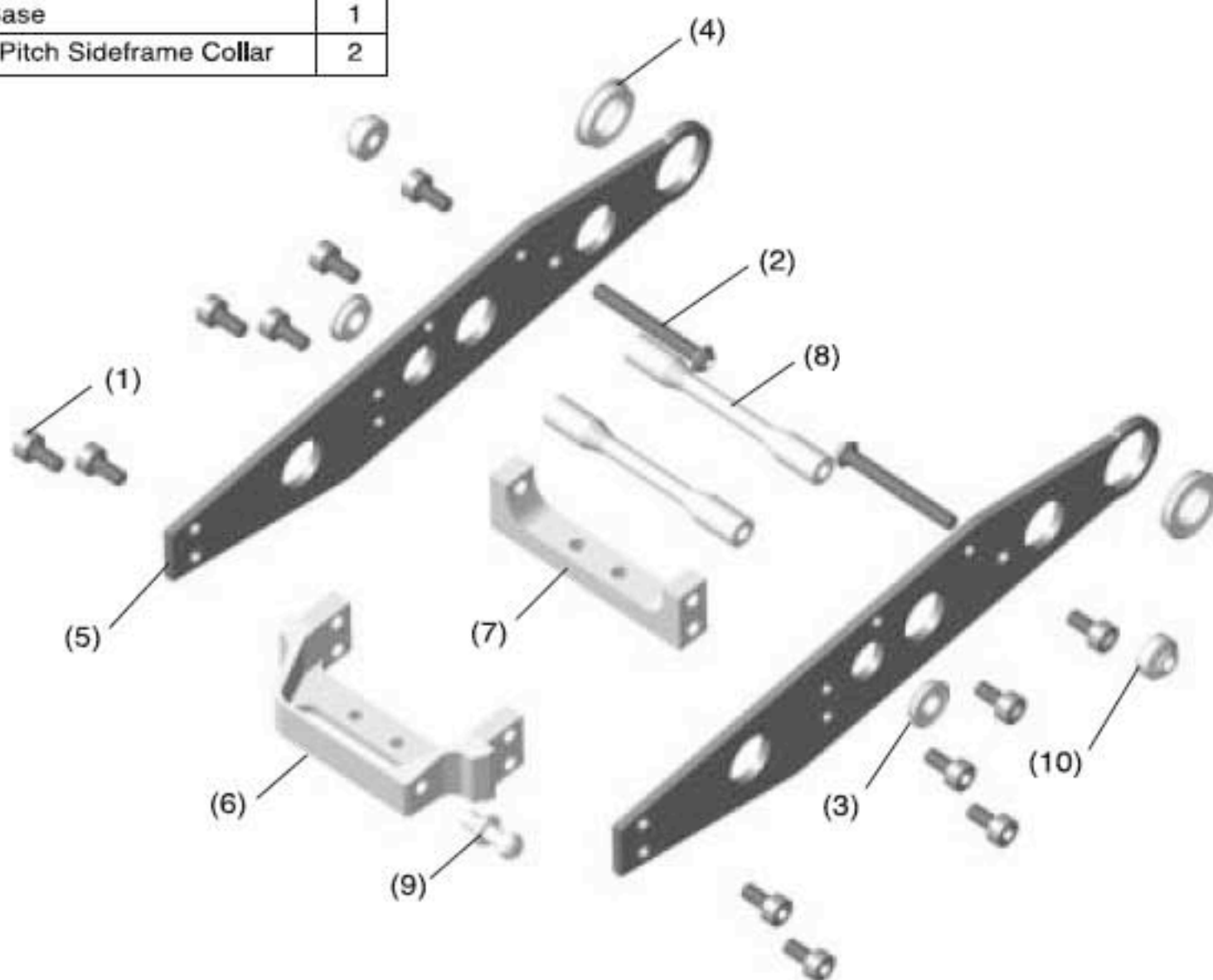
No.	Material No.	Description	Qty.
1	HMJ2-14N	Selfing-Tapping Screw M2x14	1
2	HMV840ZZ	BRG d4xD8x3	2
3	BK0075	Link Ball 4.8	2
4	BK0338	Elevator Control Lever	1



1-5-4 Carbon Collective Pitch Control Frame Subassembly

No.	Material No.	Description	Qty.
1	HMC3-6B	Socket Screw M3x6	12
2	HSA3-25	Button Head Socket Screw M3x25	2
3	HSH840Y	BRG	2
4	HSH1280Y	BRG	2
5	BK0464	Carbon Collective Pitch Sideframe	2
6	BK0469	Metal Front Servo Base	1
7	BK0470	Metal Rear Servo Base	1
8	BK0471	Metal Spacer	2
9	BK0486	Link Ball Base	1
10	BK0536	Collective Pitch Sideframe Collar	2

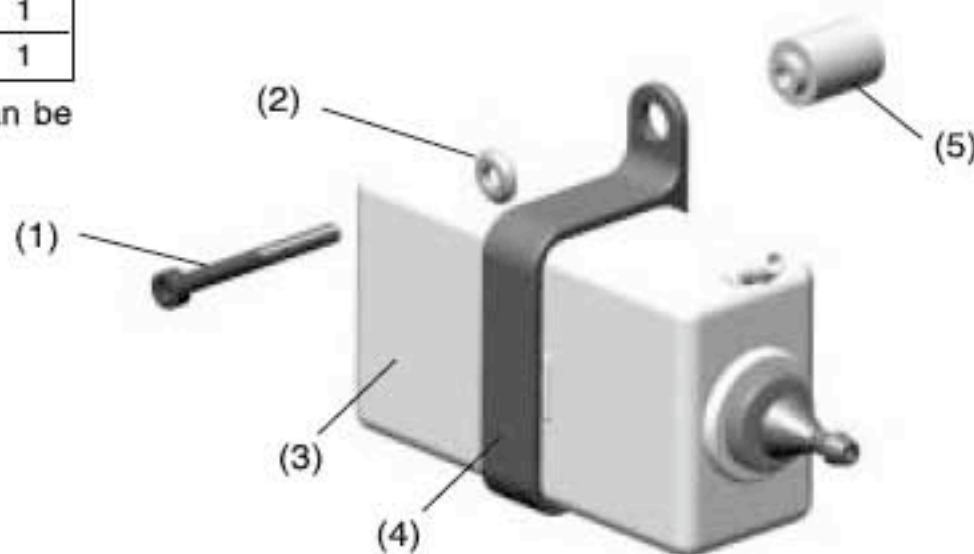
Optional: add a tiny drop of thick CA on the outside rim of the four ball bearings before inserting them into the carbon Pitch Frame. Be careful not to get any glue into the ball bearings. Add Loctite to all socket screw and link ball base.



1-5-5 Header Tank Subassembly

No.	Material No.	Description	Qty.
1	HMC3-30B	Socket Screw M3x30	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 90SE kit includes a header fuel tank that can be attached to the right side of the Raptor 90SE.



1-6

Installation of Main Shaft

BAG E

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HSA3-6B	Button Head Socket Screw M3x6	2	6	BK0547	Hardened Main Shaft	1
2	BK0617	M4x25 Bolt	1	7	BK0234	Lock Ring	1
3	HMM4B	M4 Locknut	1	8	1-6-1	Wash Out Subassembly	1
4	BK0086	Ball Link 4.8x2.0	4	9	1-6-2	Swash Plate Subassembly	1
5	BK0093	Link Rod 2x46	2	10	1-6-3	Main Gear Subassembly	1

Assemble the constant drive Main Gear Subassembly according to Figure 1-6-3 first. Then build up the Wash Out Subassembly and Swashplate Subassembly according to 1-6-1 and 1-6-2. Insert the No.6 Main Shaft into the bearings and then add the No.7 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.

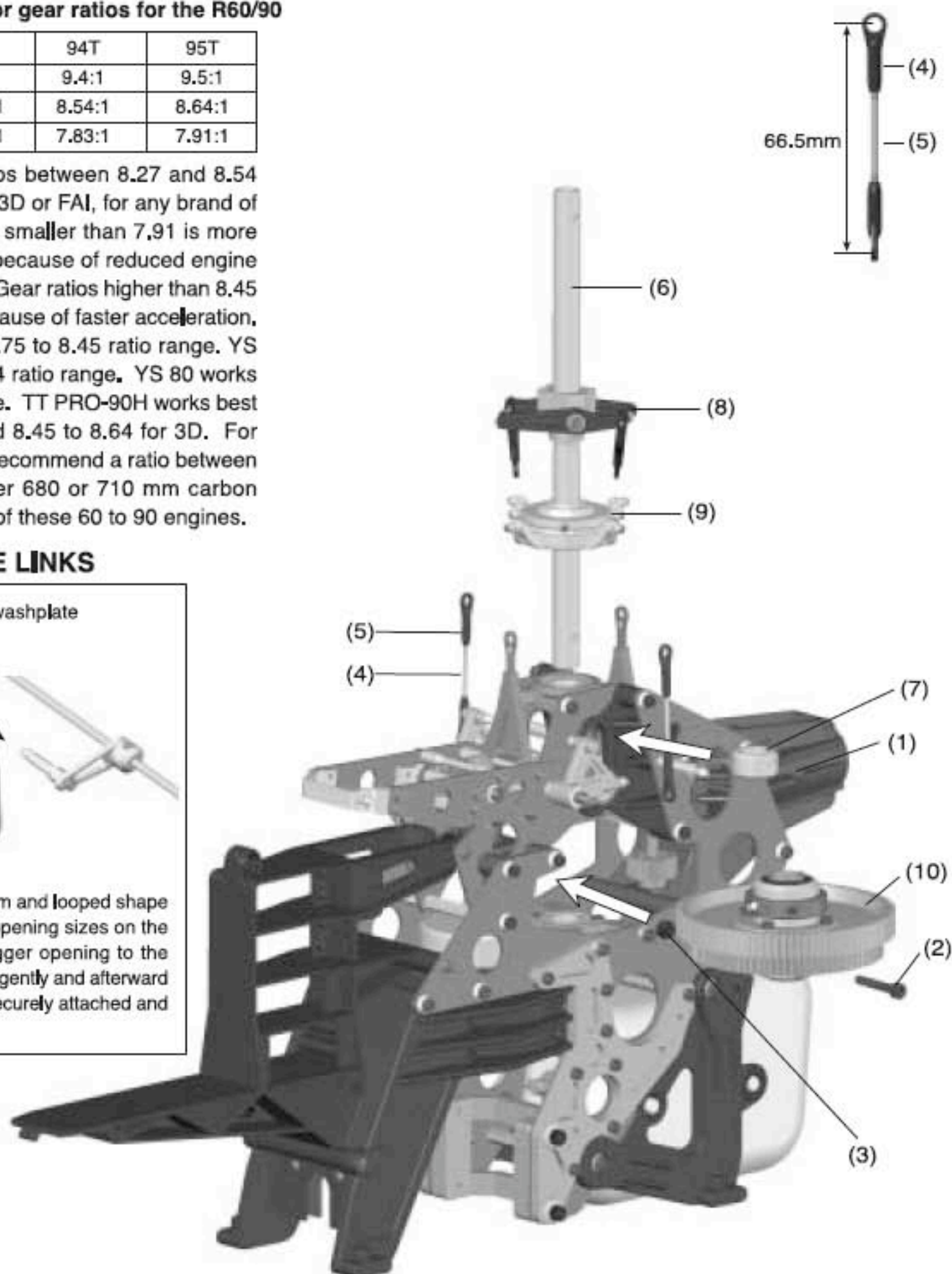
The locking ring prevents the main shaft from sliding up. Line up the hole on the main gear and the main shaft, then insert M4x25 mm Bolt through them. Place a 4 mm M4 locknut on the other side of the autorotation hub, and then tighten the Bolt. Do not over tighten Bolt, otherwise the autorotation assembly 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.

Possible engine to main rotor gear ratios for the R60/90

Main Gear Pinion	91T	93T	94T	95T
10T	9.1:1	9.3:1	9.4:1	9.5:1
11T	8.27:1	8.45:1	8.54:1	8.64:1
12T	7.58:1	7.75:1	7.83:1	7.91:1

Recommendations: Gear ratios between 8.27 and 8.54 are good for general flying, or 3D or FAI, for any brand of 91 class engine. Gear ratios smaller than 7.91 is more suited for FAI F3C flying only because of reduced engine noise from lower engine RPM. Gear ratios higher than 8.45 is more suited for 3D flying because of faster acceleration. OS C-Spec works best with 7.75 to 8.45 ratio range. YS 91 works best with 7.91 to 8.54 ratio range. YS 80 works best with 8.45 to 9.3 ratio range. TT PRO-90H works best with 7.75 to 8.27 for F3C, and 8.45 to 8.64 for 3D. For all 60 to 70 class engines, we recommend a ratio between 9.1 to 9.4. The Thunder Tiger 680 or 710 mm carbon blades will work well with any of these 60 to 90 engines.

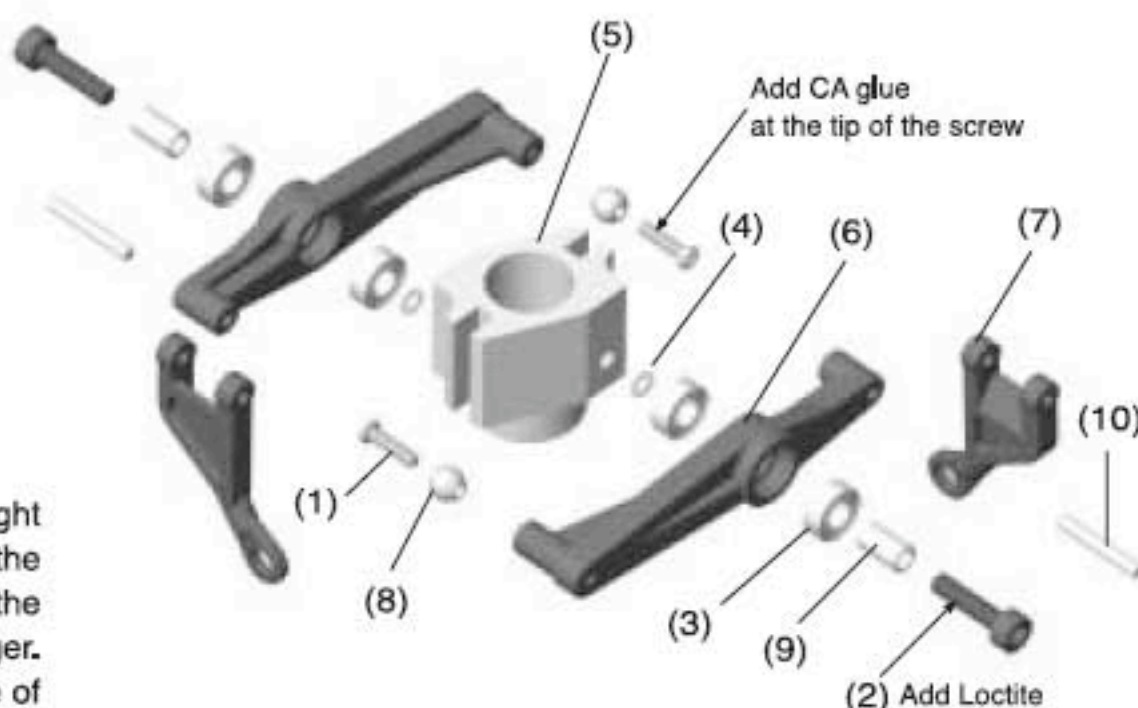
INSTALLATION OF THE LINKS



1-6-1 Wash Out Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	2
2	HMC3-12B	M3x12 Socket Screw	2
3	HMV840ZZ	d4xD8x3 BRG	4
4	BK0088	d3x5x0.5 Washer	2
5	BK0472	Wash Out Base	1
6	BK0342	Flybar Control Lever	2
7	BK0343	Wash Out Link	2
8	BK0075	Link Ball 4,8	2
9	BK0409	Collar d3xD4x7	2
10	BK0412	Pin 2x14.5	2

Insert the pin into the Washout Link. If the link is tight on the mixing arm, then gently squeeze the Link at the pin position with pliers while the Link is attached to the Arm. This will make the hole in the Link slightly bigger. Add a tiny drop of Loctite on the inside and outside of BK0409 Collar which will help give a completely stop 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 Swashplate Subassembly

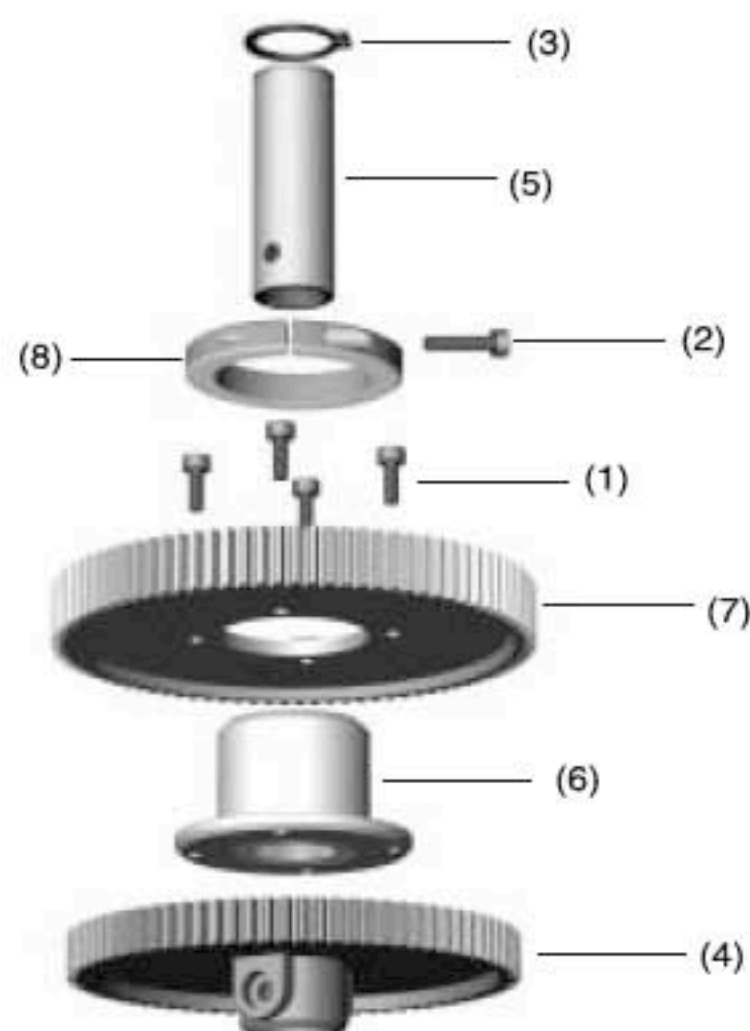
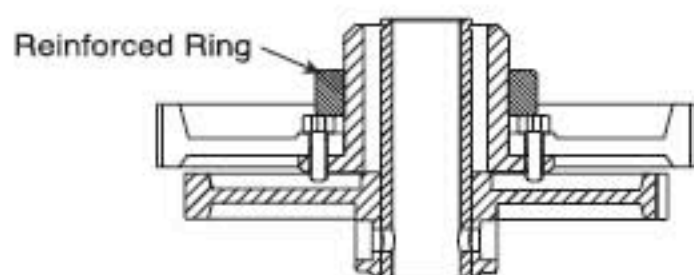
No.	Material No.	Description	Qty.
1	BV0504	Metal Swashplate	1



1-6-3 Main Gear Subassembly

No.	Material No.	Description	Qty.
1	HMC3-8B	Socket Screw M3x8	4
2	HMC3-14B	Socket Screw M3x14	1
3	HMQ16	Retaining Ring	1
4	BK0357	Tail Drive Spur Gear 83T	1
5	BK0359	One Way Clutch Shaft	1
6	BV0368	Auto Rotation Hub	1
7	BK0420	Main Spur Gear 93T	1
8	BK0613	One Way Clutch R.F Ring	1

Please see section 1-6 for main gear selection to suit your flying performance. Make sure the inside of Auto Rotation Hub is clean without any dirt before you insert the one way clutch shaft. Slide the steel clamp over the autorotation clutch housing. Tighten the 3mm bolt on the steel clamp, but do not overtighten this clamp prevents the aluminum housing from expanding.



2

ROTOR HEAD ASSEMBLY



2-1

Metal Rotor Head Assembly

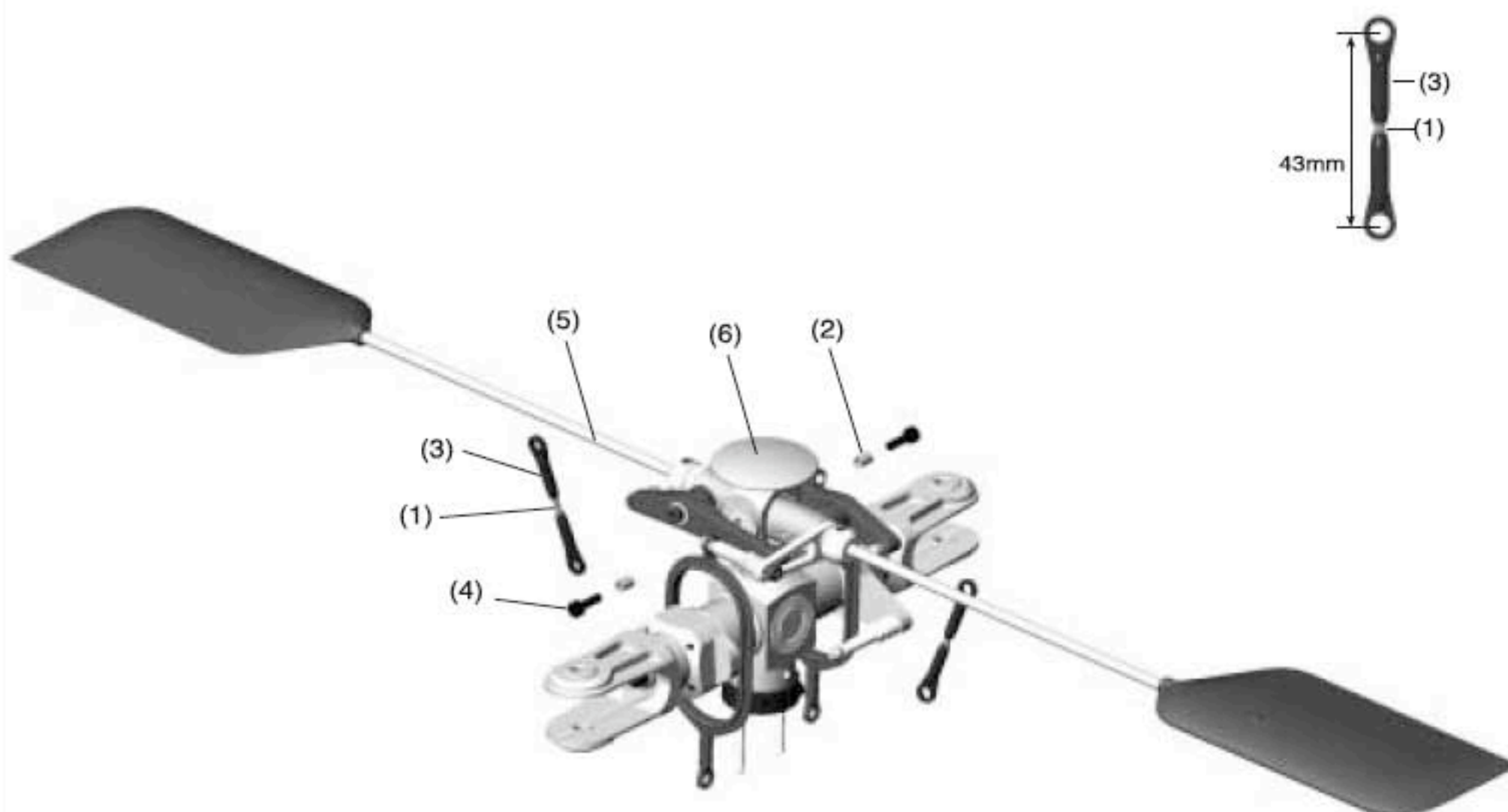
BAG F

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	BK0292	Link Rod 2.3x24	2	4	HMC3-10B	Socket Screw M3x10	2
2	BK0408	Collar d3xD4x5.5	2	5	2-1-1	Flybar Seesaw Subassembly	1
3	BK0086	Ball Link 4.8	4	6	2-1-2	Metal Main Rotor Hub Subassembly	1

Make two pushrods for controlling blade pitch. The distance of 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.4) and on the outside of the collar d3xD4x5.5 (No.2).



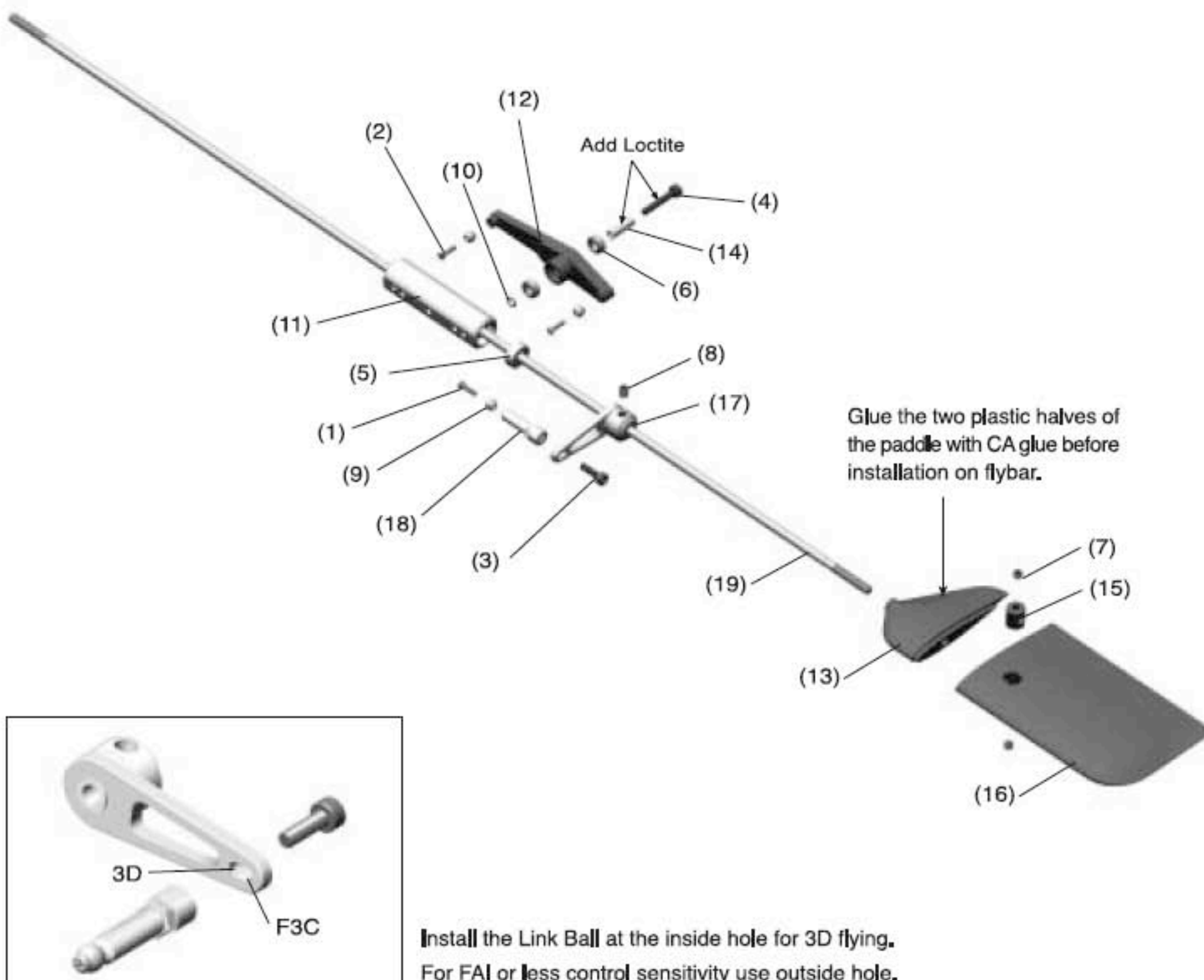
2-1-1 Flybar Seesaw Subassembly

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMF2-8N	Phillips Machine Screw M2x8	2	11	BK0322	Flybar Seesaw Hub	1
2	HMJ2-10N	Selfing-Tapping Screw M2x10	4	12	BK0324	Mixing Lever	2
3	HMC3-10B	Socket Screw M3x10	2	13	BK0406	Paddle Root	2
4	HSA3-18B	Button Head Socket Screw M3x18	2	14	BK0410	Collar d3xD4x13	2
5	HMV694ZZ	BRG d4xD11x4	2	15	BK0416	Paddle Stopper	2
6	HMV840ZZ	BRG d4xD8x3	4	16	BK0432	Flybar Paddle	2
7	HME4-3B	Set Screw M4x3	4	17	BK0633	Flybar Control Frame	2
8	HME4-5B	Set Screw M4x5	2	18	BK0634	Flybar control Arm	2
9	BK0075	Link Ball 4.8	6	19	BK0640	Flybar Rod	1
10	BK0088	Washer d3xD5x0.5	2				

Assemble the metal flybar control arms according to the drawings. Slide Flybar Control Arm onto the No.19 Flybar Rod. Slide the flybar into the No.11 Seesaw Hub. Important, push the seesaw and the flybar assembly into the BK0706 metal rotor hub first, then install the other flybar control frame and arm. 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.7 set screws.

Assemble and install the No.12 Mixing Levers and No.6 Bearings according to the drawing using No.14 Collar and No.10 a d3xD5x0.5 washer.

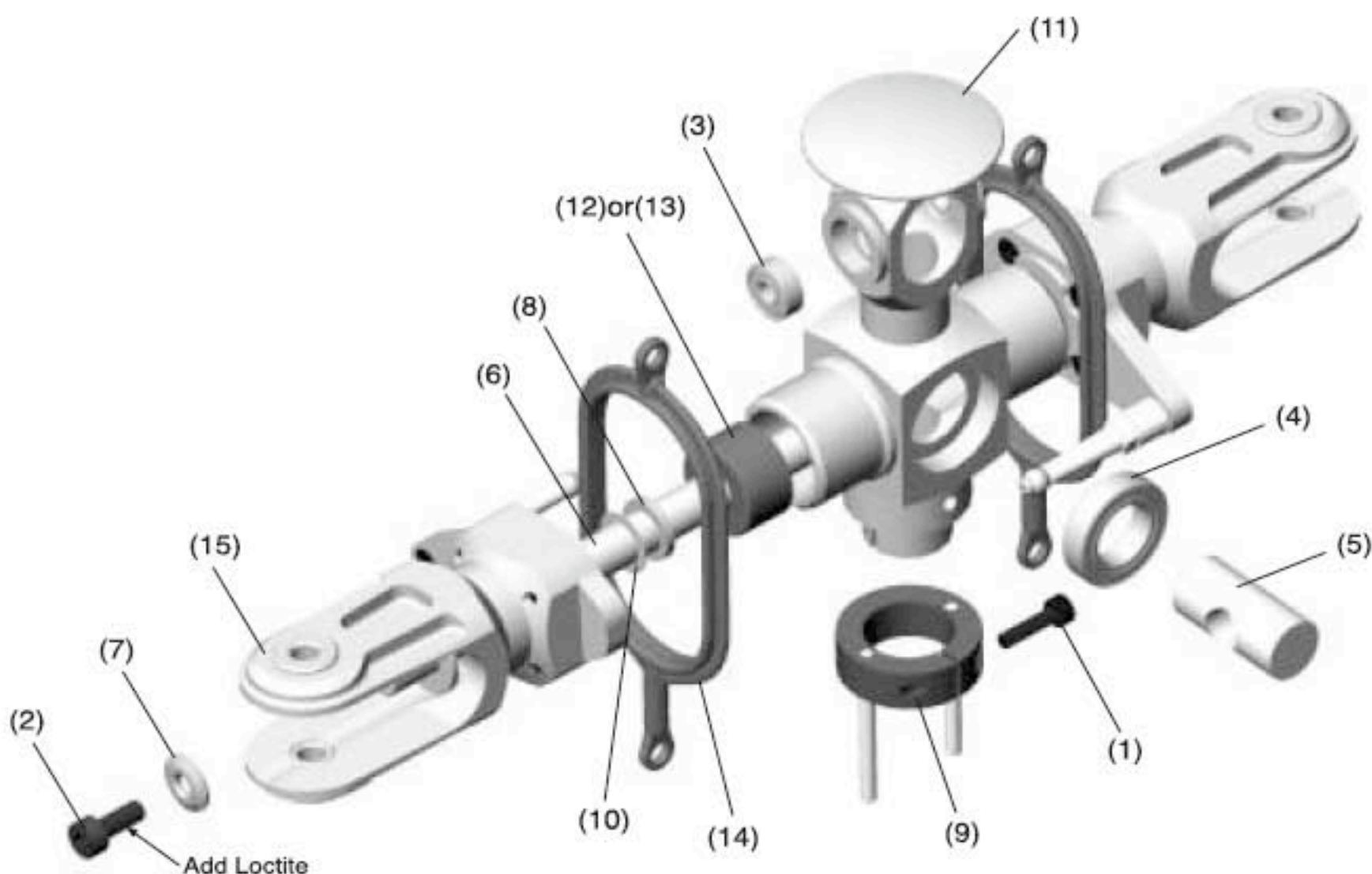
Note: Before installing the Mixing Lever (No.12), please add a small drop of Loctite along the entire length of the M3x18 button head socket screw (No.4) and on the outside of the collar d3xD4x13 (No.14). Be careful do not let the Loctite seep into the bearings. There are two choices of hole positions on the aluminum seesaw for attaching the mixing lever arm. Please use the outside hole position, this gives higher Bell-Hiller mixing ratio and more stability. For very aggressive 3D flying, attach the Bell-Hiller mixing arms to the inner hole on fly seesaw, but the optional metal flybar control arms (No.PV0294) must be used, otherwise the mixing arm can touch the BK0633 flybar control frame.



2-1-2 Metal Main Rotor Hub Subassembly

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMC3-12B	Socket Screw M3x12	1	9	BV0549	Washout Base Guidance Ring	1
2	HMC4-10B	Socket Screw M4x10	2	10	BK0703	Flap Damper Washer 0.4mm	6
3	HMV694ZZ	BRG d4xD11x4	2	11	BK0706	Metal Button Head Main Rotor Hub	1
4	HMV2112Z	BRG d12xD21x5	2	12	BK0656	70 Durometer Flap Damper	2
5	BK0330	Main Rotor Hub Pin	1	13	BK0657	80 Durometer Flap Damper	2
6	BK0326	Spindle	1	14	BK0664	Flybar Control Rod	2
7	BK0435	Washer d4xD11x1.7	2	15	2-1-3	Metal Main Rotor Grip Subassembly	2
8	BK0477	Washer	2				

Insert the aluminum Main Rotor Hub Pin and the two rubber Flap Dampers. (might need to apply silicone grease for easy installation). Push the No.6 Feathering Spindle into the dampers and the rotor hub. Add No. 14 Flybar Control Rod (see page 17 installation of the rods). 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. Temporarily install the Washout Base Guidance Ring, but do not tighten the No.1 3mm bolt yet.



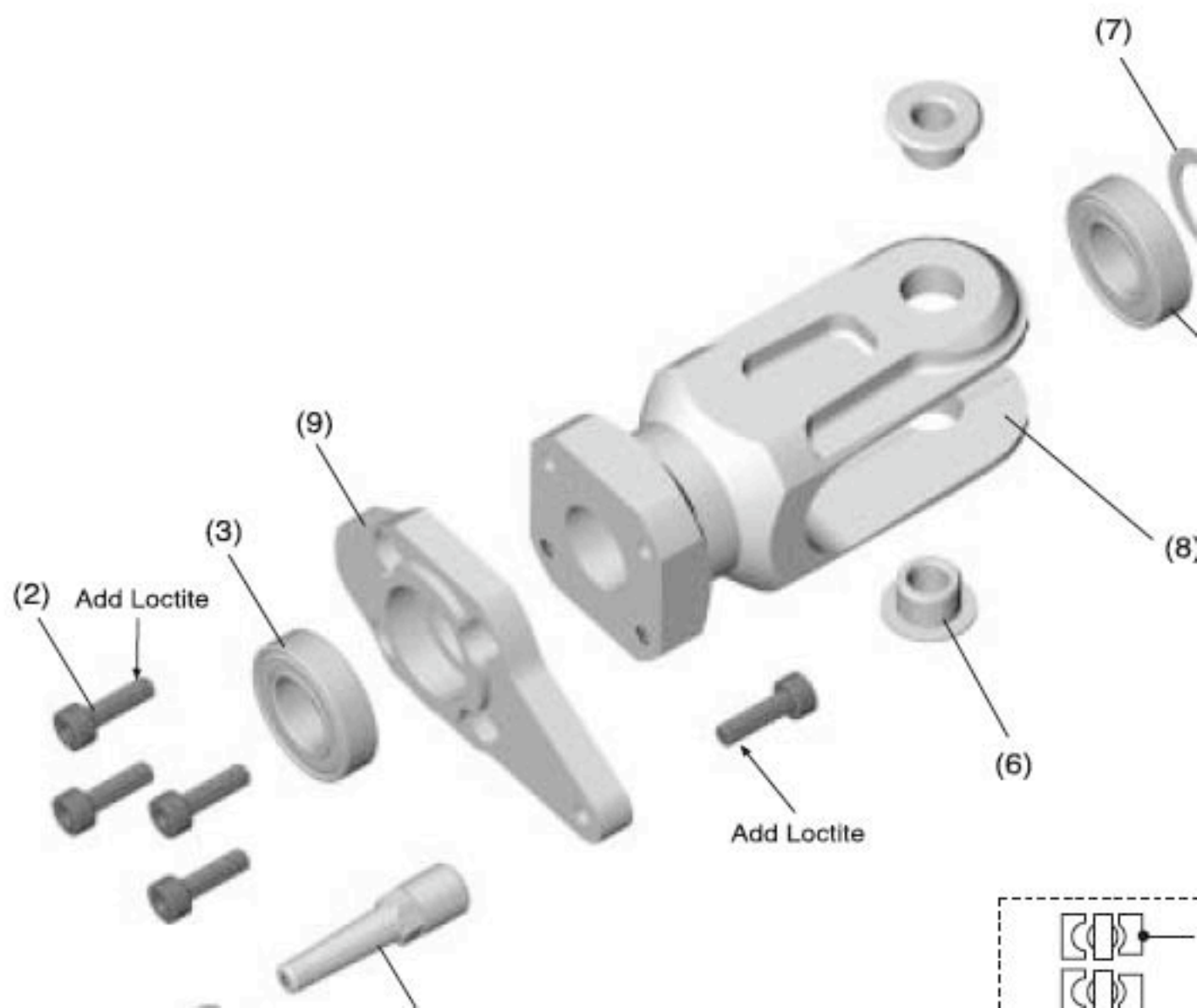
Important Note:

The Raptor 90 SE kits come with blue color flap damper that are of 70 degree durometer stiffness. This is good for F3C and beginner. For aggressive 3D flying, the pilot 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, or use red 80 degree durometer hard damper. For very aggressive 3D flying, use red dampers and shim washers.

Stiffing the main rotor head will speed up the cyclic transient response, but may cause the helicopter fuselage to oscillate at around 1600 RPM. When shim washers or harder rubber are used with the Thunder Tiger metal rotor hub, the cyclic response is quick. The pilot will usually have to set his engine governor or the throttle/pitch curve so the helicopter will hover at below the oscillation RPM, and in 3D or F3C aerobatics the rotor speed will be set above the oscillation RPM. Note, this oscillation characteristic exists for all helicopters, the softer the rubber the lower the resonant RPM. The rubber dampers should be replaced periodically if a lot of 3D flying has been done. When the rubber dampers are worn, the main rotor blades can flap excessively during some 3D maneuvers and risk touching the tail boom.

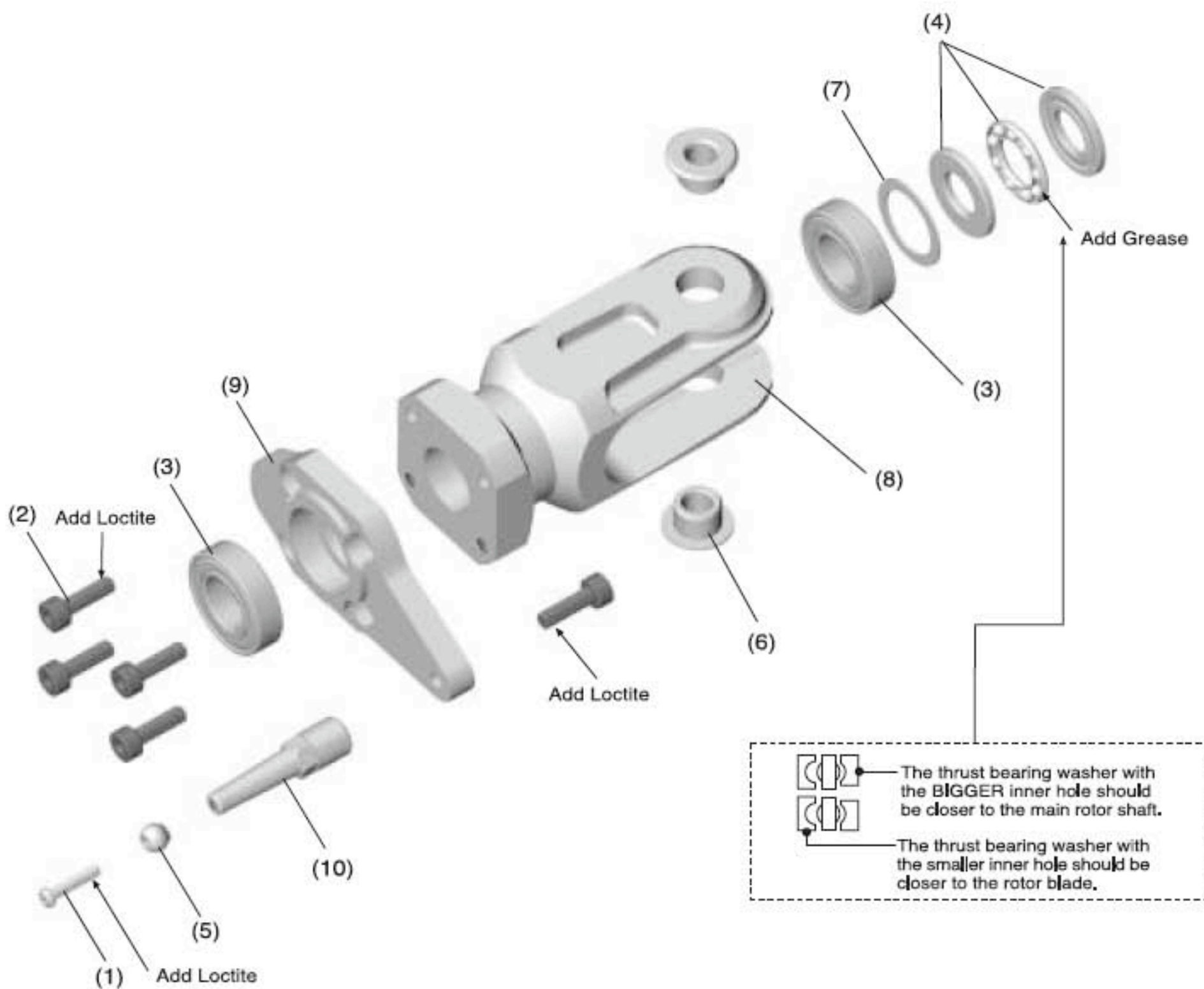
2-1-3 Metal Main Rotor Grip Subassembly

No.	Material No.	Description	Qty.	No.	Material No.	Description
1	HMF2-10N	Phillips Machine Screw M2x10	1	6	BK0297	Grip Collar
2	HMC3-10B	Socket Screw M3x10	5	7	BK0325	Thrust Collar
3	HMV1680	BRG d8xD16x5	2	8	BK0562	Metal Main F
4	HMX0816	Thrust Bearing d8x16x5	1	9	BK0563	Metal Main F
5	BK0075	Link Ball 4.8	1	10	BK0565	Metal Main F



2-1-3 Metal Main Rotor Grip Subassembly

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMF2-10N	Phillips Machine Screw M2x10	1	6	BK0297	Grip Collar	2
2	HMC3-10B	Socket Screw M3x10	5	7	BK0325	Thrust Collar	1
3	HMV1680	BRG d8xD16x5	2	8	BK0562	Metal Main Rotor Grip	1
4	HMX0816	Thrust Bearing d8x16x5	1	9	BK0563	Metal Main Rotor Plate	1
5	BK0075	Link Ball 4.8	1	10	BK0565	Metal Main Rotor Grip Post	1



3

TAIL ASSEMBLY



3-1

Carbon Tail Assembly

BAG G

No.	Material No.	Description	Qty.
1	HMC3-8B	Socket Screw M3x8	4
2	HMC3-14B	Socket Screw M3x14	2
3	HMC3-32B	Socket Screw M3x32	2
4	HMM3B	Locknut M3	4
5	BK0086	Ball Link 4.8x20	2
6	BK0087	Washer d3xD8x1.4	8
7	BK0278	Machined Washer	4
8	BK0403	Rod Guide	4
9	BK0530	Stabilizer Fin Bracket (Upper)	1

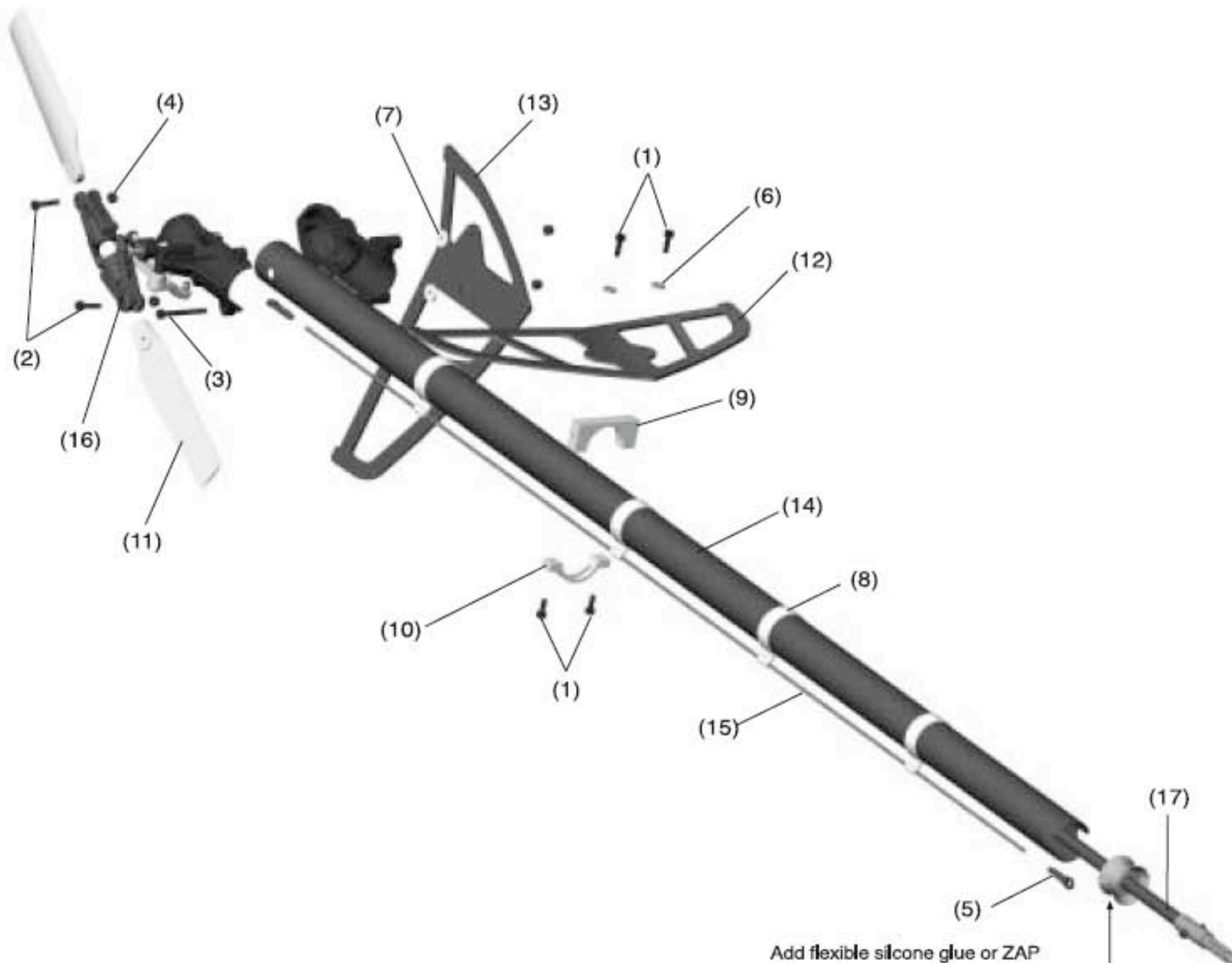
No.	Material No.	Description	Qty.
10	BK0531	Stabilizer Fin Bracket (Lower)	1
11	BK0404	Tail Rotor Blade	2
12	BK0465	Carbon Stabilizer Fin	1
13	BK0466	Carbon Vertical Fin	1
14	BK0511	Carbon Tail Boom	1
15	BK0707	Rear Servo Rod	1
16	3-1-1	Tail Transmission Subassembly	1
17	3-1-3	Carbon Tail Drive Shaft 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 then. 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. 8 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.

Install No. 9 and No. 10 Bracket now. Do not over-tighten the metal bracket, which can then crack the carbon tail boom. The exact location of the bracket will be determined when the boom supports are added in step 4-4. You can temporarily install the carbon fins. Secure the No. 11 Tail Rotor Blades using No. 2 Bolts and No. 4 Locknut.



Note: (8) BK0403 must large servo rod hole from $\phi 2 \rightarrow \phi 2.3$

Add flexible silicone glue or ZAP Goop glue around the outside before inserting into the tail boom from the front side.

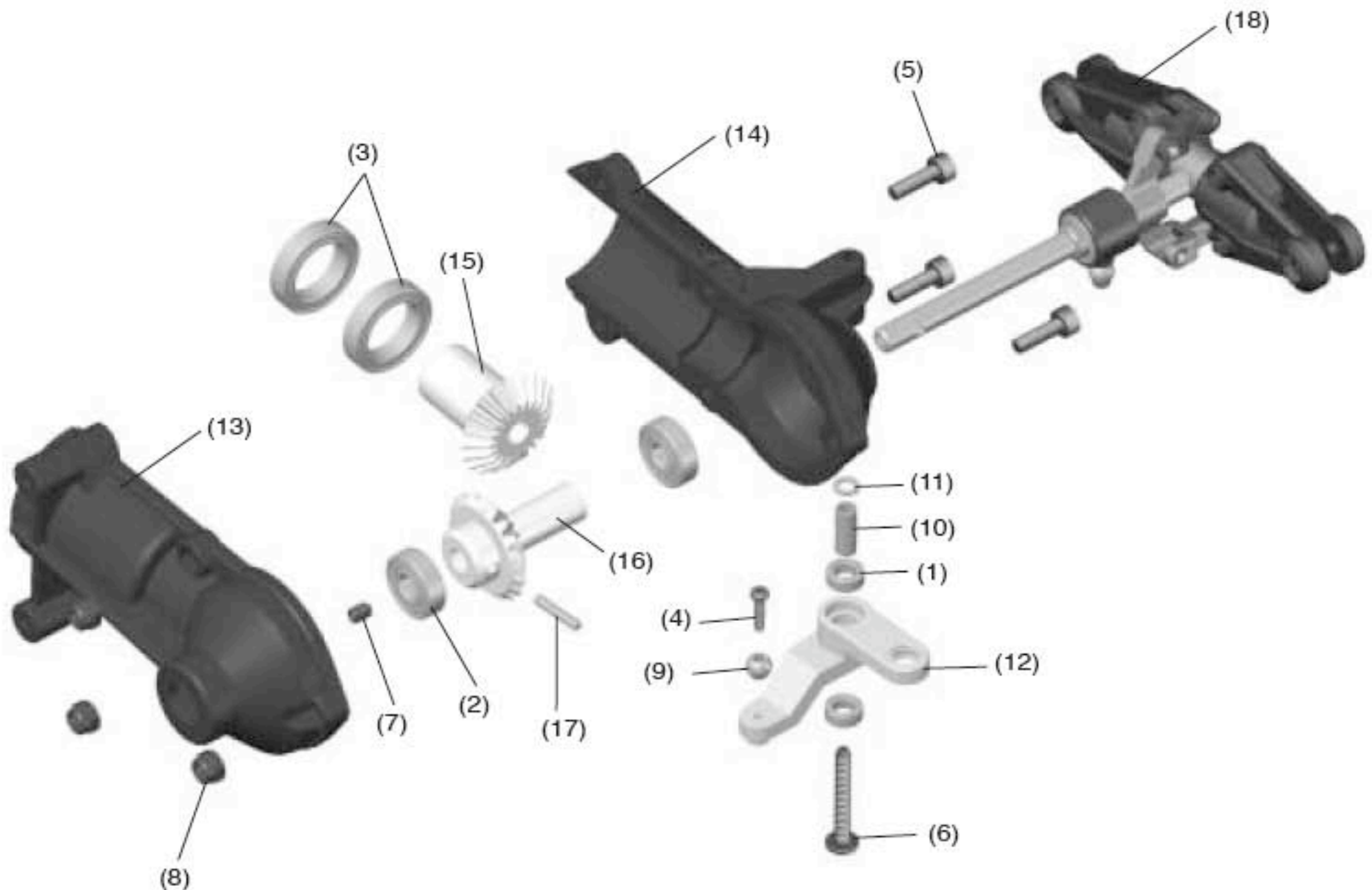
3-1-1 Tail Transmission Subassembly

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMV740ZZ	BRG d4xD7x2.5	2	10	BK0076	Collar d3xD4x10	1
2	HMV1350	BRG d5xD13x4	2	11	BK0088	Washer d3xD5x0.5	1
3	HMV6701Z	BRG d12xD18x4	2	12	BK0346	Tail Pitch Control Lever	1
4	HMJ2-8N	Self-Tapping Screw M2x8	1	13	BK0370	Tail Case L	1
5	HMC3-10B	Socket Screw M3x10	3	14	BK0371	Tail Case R	1
6	HMJ3-20N	Self-Tapping Screw M3x20	1	15	BK0372	Tail Input Bevel Gear	1
7	HME3-4B	Set Screw M3x4	1	16	BK0373	Tail Output Bevel Gear	1
8	HMM3Z	Locknut M3	3	17	BK0414	Pin 2x12	1
9	BK0075	Link Ball 4.8	1	18	3-1-2	Carbon Tail Rotor Subassembly	1

Install bearings No. 2 and 3 into the No. 13/14 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. Slide the tail shaft into the gearbox case and bearing.

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	HMC26-10B	Socket Screw M2.6x10	4
2	HMM26B	Locknut M2.6	4
3	HSE2-10B	Self-Tapping Screw M2x10	2
4	HMJ2-8N	Self-Tapping Screw M2x8	1
5	HME3-18B	Set Screw M3x18	2
6	HMM3B	Locknut M3	2
7	HMS15	E Ring	4
8	HMV1050	BRG d5xD10x4	4
9	HMV1060	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	BK0307	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

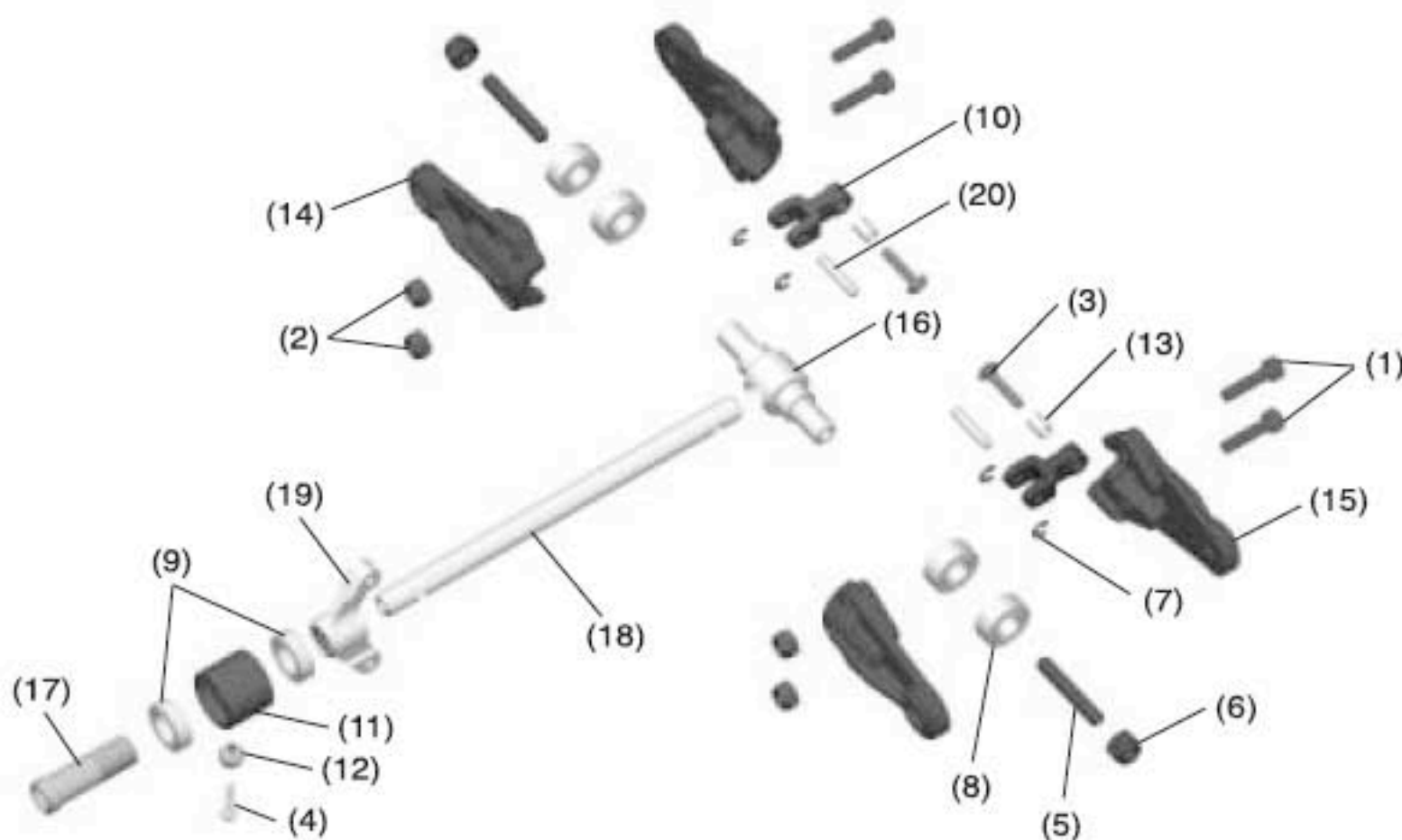
Assemble the Tail Pitch Control Slider and Pitch Control Fork according to the drawing as follows. Insert No. 9 Bearings into No. 11 Tail Pitch Control Slider. Add a tiny drop of Loctite on the "outside" surface of No. 17 Tail Pitch Control Bushing, then slide it into the two bearings in the No. 11 Tail 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. 4 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. 5 M3x18 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. Do not over tighten the two locknuts because that may break the No. 5 set screw.

Now add the two pieces plastic No. 14/15 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.

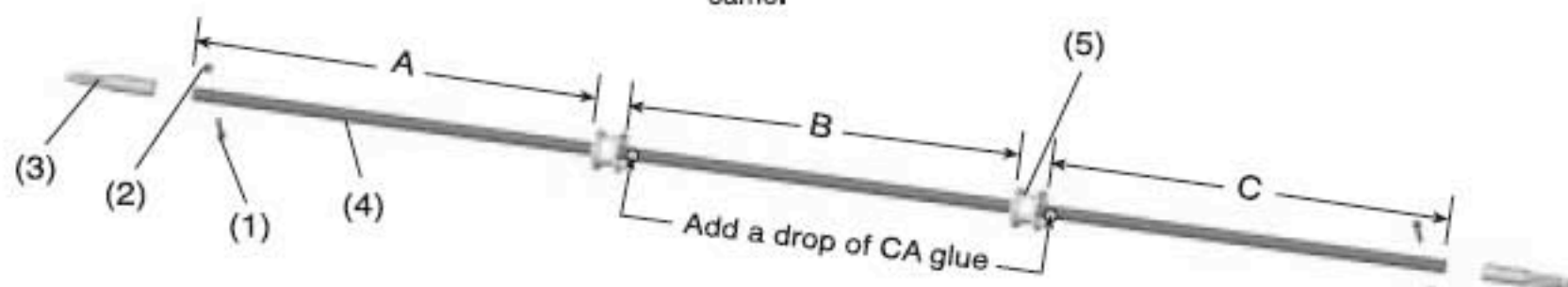


3-1-3 Tail Drive Shaft Subassembly

No.	Material No.	Description	Qty.
1	HMC2616B	M2.6x16 Socket Screw	2
2	HMM26B	M2.6 Locknut	2
3	BK0247	Tail Drive Coupling	2
4	BK0652	Carbon Tail Drive Shaft	1
5	BV0423	Tail Drive Shaft BRG	2

First slide the two support bearings over the carbon 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



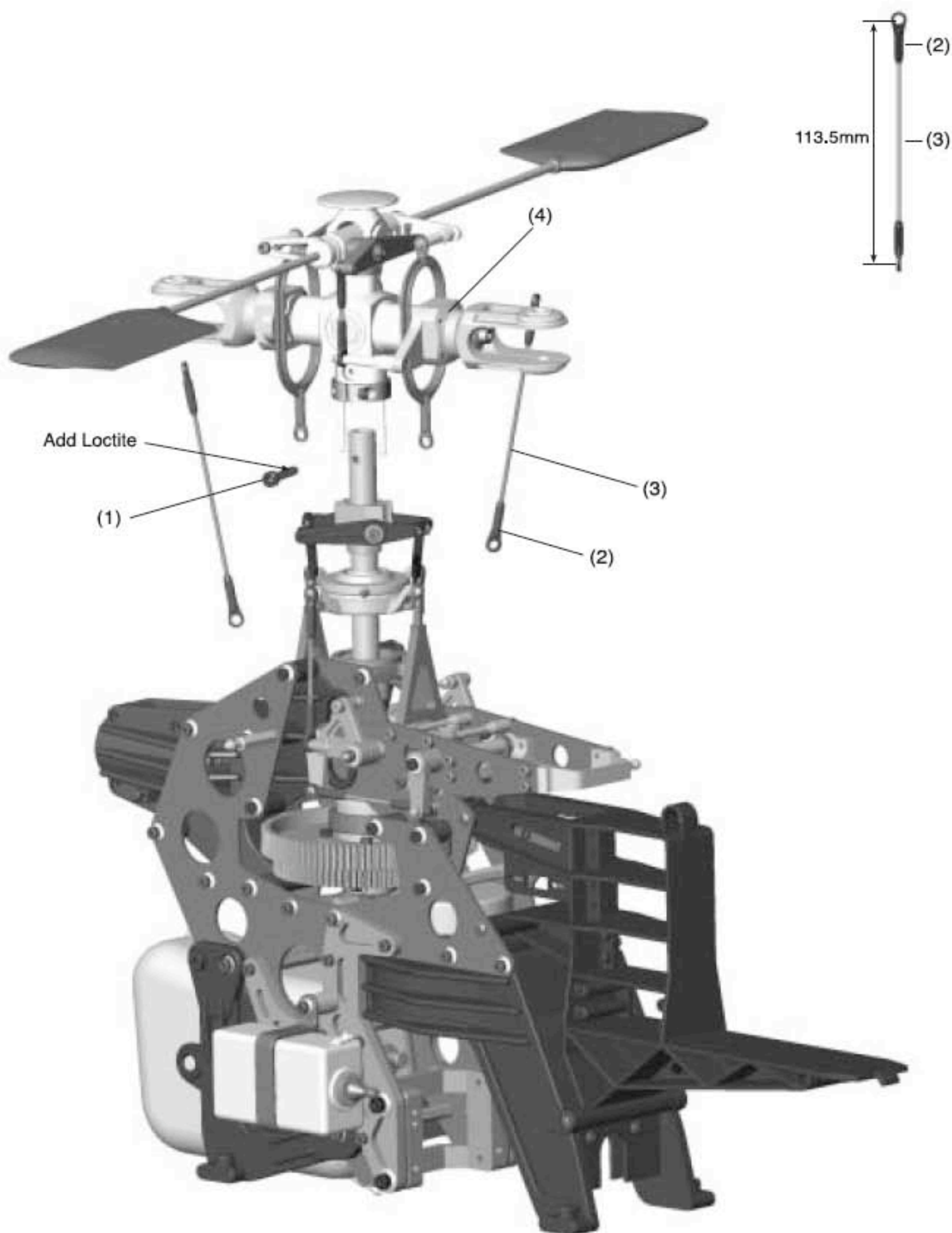
4-1

Installation of Rotor Head

BAG H

No.	Material No.	Description	Qty.
1	HMC4-20B	Socket Screw M4x20	1
2	BK0086	Ball Link 4.8x20	4
3	BK0318	Link Rod 2.3x95	2
4	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 Loctite. Make up two 113.5 mm long pushrods and attach them to the Bell-Hiller mixing arm.



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

Insert the engine into the side frames, using four M4x18 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.

Add Loctite when setting up the gearmesh in step 6-1.

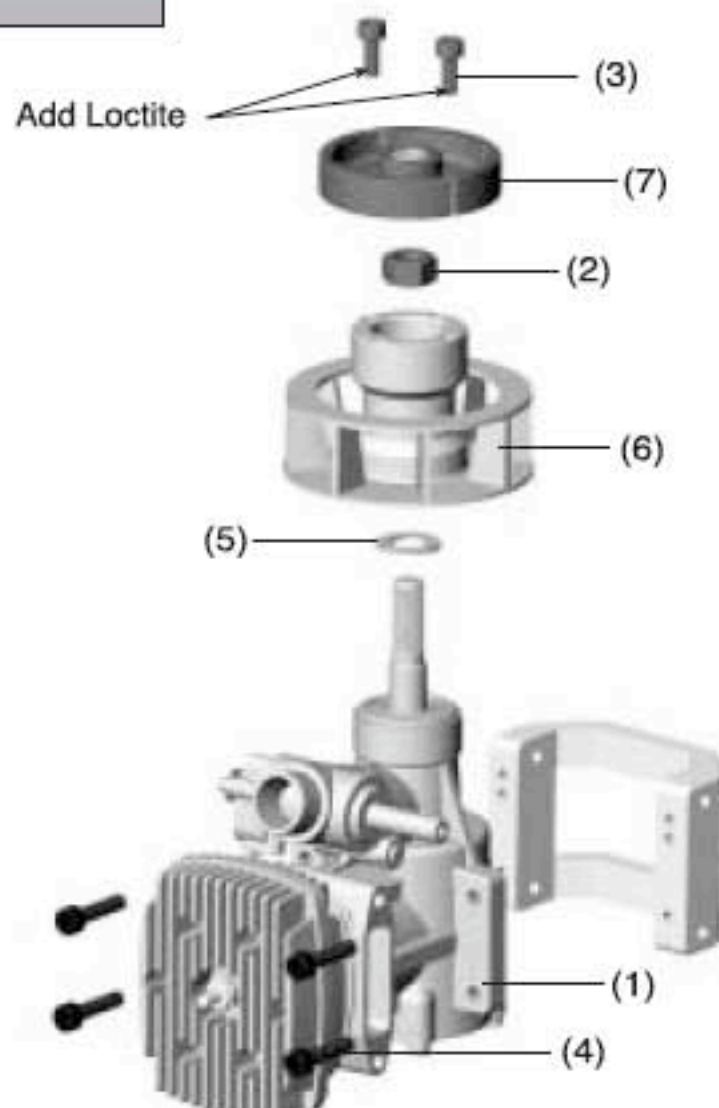
Add Loctite (1)

4-2-1 Engine Subassembly

No.	Material No.	Description	Qty.
1	*****	90 Class Heli Engine	1
2	*****	Nut (Comes With Heli Engine)	1
3	HMC4-8B	Socket Screw M4x8	2
4	HMC4-18B	Socket Screw M4x18	4
5	HMO10	Washer d9.5xD16x1	1
6	BK0457	Metal Cooling Fan	1
7	BV0521	Heavy Duty Clutch	1

Attach the engine mount to the engine using four 4mm bolts and Loctite. The aluminum 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. 6 Steel 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, then the fan hub must be re-tapped by the modeler to M8x1mm thread size or purchase optional plastic fan hub with threads for the YS engine(PV0198YS) or the metal fan for the YS (PV0293YS).

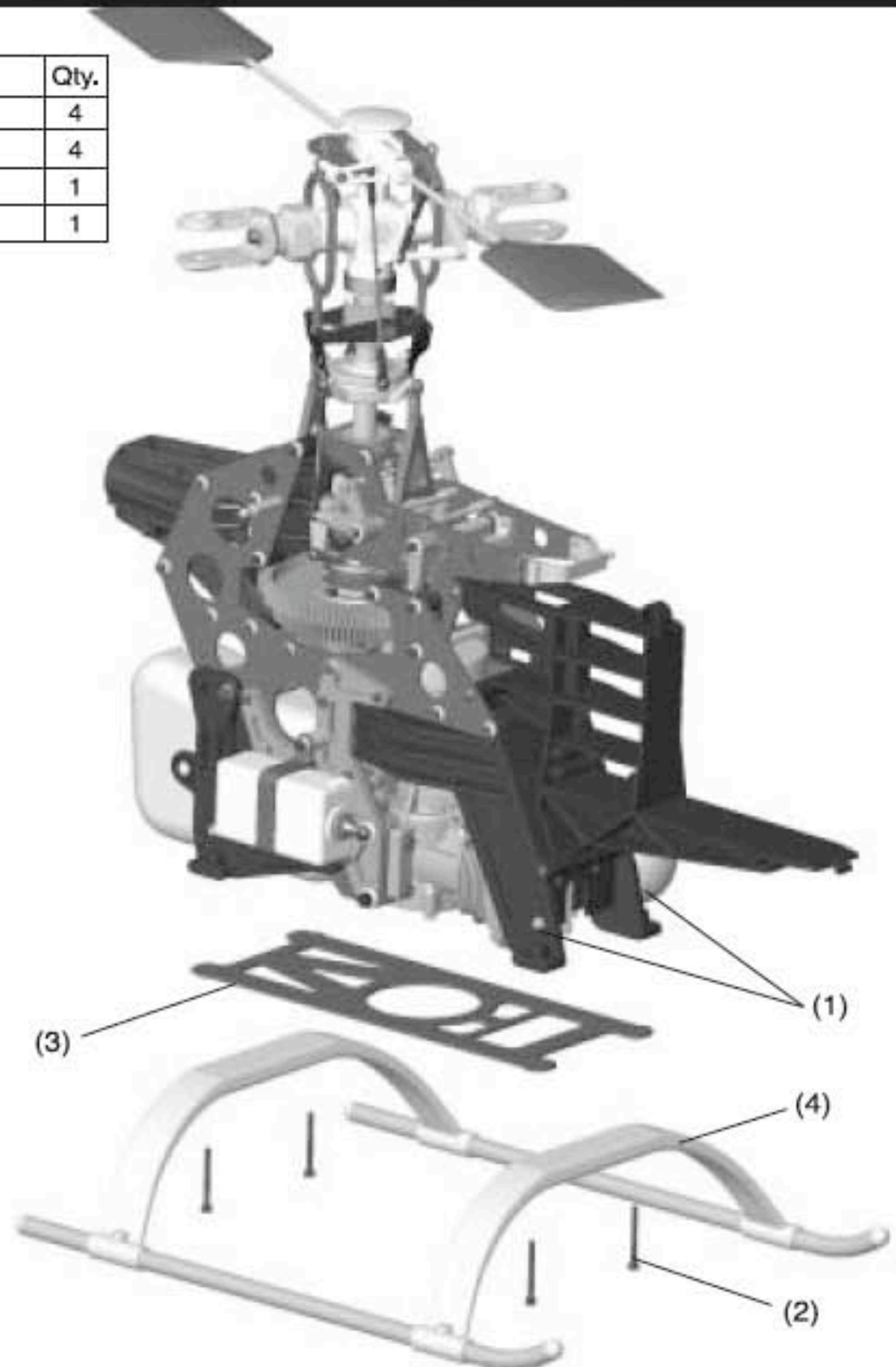


4-3

Installation of Landing Skid

No.	Material No.	Description	Qty.
1	HMM3Z	Locknut M3	4
2	HMC3-30B	Socket Screw M3x30	4
3	BK0529	Carbon Base Plate	1
4	4-3-1	Skid Subassembly	1

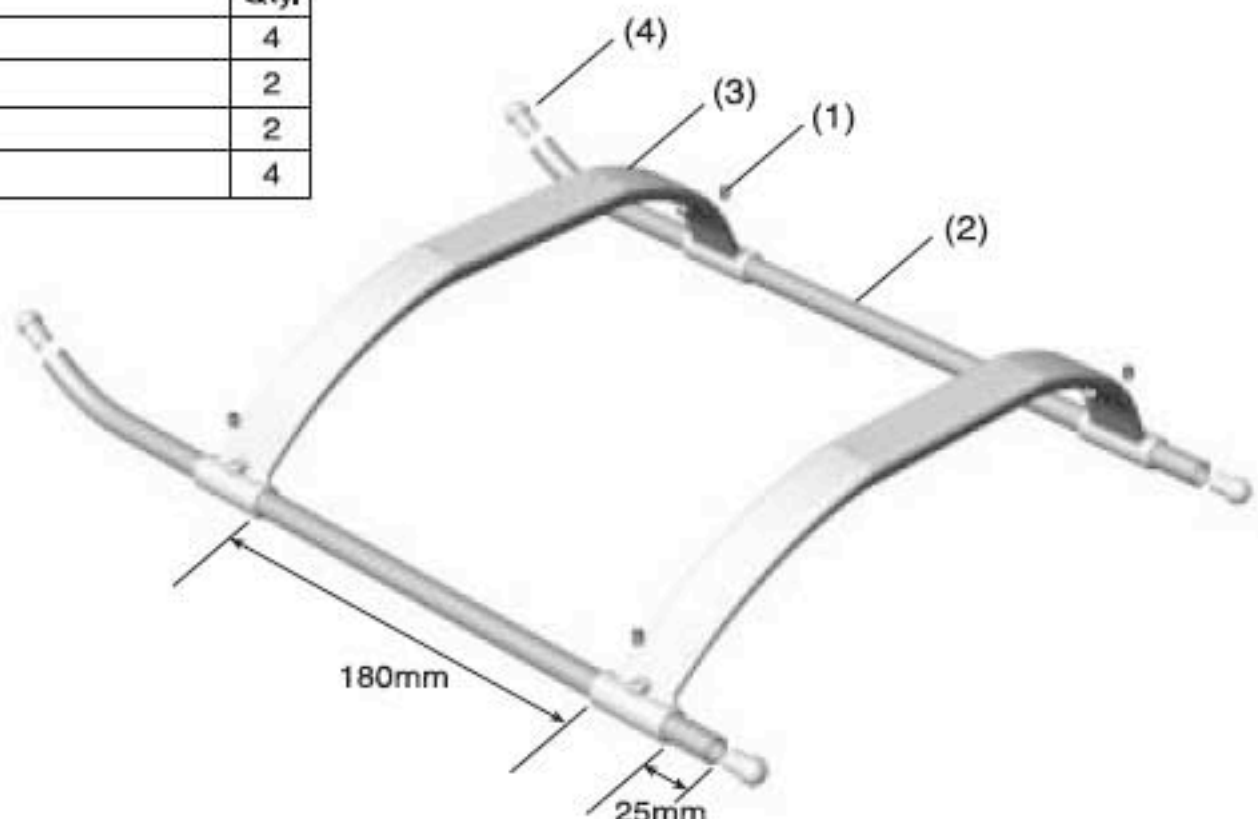
Make up the landing gear according to the drawing. After inserting the four plastic end caps into the skids, add some CA glue around the edges to prevent the caps from rotating. Please add Carbon Base Plate (No.3) before assembly the skid to the helicopter using four Socket Screws with Locknuts. You may want to add a drop of CA between the metal skid and the plastic landing gear brace to prevent the skid from turning. If you fly off concrete surface, then adding some optical silicone tubing or "skid stoppers" on the skid will help protect the bottom of the helicopter from sliding on the ground. This is useful during takeoff and at autorotation time.



4-3-1 Skid Subassembly

No.	Material No.	Description	Qty.
1	HME4-5B	Set Screw M4x5	4
2	BK0276	Skid Pipe	2
3	BK0397	Skid Brace	2
4	BK0398	Skid Pipe End Cap	4

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

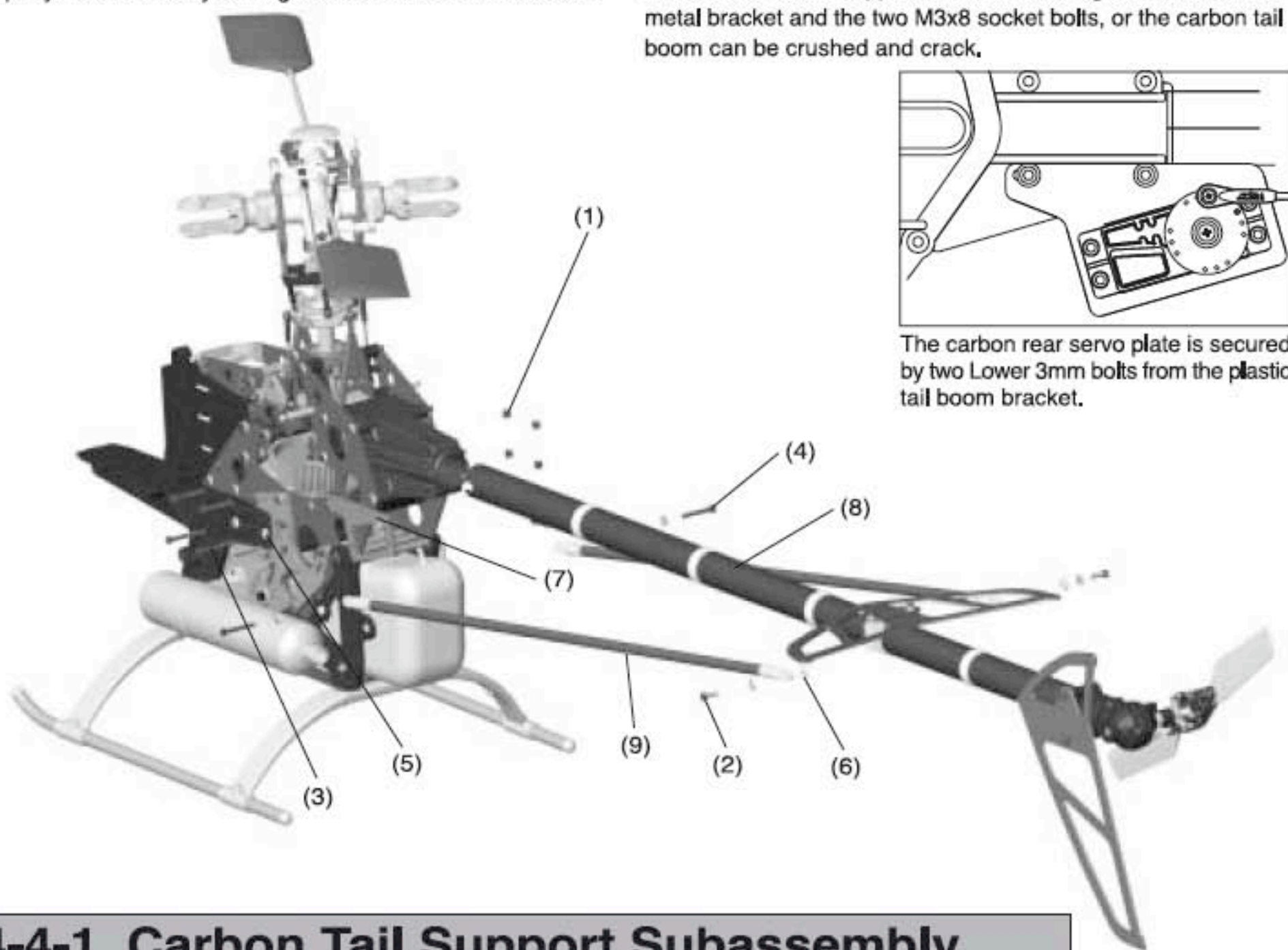
Installation of Tail Assembly

No.	Material No.	Description	Qty.
1	HMM3Z	Locknut M3	4
2	HMC3-10B	Socket Screw	2
3	HMC3-25B	Socket Screw M3x25	4
4	HMC3-30B	Socket Screw M3x30	2
5	BK0087	Washer d3xD8x1.4	4

No.	Material No.	Description	Qty.
6	BK0278	Machined Washer	2
7	BK0539	Carbon Rear Servo Plate	1
8	3-1	Tail Assembly	1
9	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.

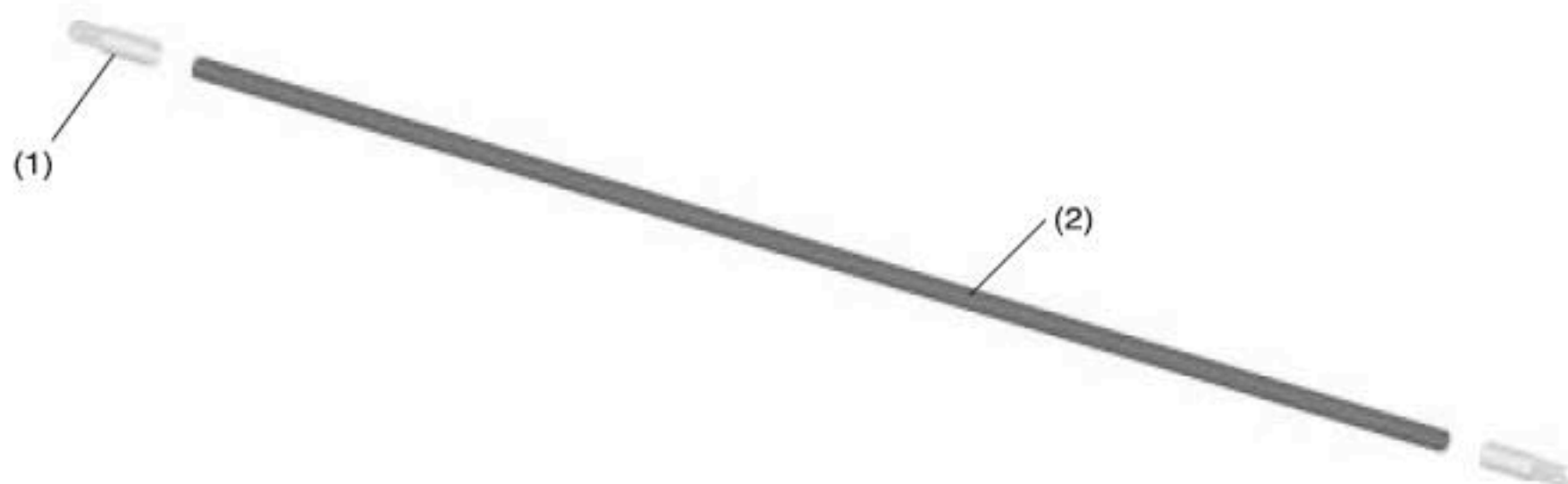


The carbon rear servo plate is secured by two Lower 3mm bolts from the plastic tail boom bracket.

4-4-1 Carbon Tail Support Subassembly

No.	Material No.	Description	Qty.
1	BK0280	Metal Tail Support Rod End	2
2	BK0510	Carbon Tail Support Rod	1

Secure the two metal ends to the carbon tube with Epoxy glue, making sure the two metal ends are parallel to each other.



5

INSTALLATION OF PERIPHERAL EQUIPMENT



5-1

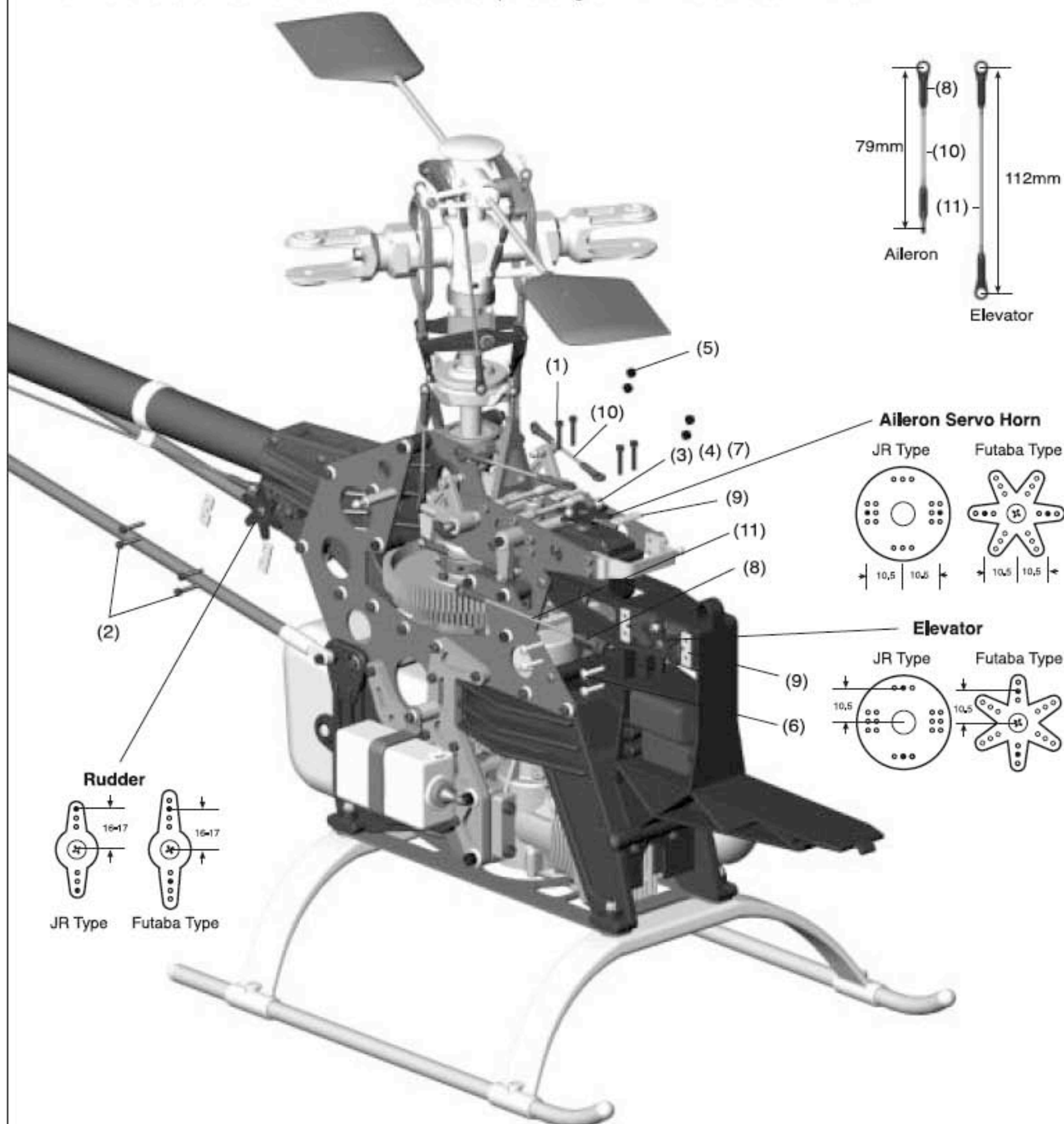
Installation of Servo-Part 1

BAG I

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMC2612B	Socket Screw 2.6x12	4	7	BK0075	Link Ball 4.8	4
2	HMC2614B	Socket Screw 2.6x14	4	8	BK0086	Ball Link 4.8x20	6
3	HML2	Nut M2	4	9	BK0104	Servo Mounting Plate	6
4	HMF2-8N	Phillips Machine Screw M2x8	4	10	BK0436	Link Rod 2.3x55	2
5	HMM26B	Locknut M26	4	11	BK0438	Link Rod 2.3x88	1
6	HSE2614N	Self Tapping Screw 2.6x14	4	12	*****	Servo	3

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. Fine tune them later on to suit your personal flying style.

Attach the tail rotor servo to the tail boom mounted carbon plate using four 2.6mm bolts and four M2.6 locknut.



5-2

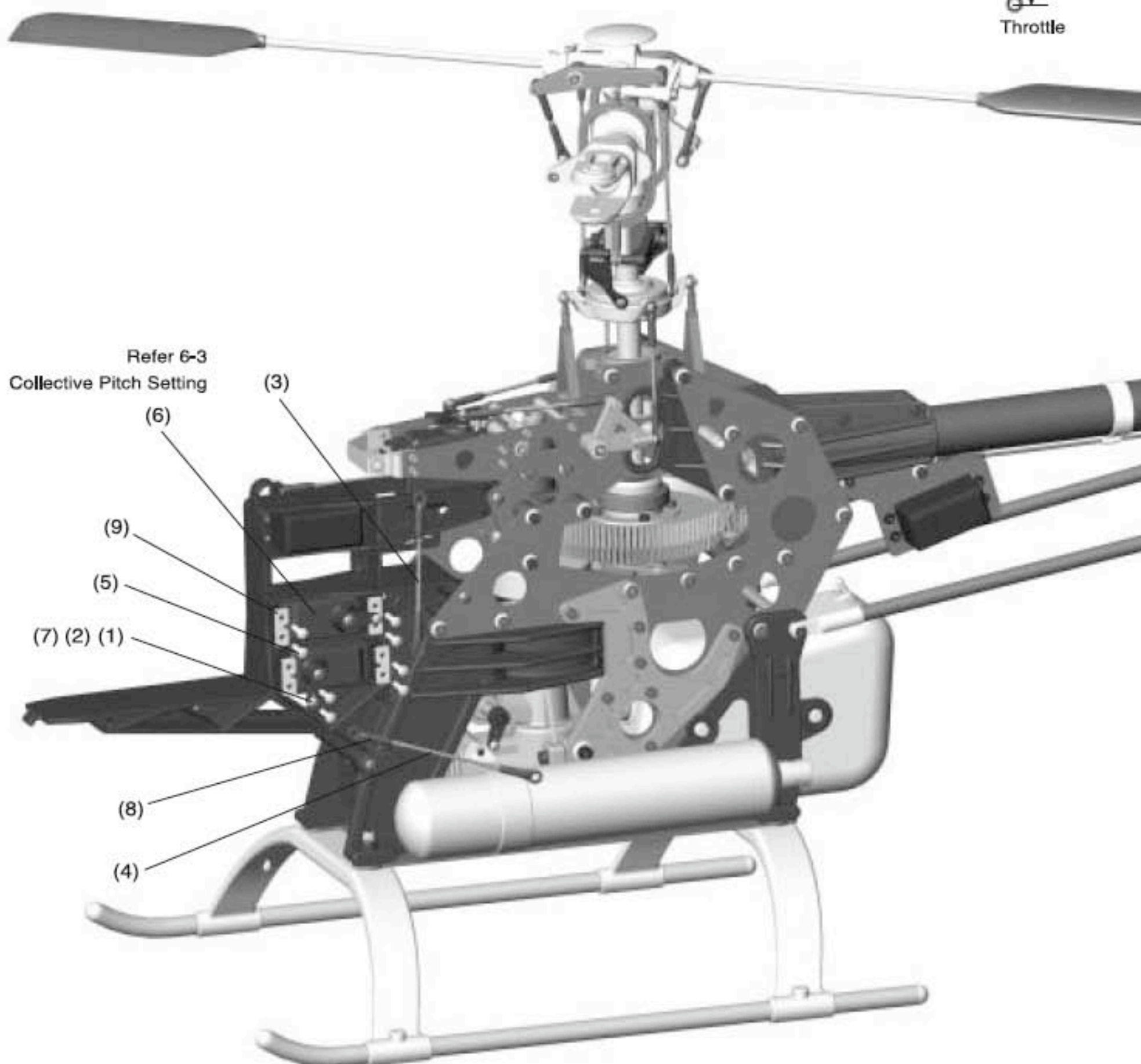
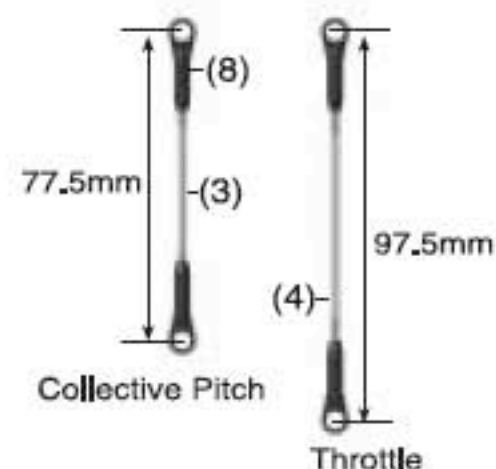
Installation of Servo-Part 2

BAG I

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HML2	M2 Nut	2	6	*****	Servo	2
2	HMF2-8N	M2x8 Phillips Machine Screw	2	7	BK0075	Link Ball 4.8	2
3	BK0436	2.3x55 Link Rod	1	8	BK0086	Ball Link 4.8x20	4
4	BK0095	2.3x76 Link Rod	1	9	BK0104	Servo Mounting Plate	4
5	HSE2614N	2.6x14 Self-Tapping Screw	8				

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.

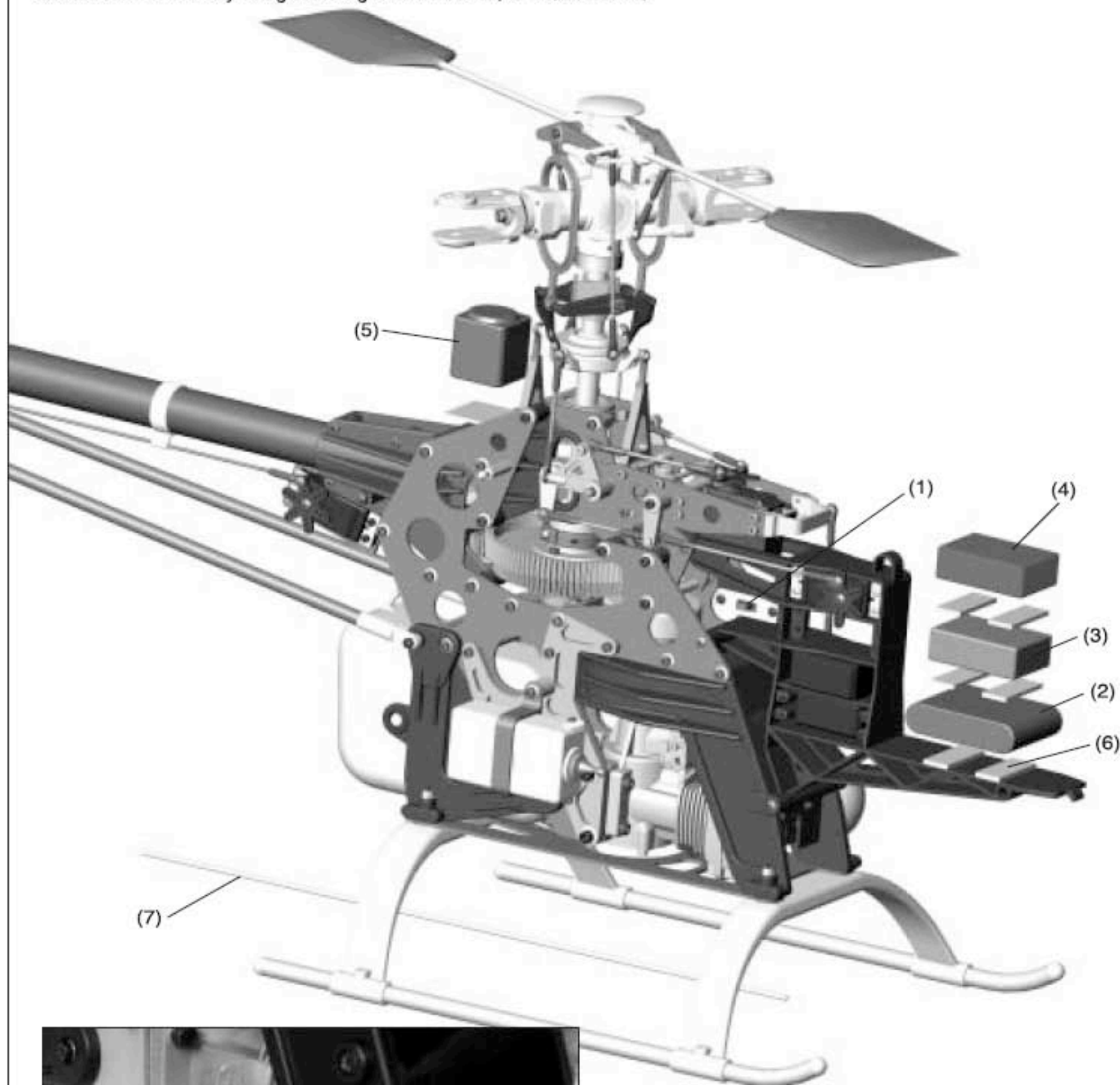


5-3

Installation of Receiver & Gyro

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	*****	Switch JR Type	1	5	*****	Gyro	1
2	*****	Battery (Recommend 1700mAh)	1	6	BK0106	Two Touch Tape	2
3	*****	Receiver	1	7	BE1052	Antenna Pipe	1
4	*****	Gyro AMP	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.

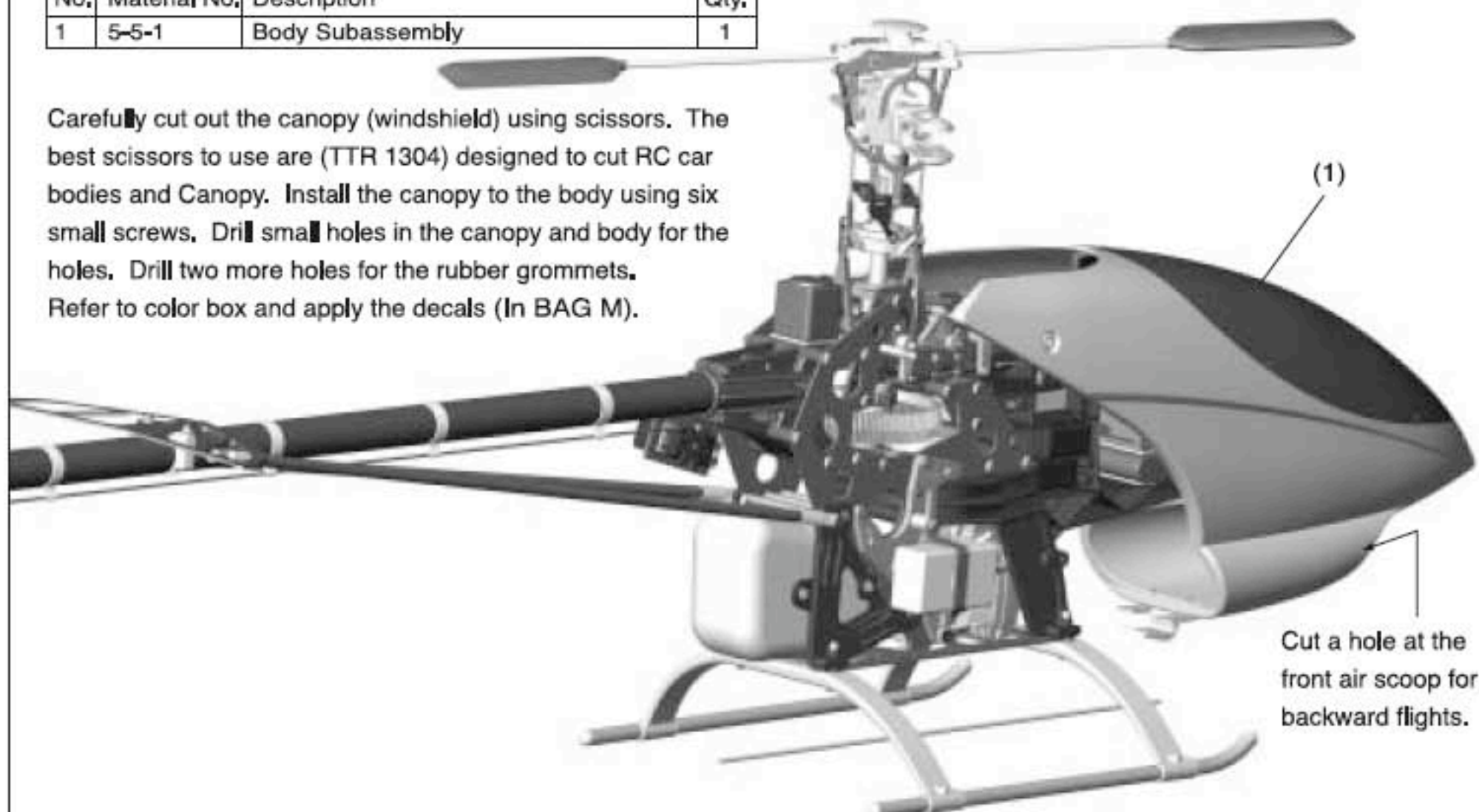
5-4

Installation of Body

BAG J

No.	Material No.	Description	Qty.
1	5-5-1	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).

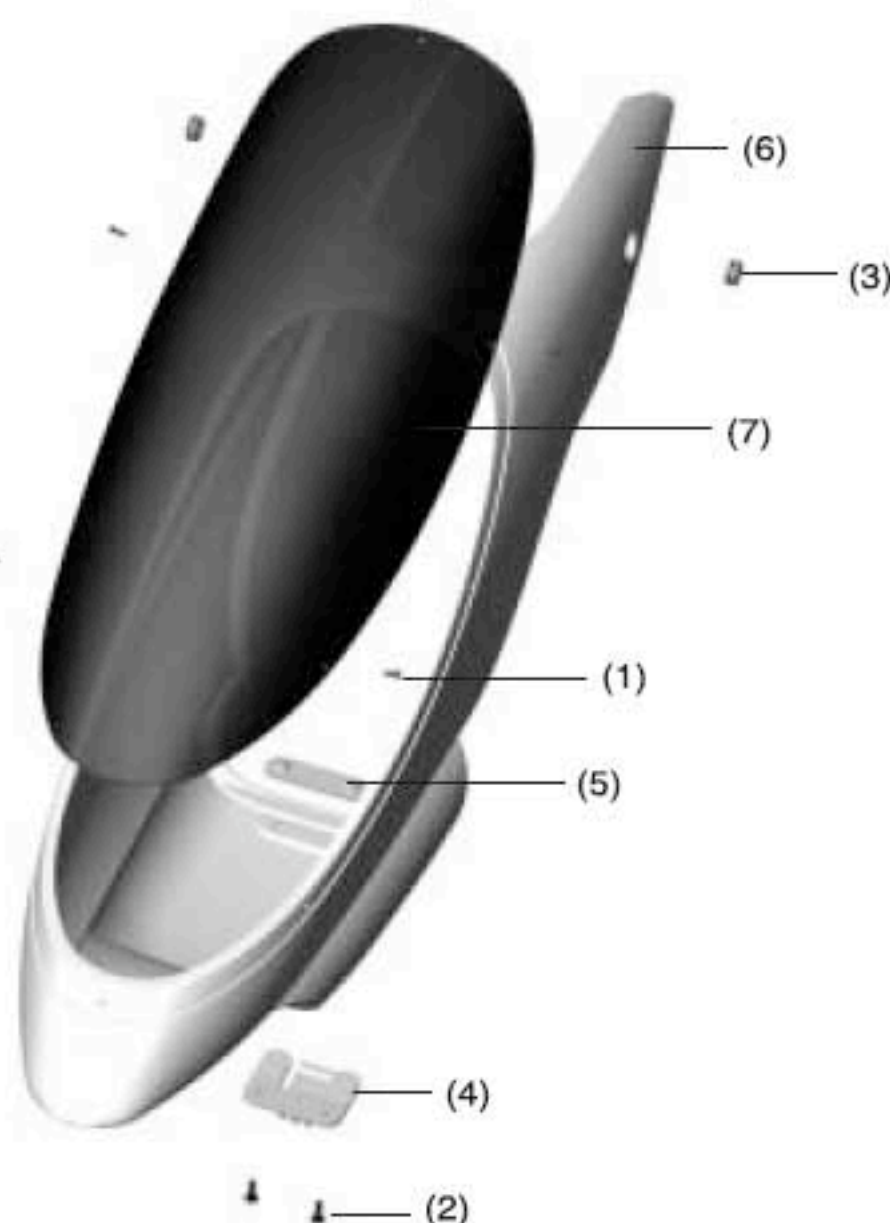
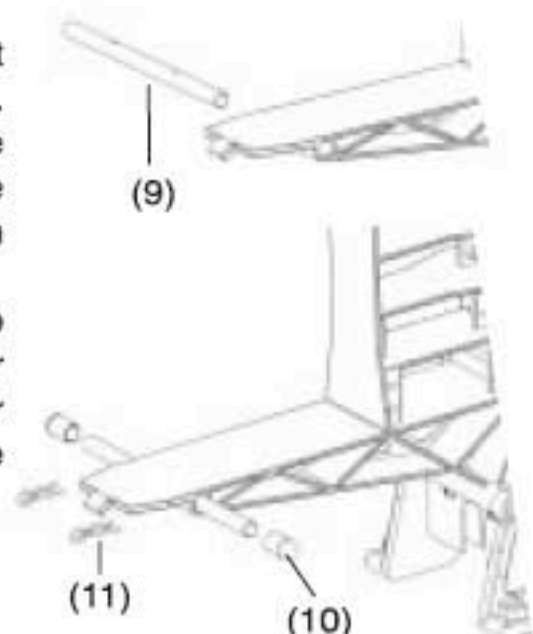


5-4-1 Body Subassembly

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	BK0699	Sin-Carbon Canopy	1
8	JV0139	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.



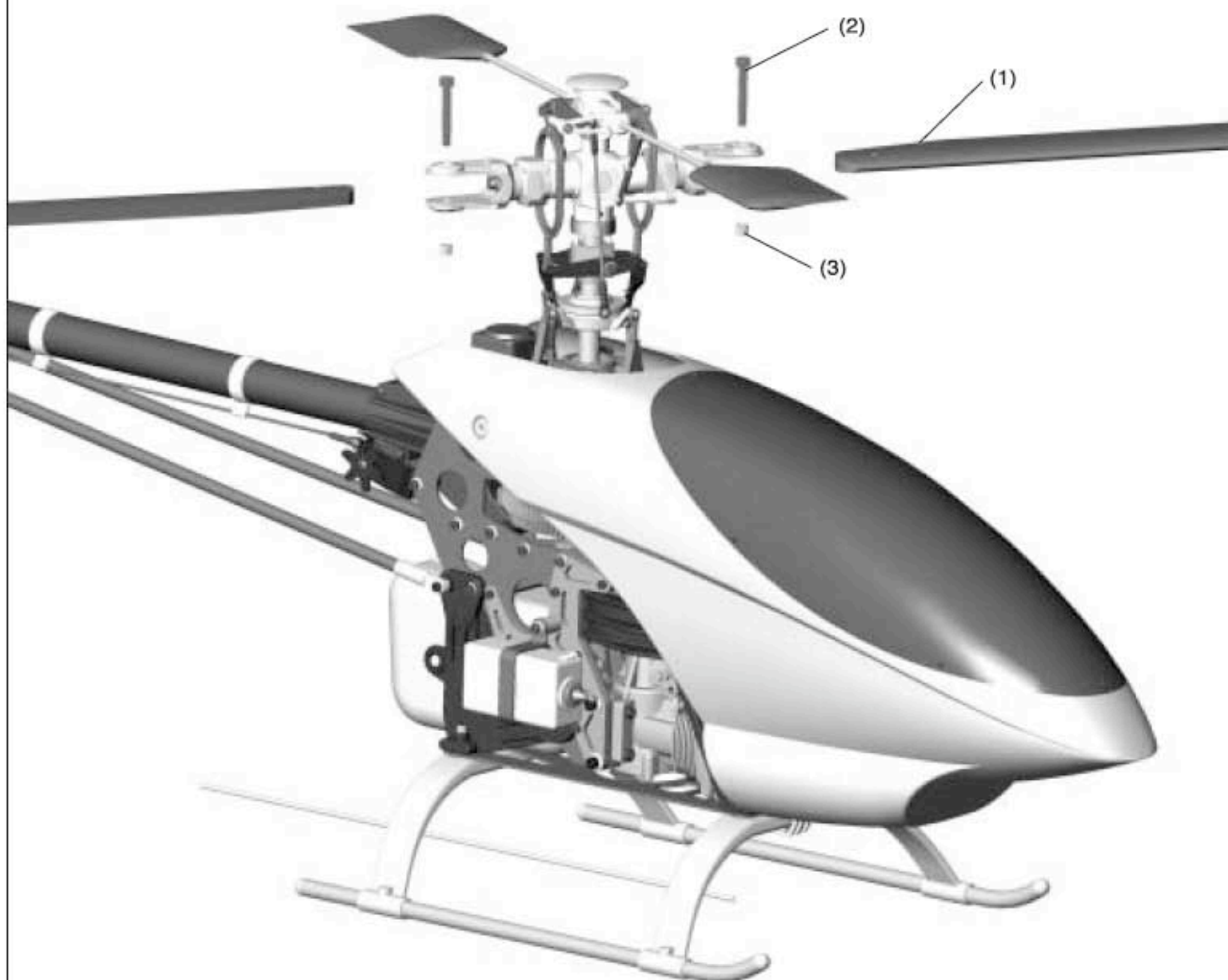
5-5

Installation of Rotor Blades

BAG K

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

Thunder Tiger has designed high performance 710mm carbon fiber rotor blades (TTR 3821) for the raptor 90. You will achieve the best flight performance with the Thunder Tiger 710mm carbon blades. They weight 185-195 grams each. Please check your local dealer for more information on upgrading your rotor blades.



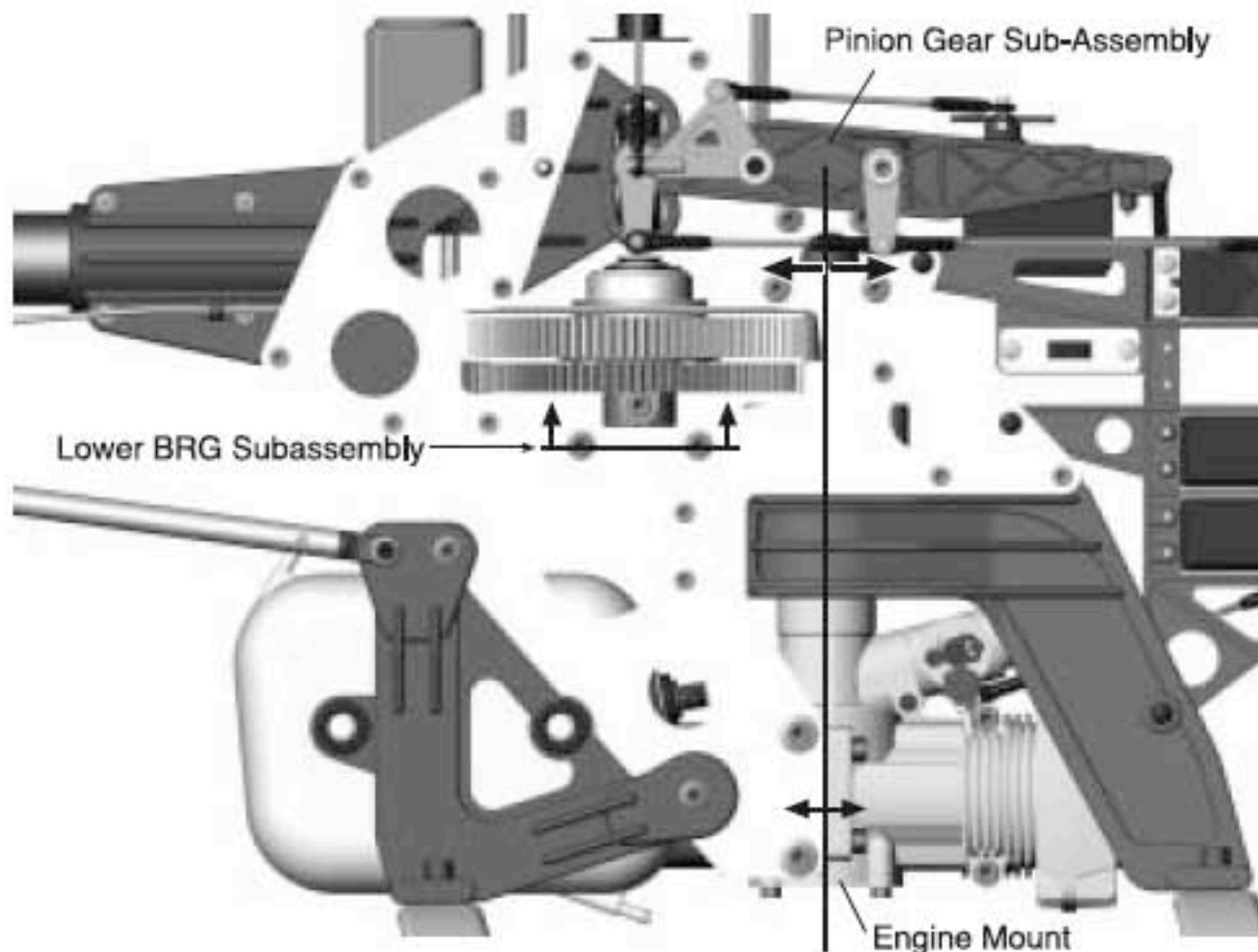
6

SETTINGS



6-1

Setting up Gear Backlash



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

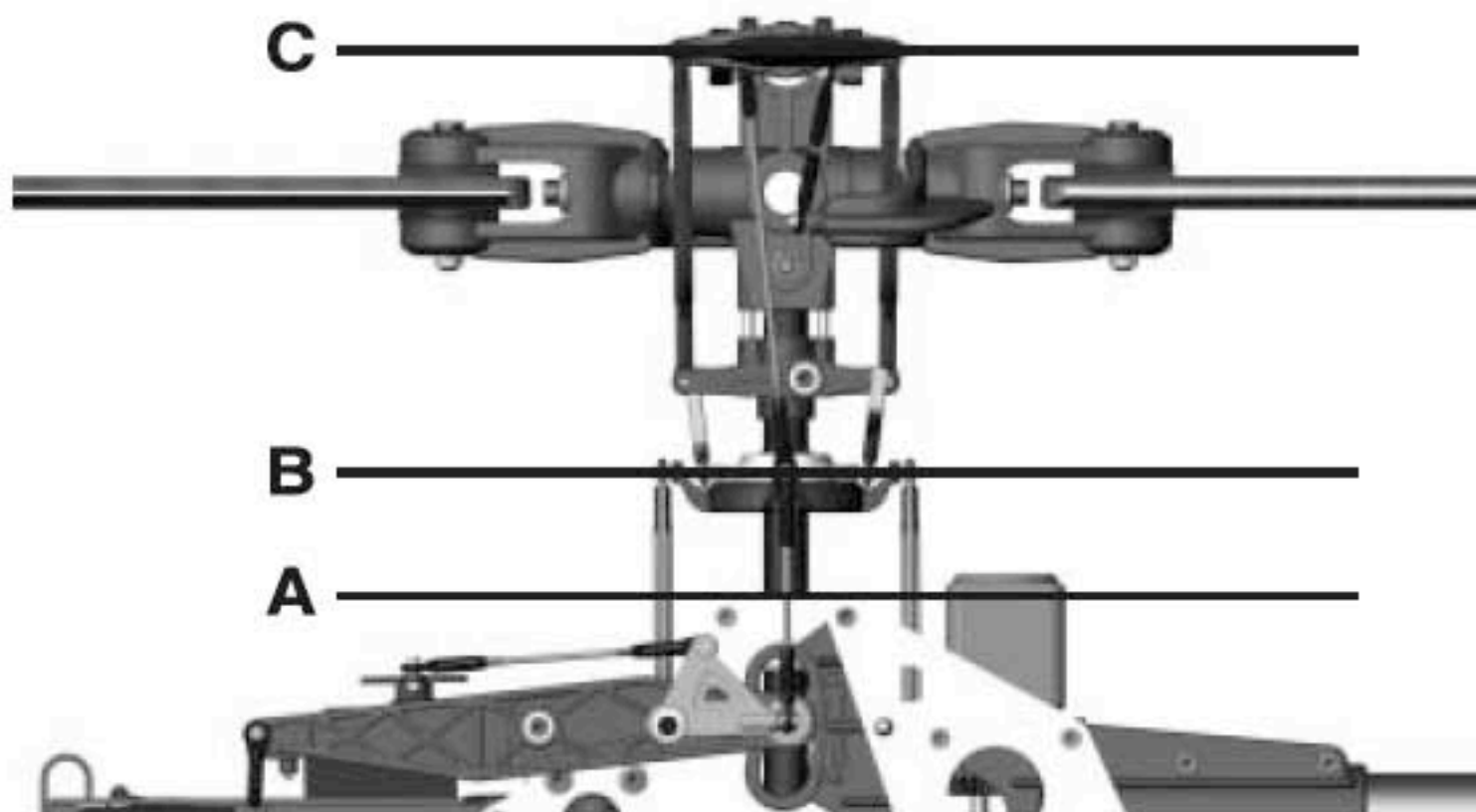
The Raptor 90SE is designed to accept a diverse gear ratio to suit different flying needs. Currently the main gear is available with 91,93,94 and 95 teeth. The clutch pinion is available with 10,11 and 12 teeth. This gives the pilot a choice of twelve different gear ratios ranging from 7.6 to 9.5 to one. When a 90 class engine is used for 3D flying we recommend trying the 11 teeth pinion and 93 teeth main gear first which give 8.45:1 ratio. A ratio below 8.45 gives quieter flying which is preferred for F3C flying. A ratio higher than 8.45 gives more powerful 3D flying.

The side frame on the Raptor 90SE have elongated slots for the engine mounting bolts and for the engine starting shaft support bearing block. Loose 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 the engine crankshaft and starting shaft is perfectly straight and vertical, like that 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. When the starting shaft and engine shaft are properly aligned, the BK0594 Starter Coupler should turn clockwise smoothly when turned by hand.

6-2

Setting up of Stabilizer Paddles

A // B // C



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

6-3

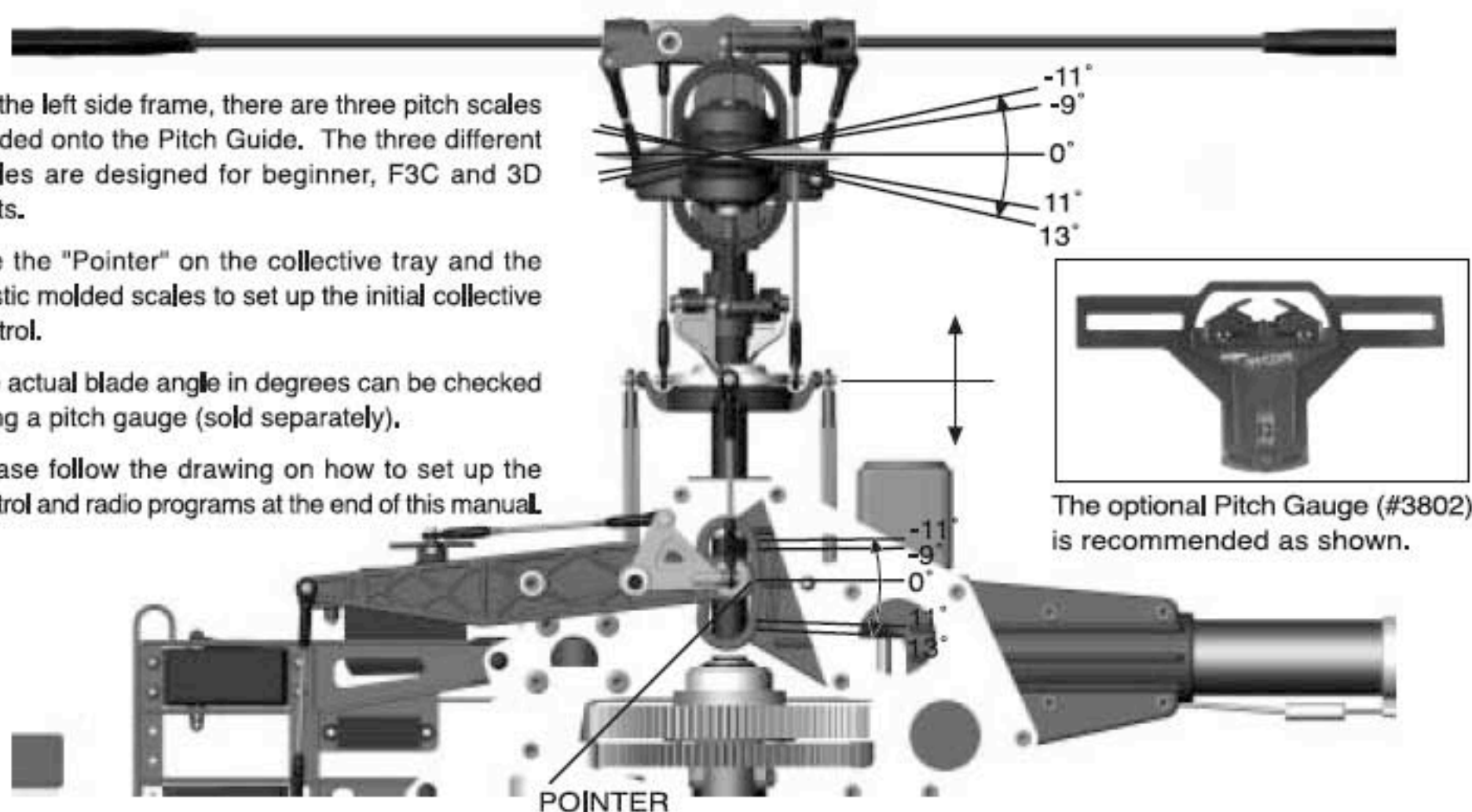
Setting up of Blade Pitch Angle

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 using a pitch gauge (sold separately).

Please follow the drawing on how to set up the control and radio programs at the end of this manual.



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

Note: Recommended rotor speed is 1500 rpm for hover and 1750 rpm for idle-up aerobatics.

TT has a full line of Optional Carbon Graphite rotor blades, please contact your local dealer for ordering these high performance blades. We strongly recommend the Thunder Tiger 710mm Carbon blades (TTR3821) for the Raptor 90 and the Thunder Tiger 680mm (TTR3836) for the Raptor 60.

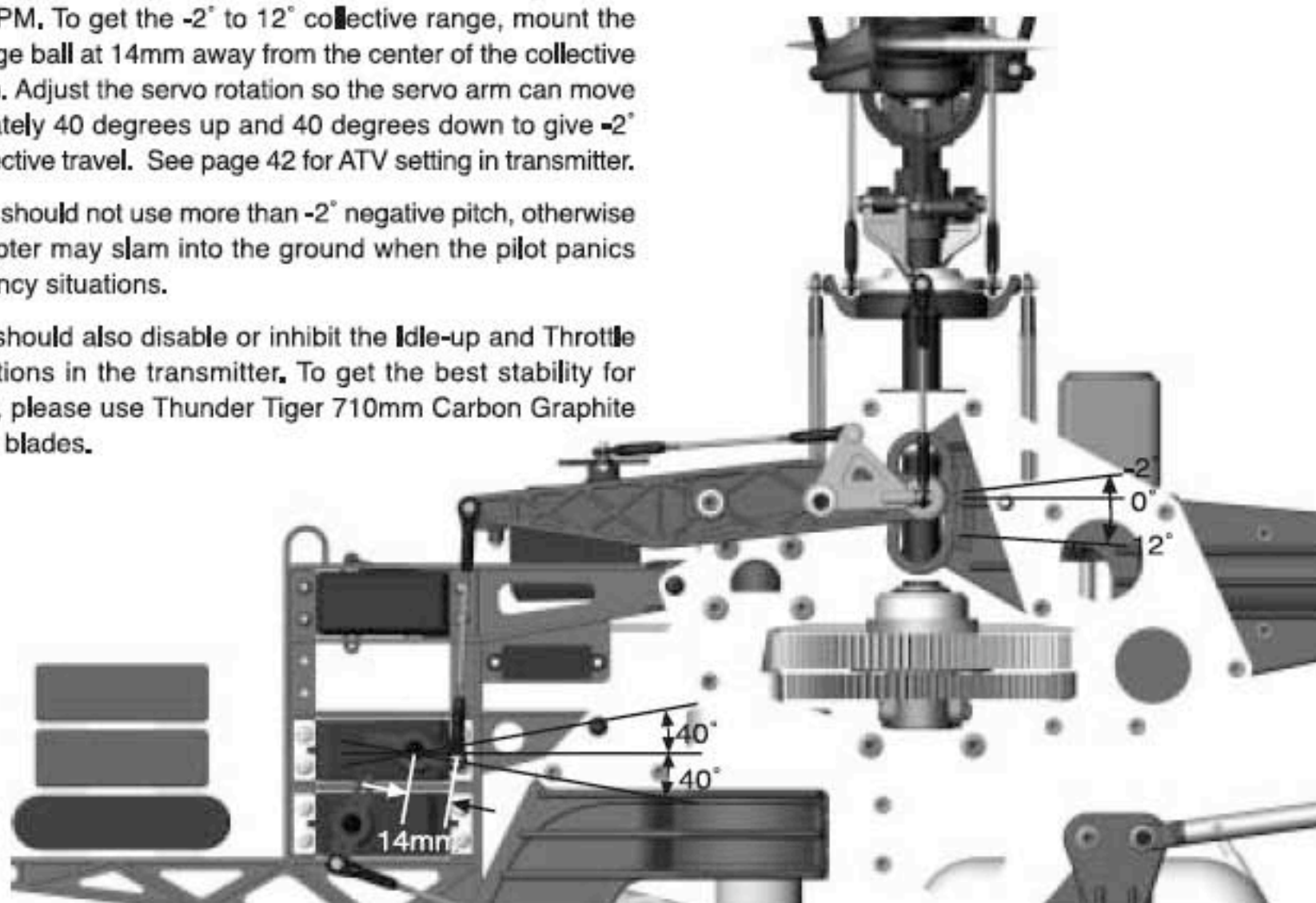
6-3-1

Collective Travel for Beginners

The hovering pitch angle should be at 4.5° to 5.5° to get 1600 to 1500 RPM. To get the -2° to 12° collective range, mount the steel linkage ball at 14mm away from the center of the collective servo horn. Adjust the servo rotation so the servo arm can move approximately 40 degrees up and 40 degrees down to give -2° to 12° collective travel. 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. To get the best stability for beginners, please use Thunder Tiger 710mm Carbon Graphite main rotor blades.

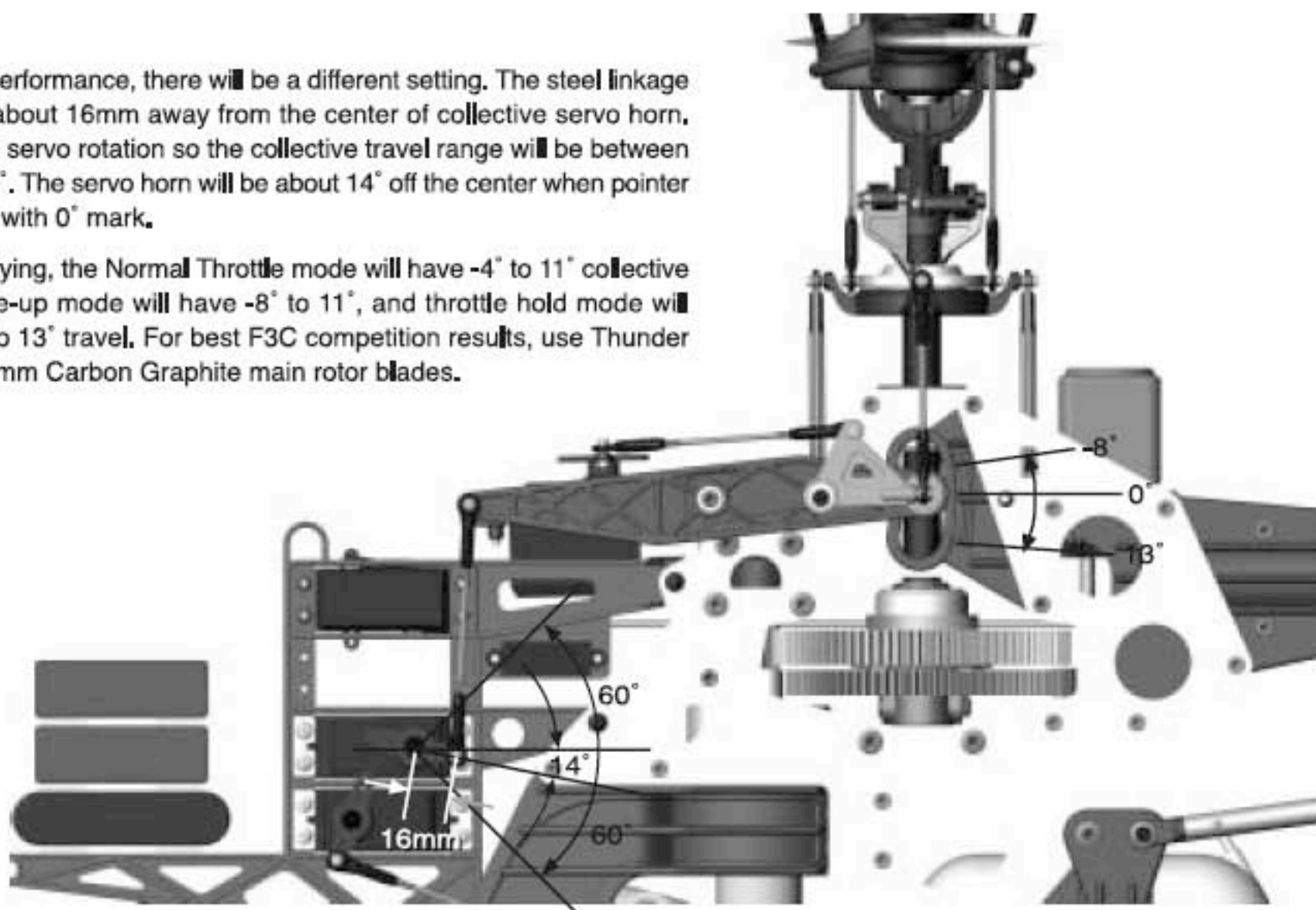


6-3-2

Collective Travel for F3C

For F3C performance, there will be a different setting. The steel linkage ball is at about 16mm away from the center of collective servo horn. Adjust the servo rotation so the collective travel range will be between -8° and 13° . The servo horn will be about 14° off the center when pointer is leveled with 0° mark.

For F3C flying, the Normal Throttle mode will have -4° to 11° collective travel. Idle-up mode will have -8° to 11° , and throttle hold mode will have -8° to 13° travel. For best F3C competition results, use Thunder Tiger 710mm Carbon Graphite main rotor blades.

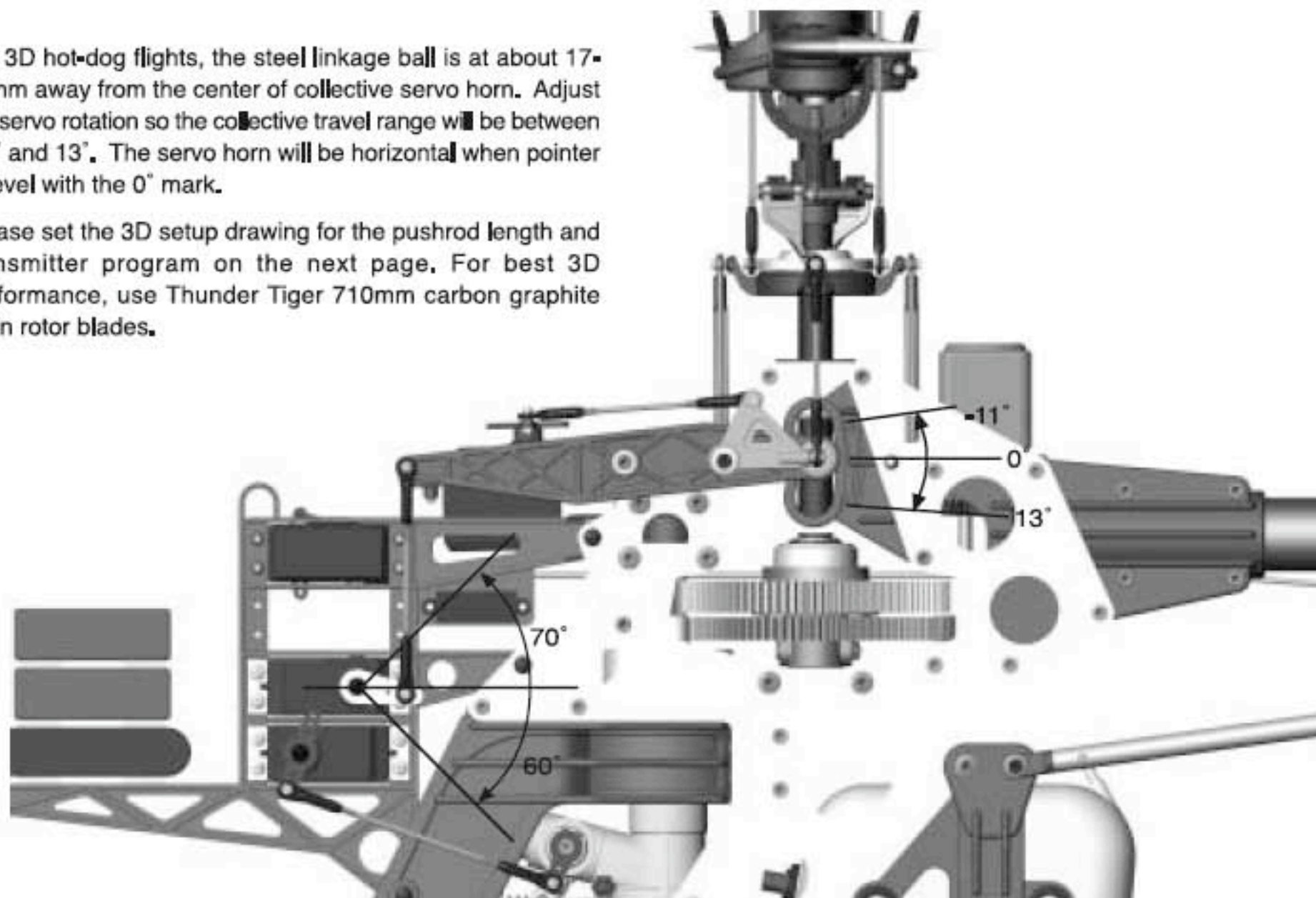


6-3-3

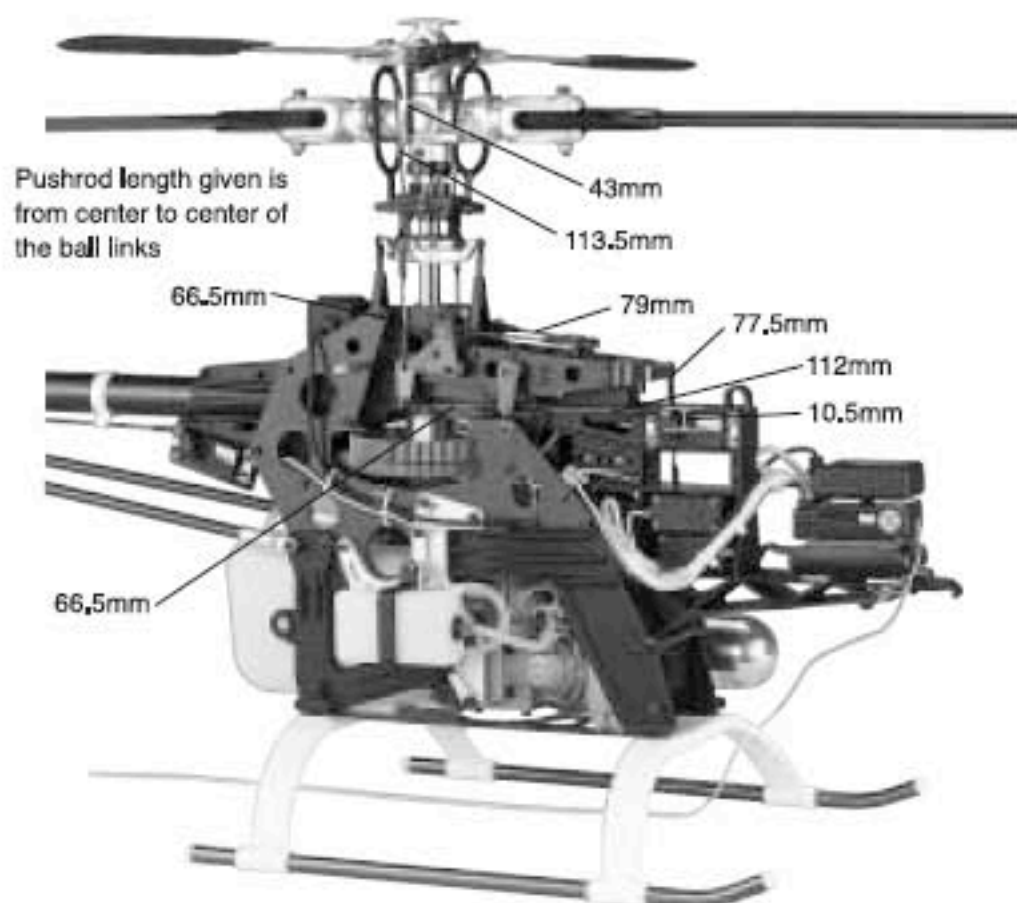
Collective Travel for 3D

For 3D hot-dog flights, the steel linkage ball is at about 17-18mm away from the center of collective servo horn. 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.

Please set the 3D setup drawing for the pushrod length and transmitter program on the next page. For best 3D performance, use Thunder Tiger 710mm carbon graphite main rotor blades.

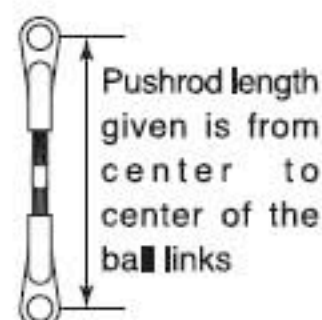


6-3-4 CONFIGURING THE RAPTOR 90 FOR 3D



Use these number as a start only.

Program the radio values into the transmitter. The EXPO should be to reduce the control sensitivity near center stick, some radio manufacturer use negative value and some use positive value. Adjust the pushrods to the above lengths. 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%	100%	100%
EXPO	30%	30%		10%	

Radio Setting	Low	Pt. 2	Pt. 3	Pt. 4	High
Normal mode Throttle Curve	0	25	50	75	100
Normal mode Pitch Curve	15	35	60	80	100
Blade Angle	-2°	3°	5.5°	9°	12°

Additional Setting

Besides the original settings, we have provided an additional setting for your reference. (Suitable for extreme 3D flying) The only difference being the Pushrod and servo horn setting indicated with the instructions and the setting table below.

Elevator Rod Length: 66.5 → 69mm

Rudder Arm: 13.5 → 17mm

Pitch Rod Length: 77.5 → 73.5mm

Pitch Arm: 18mm → 19mm

Aileron Rod to swash: 66.5 → 68mm

Aileron Arm: 10.5 → 14mm

Swash to Hiller Assembly: 113.5 → 115mm

Beginner Setup

	Aileron	Elevator	Throttle	Rudder	Pitch
ATV	100%	100%	100%	100%	100%
Dual Rate Normal	70%	70%		80%	
Dual Rate Idle Up 1&2	90%	90%		100%	
EXPO	25%	25%		30%	

Radio Settings	Point 1	Point 2	Point 3	Point 4	Point 5
Normal Pitch Radio	35	INH	50	63.5	100
Normal Pitch Blade Angle	-3	INH	3	5.5	10
Normal Throttle	0	35	45	70	100

Advance 3-D Setup

	Aileron	Elevator	Throttle	Rudder	Pitch
ATV	110%	110%	100%	120%	110%
EXPO	30%	30%		10%	

Throttle Curve	Low	Pt. 1	Pt. 2	Pt. 3	High
Normal	0	25	50	75	100
Idle-up1	100	70	60	70	100
Idle-up2	100	80	70	80	100

Pitch Curve	Low	Pt. 1	Pt. 2	Pt. 3	High
Normal	15	35	60	78	95
Idle-up1	0	23	47	73	95
Idle-up2	0	23	47	73	95
Hold	10	35	60	78	100

Blade Angle	Low	Pt. 1	Pt. 2	Pt. 3	High
Normal	-6°	0°	4~5°	8°	11.5°
Idle-up1	-10°	-5.5°	0°	5.5°	10°
Idle-up2	-10°	-5.5°	0°	5.5°	10°
Hold	-8°	0°	-4°	8°	13°

Extreme 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	35	INH	50	63.5	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	50	63.5	100
Idle Up 1	0	22	40	63.5	100
Idle Up 2	7	25.5	50	63.5	100
Hold	0	25.5	50	63.5	100

Blade Angels	Point 1	Point 2	Point 3	Point 4	Point 5
Normal	-3	INH	3	5.5	10
Idle Up 1	10	-5.5	0	5.5	10
Idle Up 2	-9	-5	4	5.5	10
Hold	-10	-5.5	0	5.5	10

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.

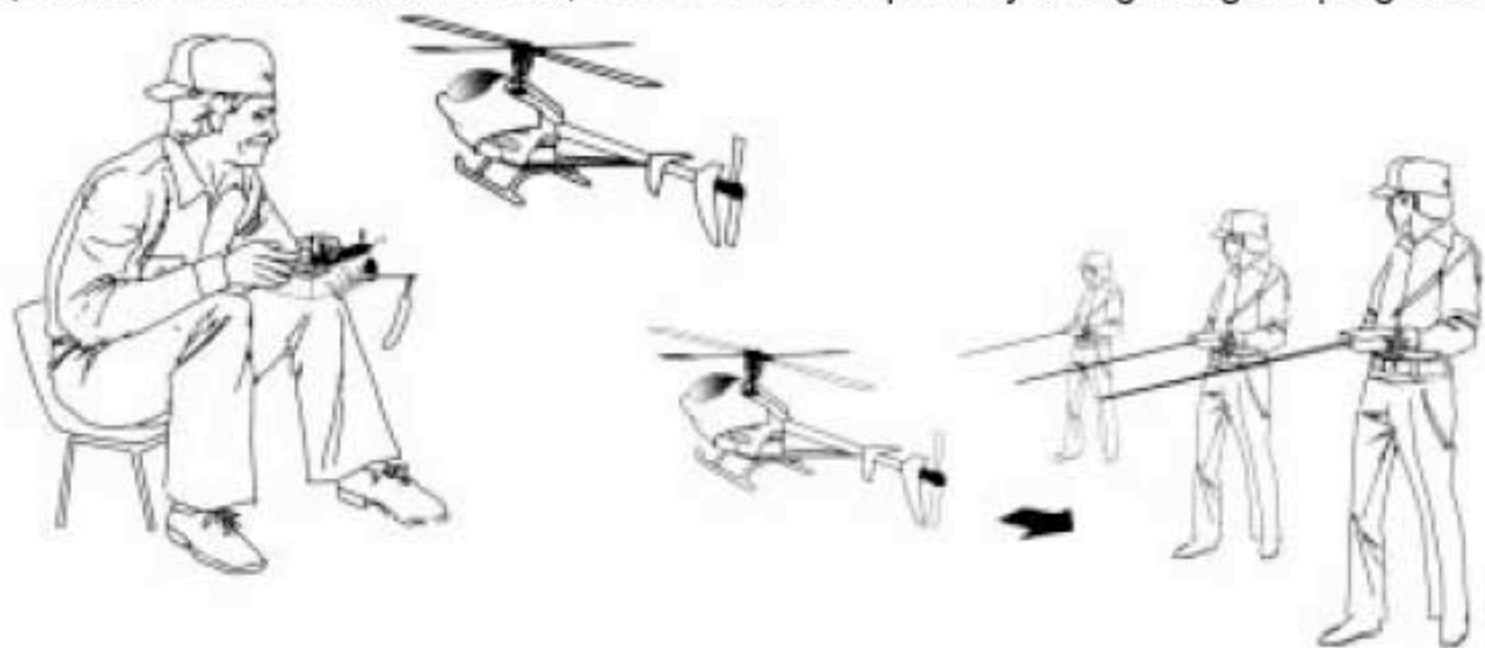
Warning (For Storage)

- 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.

Preflight Checklist and Starting Procedure

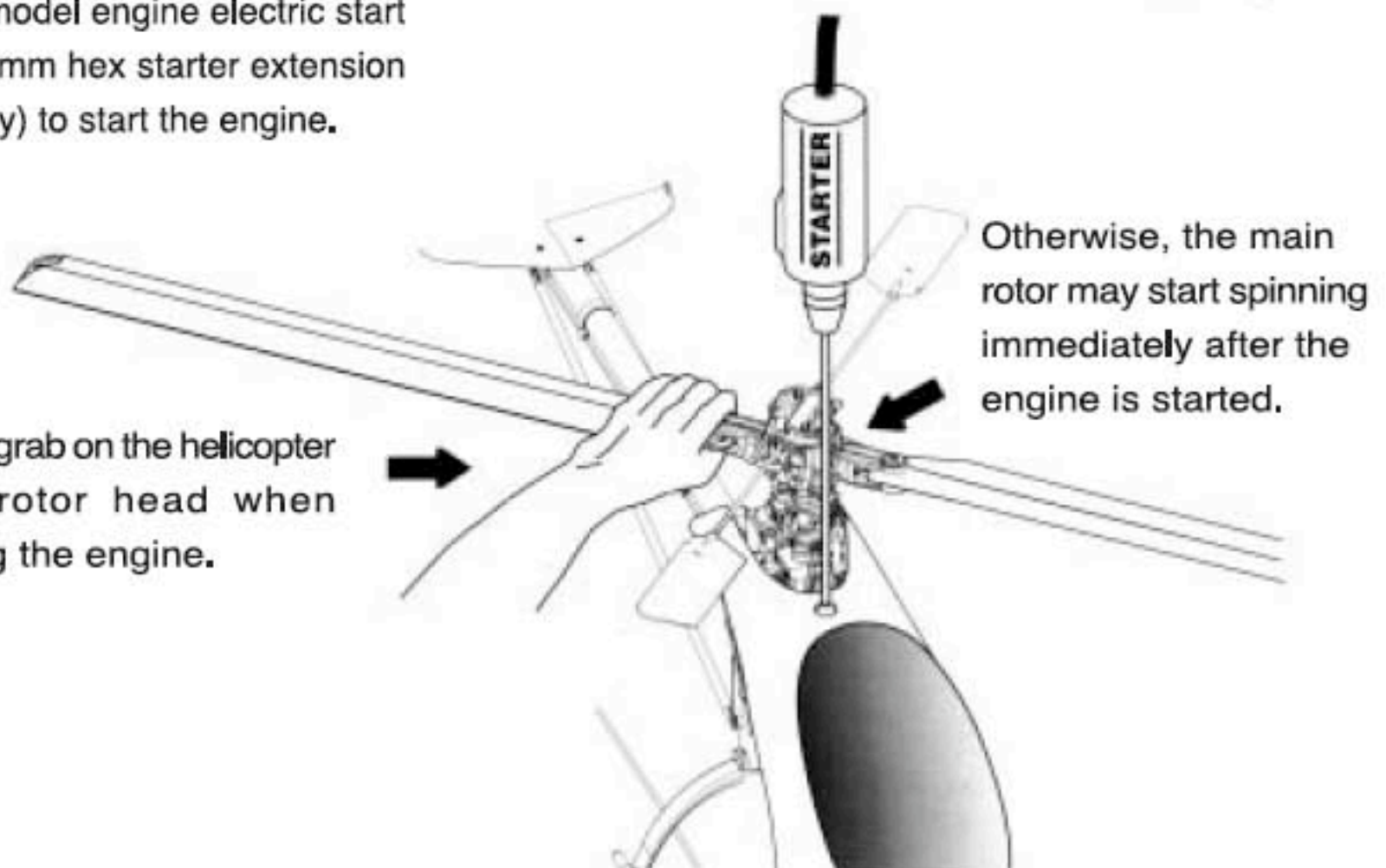
Control system check.

- (1) The flybar and control paddles must tilt in the proper direction and smoothly through the whole range.
- (2) The rotor shaft and flybar must be straight and not damaged.
- (3) The swashplate must remain clean and tilts freely.
- (4) When control input are given to tilt the swashplate, make sure none of the control arms and pushrods show any binding.
- (5) The two control paddles must be leveled and parallel to each other, and point in the correct direction.
- (6) Check to make sure there is no radio interference before operating the model helicopter.
- (7) Make sure the transmitter and receiver are on and all controls operate properly before flight. Range check the radio.
- (8) The engine carburetor must be in the idle position before starting the engine. Please read the engine instruction manual on how to properly adjust the engine. Set the carburetor main needle according to the engine instruction. Depends on the fuel and glow plug used, the carburetor idle screw may require fine adjustment of 1/4 to 1/2 turns away from the factory setting.
- (9) Fuel up the tank, move the throttle stick to idle, and connect a specially designed glow plug battery to the glow plug.



- (10) Use a 12 volt model engine electric start along with a 6 mm hex starter extension (sold separately) to start the engine.

● Always grab on the helicopter main rotor head when starting the engine.



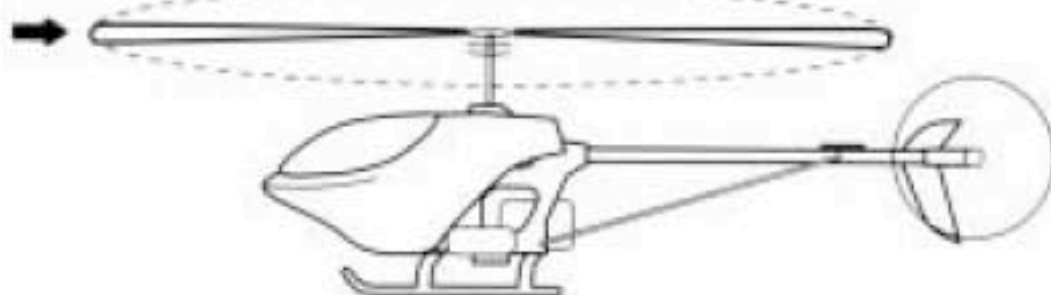
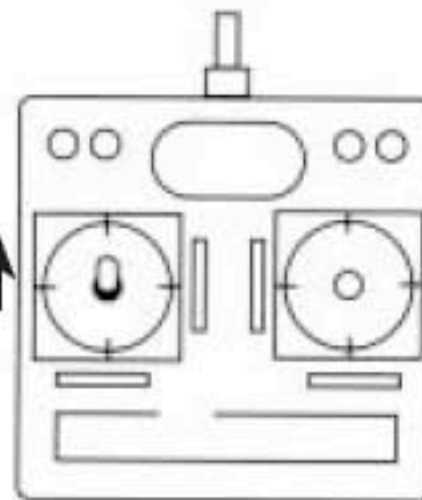
Flying Adjustments (1)

Tracking adjustment ... When the two main rotor blades are in track it means their blade tips should follow the same path as they rotate.

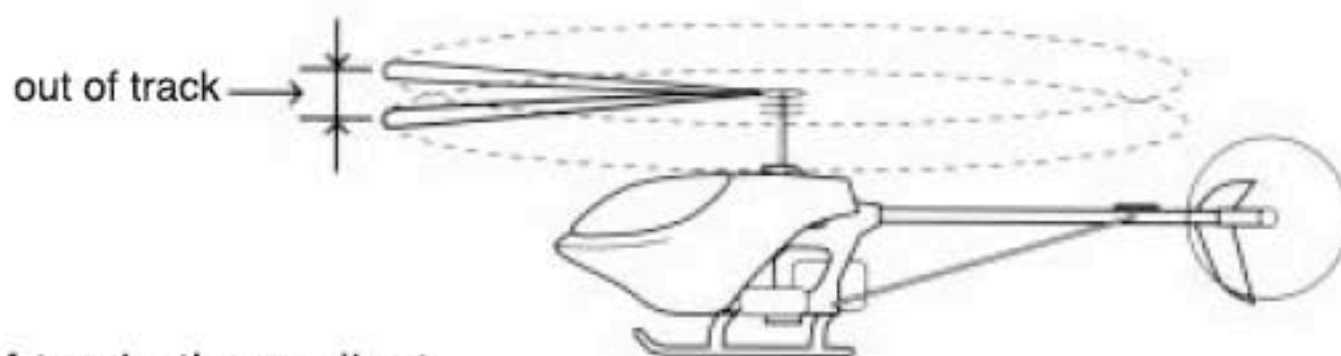
(1) Rev up the motor until the helicopter becomes light on its skids.

(2) When the two main rotor blades are in track it means their blade tips should follow the same path as they rotate, then it's ok.

increase throttle gently and not too much

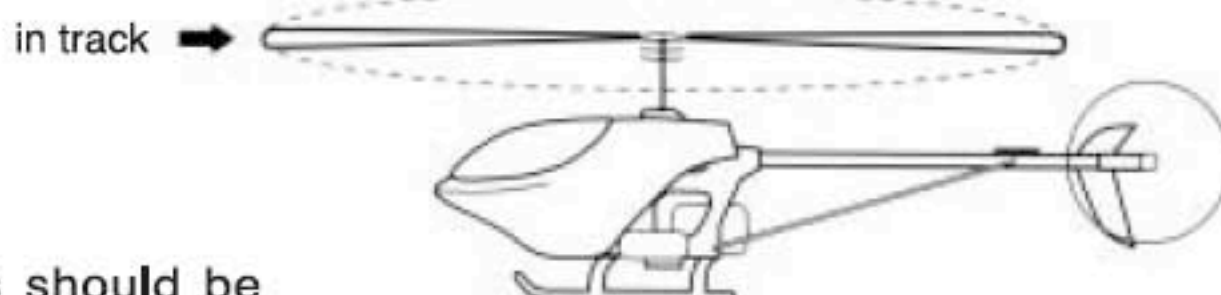


(3) When two blades are in track, the blade tips will appear overlapped as one look at the rotor tip path plane from the edge.



If the blades are out of track, then adjust one of the pushrods that connects to the main rotor blade pitch arm.

Redo steps (1) to (3) until the blades are tracking properly.

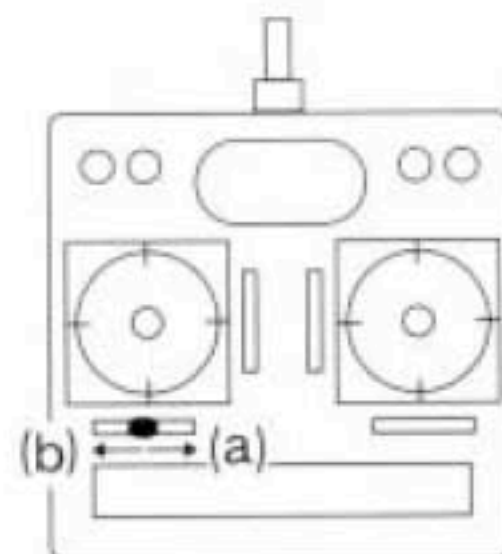
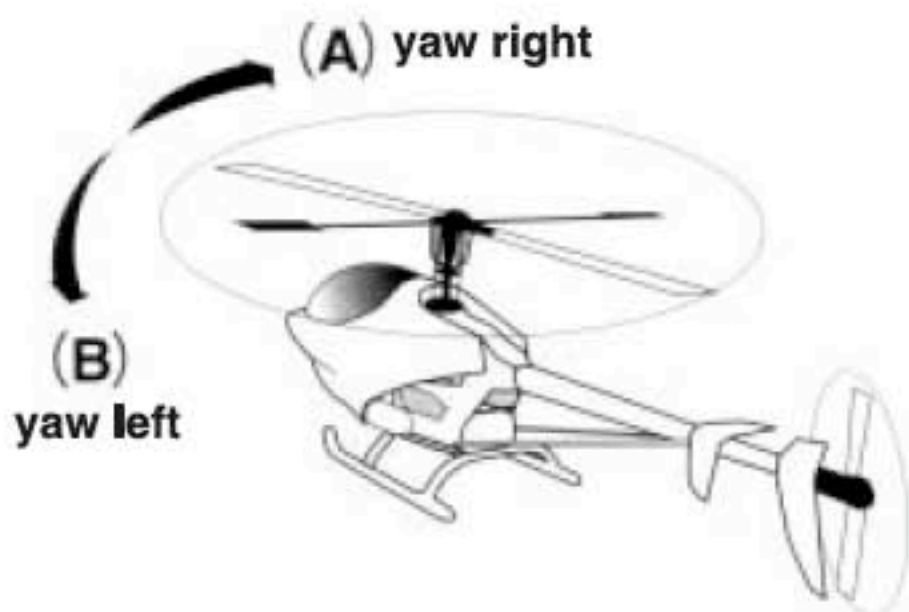


In hover, the main blades should be around 5.5 to 6 degrees in pitch.

Flying Adjustments (2)

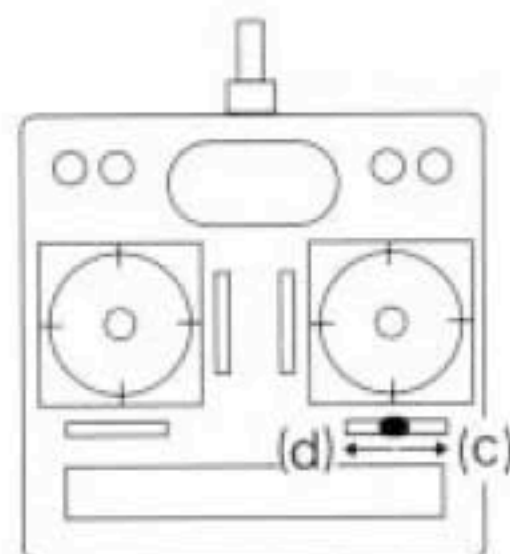
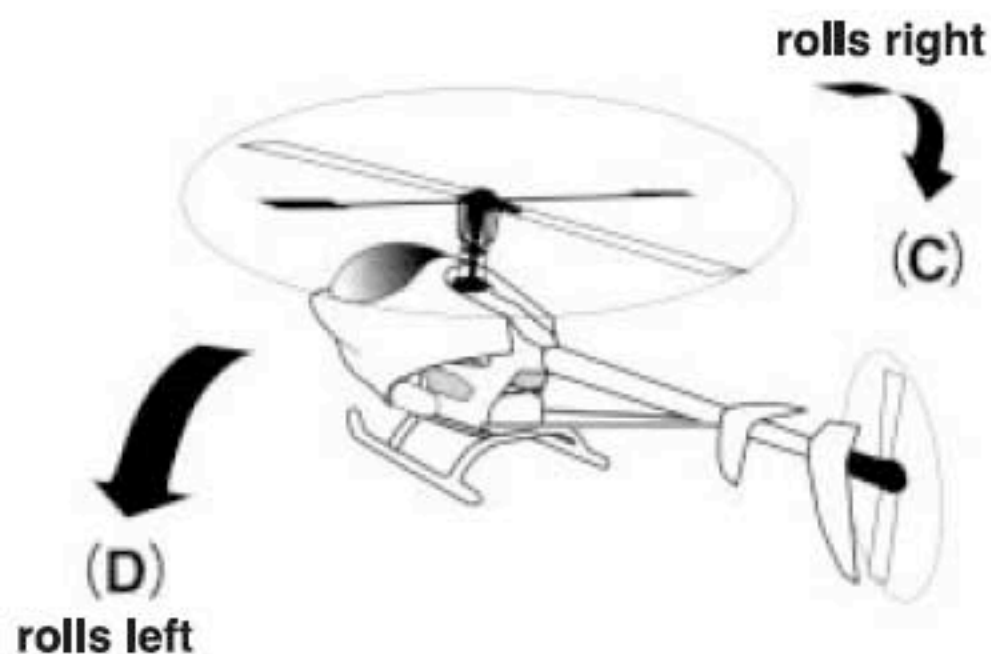
Trimming: All helicopters are inherently unstable. But when a helicopter is properly trimmed, it will not drift away or yaw by itself quickly. Use the following procedure to trim your helicopter.

- (1) If the helicopter nose starts to yaw left or right, then use the transmitter trim to compensate:



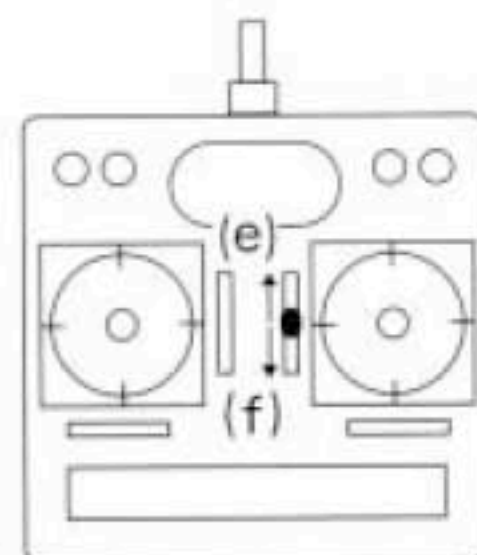
- (A) situation: move to (b)
(B) situation: move to (a)

- (2) If the helicopter rolls to left or right, then:



- (C) situation: move to (d)
(d) situation: move to (c)

- (3) If the helicopter noses down or up, then:



- (E) situation: move to (f)
(F) situation: move to (e)

After Flight Checklist

The model helicopter should be thoroughly inspected after each flying session.

- (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.

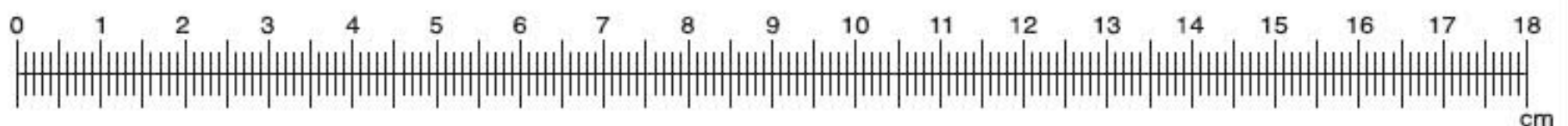
* The helicopter shakes.

- (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.

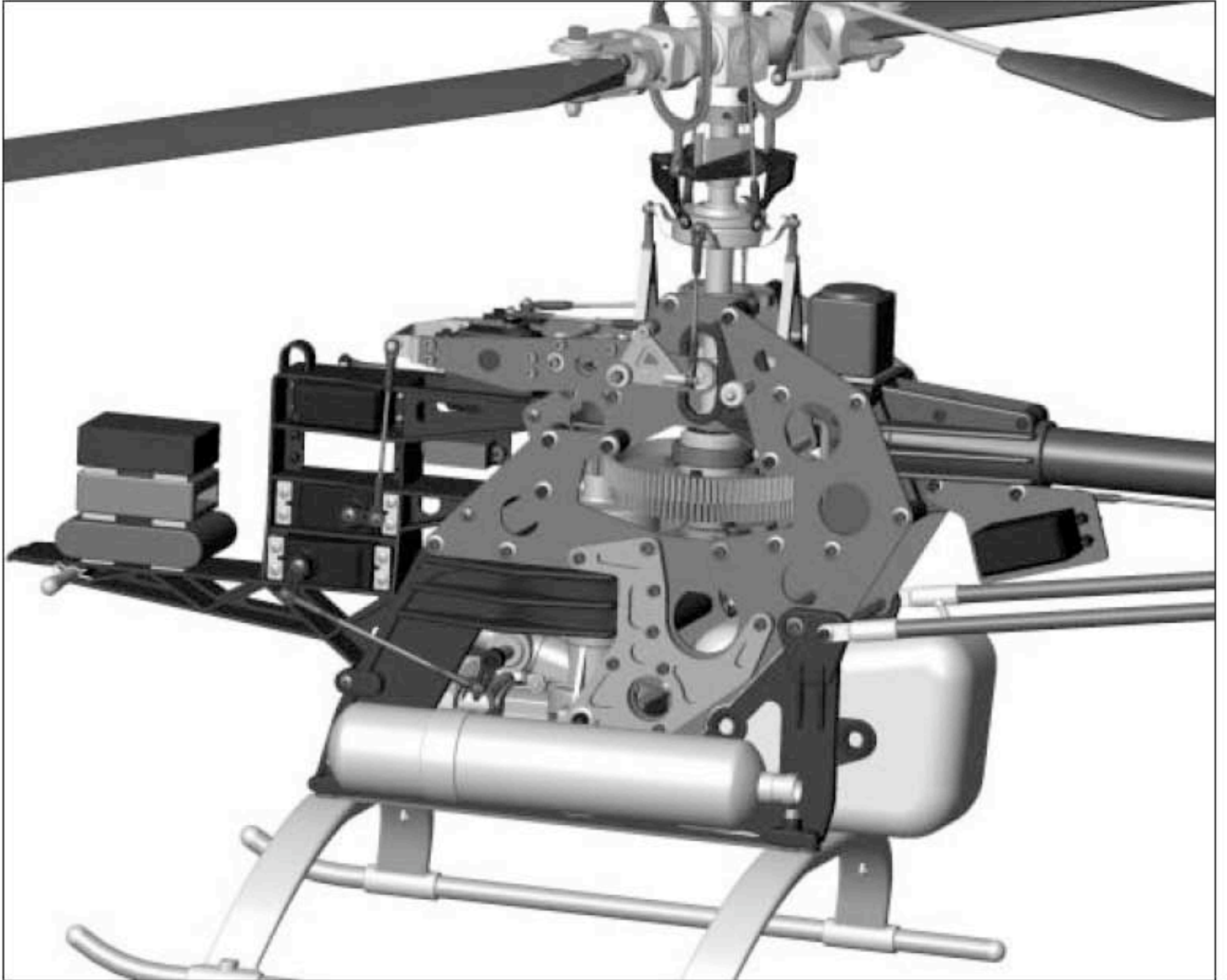
Inspect the flybar, rotor shaft and the blade spindle to make sure they are not bent at all. If any item is damaged, it must be replaced by a new part to ensure safe operation. Do not glue any broken or damaged plastic part. Do not repair broken rotor blades. Always inspect the following items immediately:

- (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 and horizontal fins.
- (g). Tail rotor shaft and control system.
- (h). Main and tail rotor blades.
- (i). Main frame.



7

PARTS LIST SECTION



RAPTOR 90 SE EXCLUSIVE PARTS



PV0041 BALL LINK



PV0050 TAIL SHAFT BRG



PV0052 TAIL SLIDER BRG



PV0054 SERVO MOUNTING PLATE



PV0058 LINK BALL



PV0062 BODY MOUNT RUBBER GROMMETS



PV0123 MIXING LEVER



PV0124 FLYBAR CONTROL ROD



PV0125 THRUST WASHER



PV0126 SPINDLE



PV0133 ELEVATOR LEVER



PV0134 AILERON LEVER



PV0135 TAIL PITCH CONTROL LEVER



PV0139 ONE WAY CLUTCH SHAFT



PV0140 TAIL DRIVE GEAR



PV0147 TAIL CASE



PV0148 TAIL ROTOR GRIP



PV0149 TAIL BEVEL GEAR



PV0150 TAIL ROTOR SHAFT



PV0151 TAIL ROTOR HUB



PV0155 PITCH GUIDE COLLAR



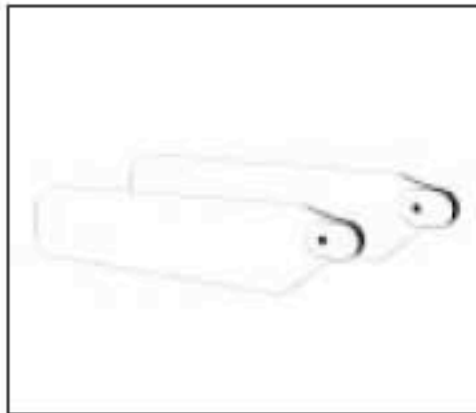
PV0157 REAR FRAME



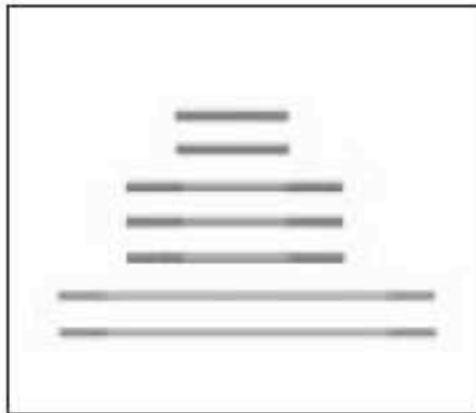
PV0158 TAIL BOOM BRACKET



PV0162 FLYBAR PADDLE



PV0163 TAIL ROTOR BLADE



PV0169 LINKAGE ROD



PV0172 THRUST BRG



PV0174 FLYBAR SEESAW BRG



PV0175 FEATHERING BRG



PV0176 TAIL PITCH CONTROL
LEVER BRG



PV0177 ROTOR BOLT



PV0182 CLUTCH BELL BRG



PV0183 BODY RETAINING
BOLT



PV0184 FLYBAR SEESAW



PV0186 MAIN SPUR GEAR
93T (STD)



PV0188 MAIN SPUR GEAR
95T (STD)



PV0189 MAIN SPUR GEAR
94T(OPT)



PV0190 TAIL DRIVE SPUR
GEAR



PV0192 PINION GEAR
11T (STD)



PV0193 PINION GEAR
12T (STD)



PV0195 TAIL DRIVE SHAFT
BRG



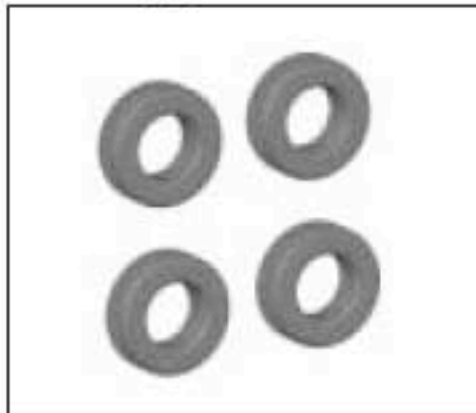
PV0197 TAIL DRIVE SHAFT
BEVEL GEAR BRG



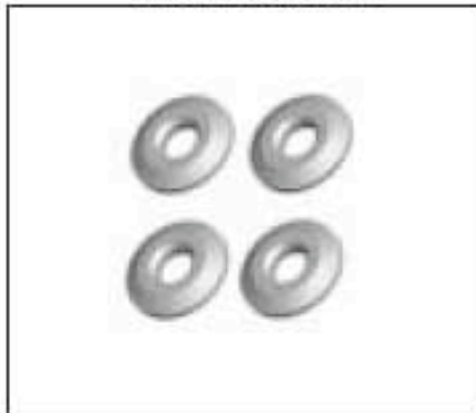
PV0200 TAIL ROTOR BRG



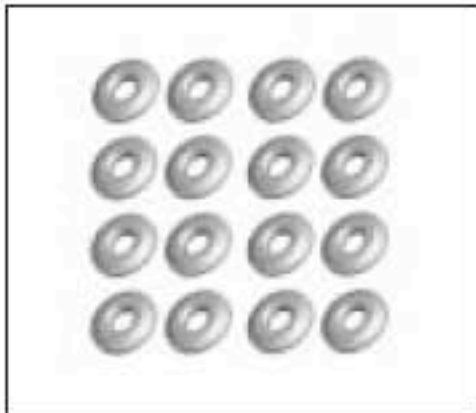
PV0203 STARTER SHAFT BRG



PV0208 FUEL TANK RUBBER
GROMMET



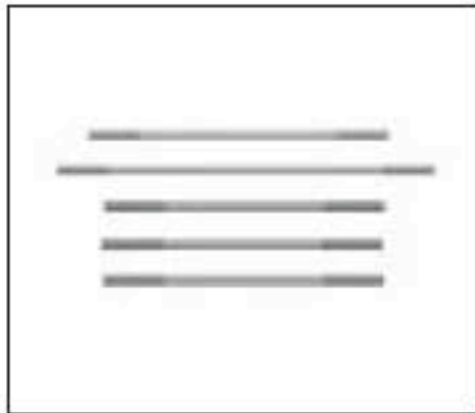
PV0209 WASHER, d4xD11x1,7



PV0210 WASHER, d3xD8x1,4



PV0239 BODY CLIP



PV0240 SERVO LINK ROD



PV0241 ROD GUIDE COLLAR



PV0243 CLUTCH BRG CASE



PV0244 PINION BRG



PV0245 WASH OUT LINK



PV0246 TAIL DRIVE GEAR SHAFT



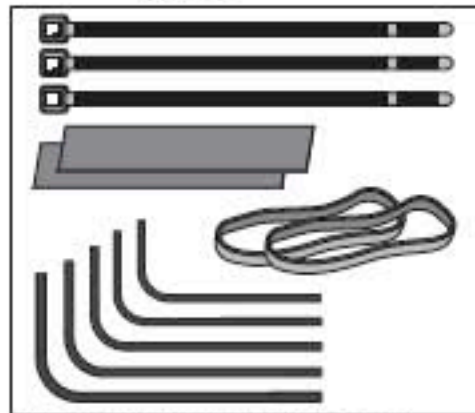
PV0248 PITCH ARM CROSS MEMBER



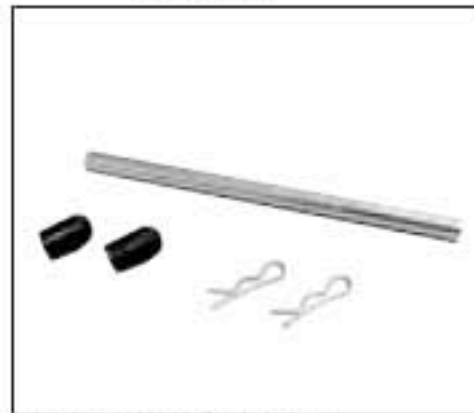
PV0251 FUEL PLUG



PV0253 ANTENNA PIPE



PV0254 INSTALLATION TOOLS



PV0262 BODY SUPPORT



PV0267 LOCTITE #242



PV0268 LOCTITE #262



PV0269 GREASE
(FOR PLASTIC GEAR)



PV0270 GREASE
(FOR BEARING)



PV0283 METAL SIDEFRAME
STIFFENER



PV0284 METAL SWASH PLATE



PV0286 MACHINED ELEVATOR ARM
LINK



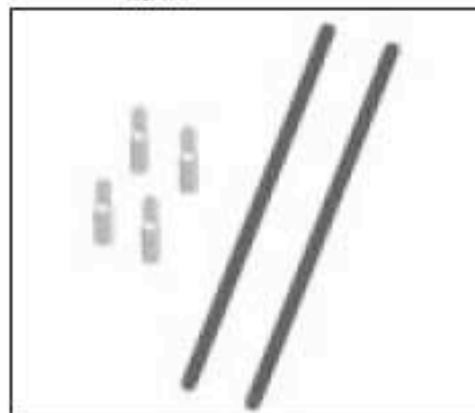
PV0291 WASH OUT BASE



PV0299 CARBON GRAPHITE
HORIZONTAL FIN



PV0300 CARBON GRAPHITE
VERTICAL FIN



PV0306 TAIL SUPPORT



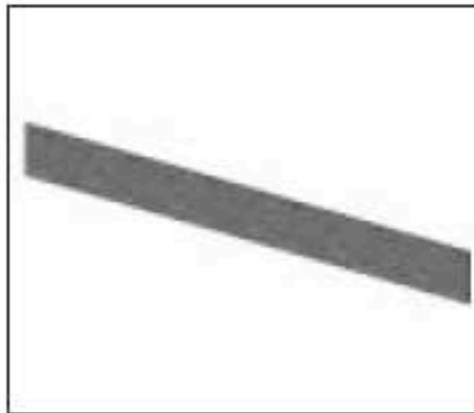
PV0310 FUEL TANK, 550c.c.



PV0321 REAR MOUNTED TAIL
SERVO TRAY



PV0322 HEAVY DUTY CLUTCH



PV0324 HEAVY DUTY CLUTCH LINER



PV0327 CARBON GRAPHITE BASE PLATE



PV0335 METAL MAIN ROTOR GRIP SET



PV0350 HARDENED MAIN SHAFT



PV0351 ONE WAY CLUTCH REINFORCED RING



PV0360 STARTER SHAFT



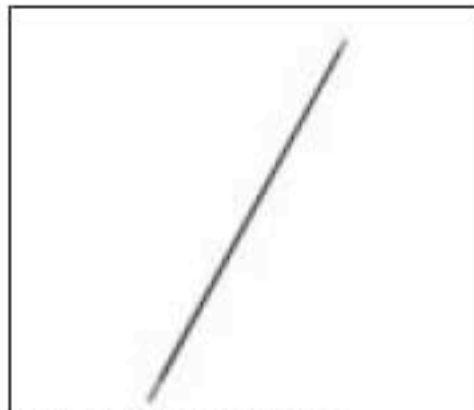
PV0361 STARTER COUPLING



PV0385 ROTOR GRIP PLATE SET



PV0386 ROTOR HUB SLIDER RING



PV0395 SUS FLYBAR ROD



PV0396 METAL FLYBAR CONTROL ARM SET



PV0397 SIM-CARBON CANOPY



PV0400 METAL MAIN ROTOR GRIP POST



PV0404 70° FLAP DAMPER



PV0405 80° FLAP DAMPER



PV0406 FLYBAR CONTROL LEVER SET



PV0407 TAIL PITCH SLIDER



PV0408 HEAVY DUTY CLUTCH BELL



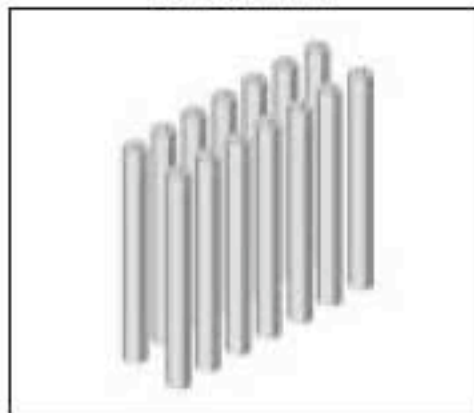
PV0409 ONE WAY CLUTCH



PV0412 FAN CASING



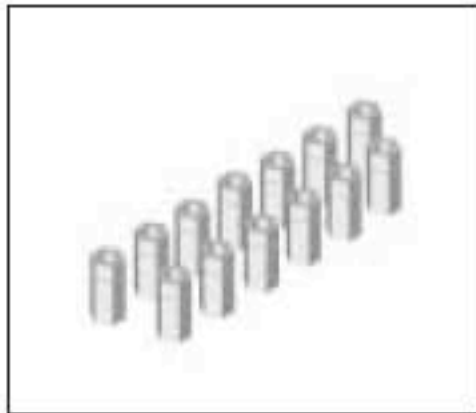
PV0413 SERVO FRAME



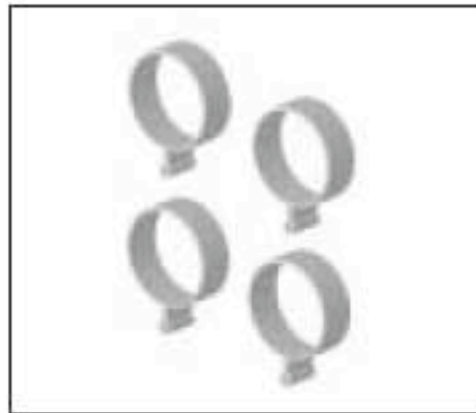
PV0418 FRAME SPACER (L)



PV0419 FRAME SPACER (M)



PV0420 FRAME SPACER (S)



PV0423 TAIL ROD GUIDE



PV0424 METAL FORK



PV0425 TAIL PITCH CONTROL SLIDE BUSHING



PV0429 METAL ELEVATOR LEVER SET



PV0430 METAL UPPER BEARING BLOCK



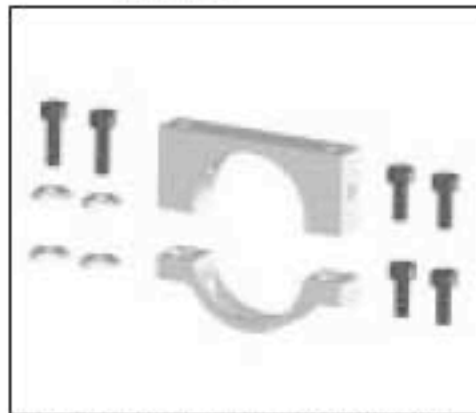
PV0431 METAL LOWER BEARING BLOCK



PV0432 CARBON GRAPHITE COLLECTIVE CONTROL ARM



PV0435 METAL COOLING FAN



PV0438 METAL HORIZONTAL FIN BRACKET



PV0453 REAR SERVO ROD, 4890



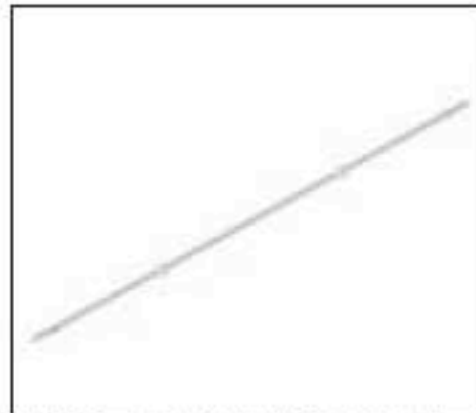
PV0455 SKID PIPE END CAP



PV0458 METAL BUTTON MAIN ROTOR HUB



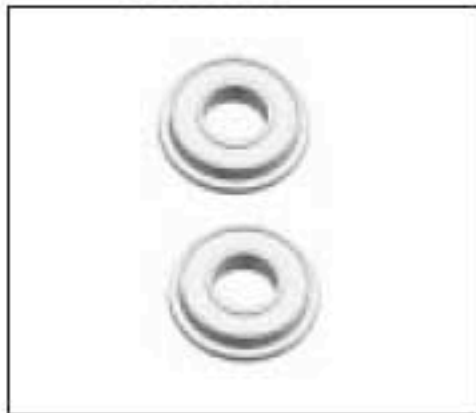
PV0461 CARBON TAIL BOOM



PV0462 CARBON DRIVE SHAFT



PV0467 CARBON COLLECTIVE PITCH SIDEFRAME BRG



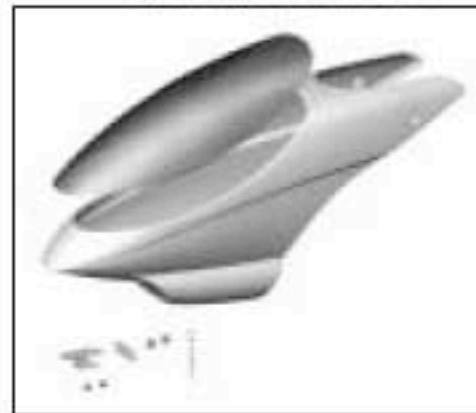
PV0468 CARBON COLLECTIVE PITCH SIDEFRAME BRG



PV0469 MAIN SHAFT LOCK RING, R90SE



PV0470 MAIN SHAFT BRG, R90SE



PV0471 BODY, R90SE



PV0472 LANDING SKID



PV0473 DECAL, R90SE



PV0474 CARBON GRAPHITE UPPER SIDEFRAME



PV0475 CARBON GRAPHITE LOWER SIDEFRAME

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0140	TAIL DRIVE GEAR SET	BK0362	Tail Drive Bevel Gear A	1	1-2-4
		BK0363	Tail Drive Bevel Gear B	1	1-2-4
		BK0364	Tail Drive Pinion	1	1-2-4
		BK0414	Pin 2x12	2	1-2-4
		HME3-4B	M3x4 Set Screw	2	1-2-4
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 Locknut	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
		HMC26-10B	M2,6x10 Socket Screw	4	3-1-2
		HMC3-14B	M3x14 Socket Screw	2	3-1
		HMM26B	M2,6 Locknut	4	3-1-2
		HMM3B	M3 Locknut	2	3-1-2
PV0149	TAIL BEVEL GEAR	BK0372	Tail Input Bevel Gear	1	3-1-1
		BK0373	Tail Output Bevel Gear	1	3-1-1
		BK0414	Pin 2x12	1	3-1-1
		HME3-4B	M3x4 Set Screw	1	3-1-1
PV0150	TAIL ROTOR SHAFT	BK0374	Tail Shaft	1	3-1-2
		BK0414	Pin 2x12	1	3-1-2
		HME3-4B	M3x4 Set Screw	1	3-1-2
PV0151	TAIL ROTOR HUB	BK0307	Tail Rotor Hub	1	3-1-2
		HME3-18B	M3x18 Set Screw	2	3-1-2
		HMM3B	M3 Locknut	2	3-1-2
PV0155	PITCH GUIDE COLLAR SET	BK0384	Pitch Guide Collar L	1	1-1-3
		BK0385	Pitch Guide Collar R	1	1-1-4
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	1-2-4
		BK0383	Tail Boom Bracket R	1	1-2-4
PV0162	FLYBAR PADDLE SET	BK0406	Paddle Root	2	2-1-1
		BK0416	Paddle Stopper	2	2-1-1
		BK0432	Flybar Paddle	2	2-1-1
		HME4-3B	M4x3 Set Screw	4	2-1-1
PV0163	TAIL ROTOR BLADE	BK0404	Tail Rotor Blade	2	3-1
PV0169	LINKAGE ROD	BK0093	2x46 Link Rod	3	1-6
		BK0292	2,3x24 Link Rod	2	2-1
		BK0318	2,3x95 Link Rod	2	4-1
PV0172	THRUST BRG	HMX0816	d8xD16x5 Thrust Bearing	2	2-1-3
PV0174	FLY BAR SEESAW BRG	HMV694ZZ	d4xD11x4 BRG	2	2-1-1
PV0175	FEATHERING BRG	HMV1680	d8xD16x5 BRG	2	2-1-3
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
PV0182	CLUTCH BELL BRG	HMV1360Z	d6xD13x5 BRG	2	1-1-2
PV0183	BODY RETAINING SET	BK0103	Body Fitting Pin	2	1-3
		HSA3-22	M3x22 Button Head Socket Screw	2	1-3
PV0184	FLYBAR SEESAW	BK0322	Flybar Seesaw Hub	1	2-1-1
		BK0408	Collar d3xD4x5,5	2	2-1
		HMC3-10B	M3x10 Socket Screw	2	2-1
PV0186	MAIN SPUR GEAR 93T(STD)	BK0420	Main Spur Gear 93T	1	1-6-3
PV0188	MAIN SPUR GEAR 95T(STD)	BK0431	Main Spur Gear 95T	1	1-6-3
PV0189	MAIN SPUT GEAR 94T(OPT)	BK0421	Main Spur Gear 94T	1	1-6-3
PV0190	TAIL DRIVE SPUR GEAR	BK0357	Tail Drive Spur Gear 83T	1	1-6-3
		HMC4-25B	M4x25 Socket Screw	1	1-6-3
		HMM4B	M4 Locknut	1	1-6-3
PV0191	PINION GEAR 10T(OPT)	BK0355	Drive Pinion 10T	1	1-1-2
		BK0366	Pinion Gear Nut	1	1-1-2
PV0192	PINION GEAR 11T(STD)	BK0422	Drive Pinion 11T	1	1-1-2
		BK0366	Pinion Gear Nut	1	1-1-2
PV0193	PINION GEAR 12T(STD)	BK0423	Drive Pinion 12T	1	1-1-2
		BK0366	Pinion Gear Nut	1	1-1-2

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
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	3-1-1
PV0200	TAIL ROTOR BRG	HMV1050	d5xD10x4 BRG	4	3-1-2
PV0203	STARTER SHAFT BRG	HMV696Z	d6xD15x5 BRG	2	1-1-2
PV0208	FUEL TANK RUBBER GROMMET	BK0274	Tank Rubber Grommet	4	1-2
PV0209	WASHER,d4xD11x1.7	BK0435	d4xD11x1.7 Washer	4	
PV0210	WASHER,d3xD8x1.4	BK0087	d3xD8x1.4 Washer	16	
PV0211	SOCKET SCREW,M2.6x10	HMC2610B	M2.6x10 Socket Screw	20	
PV0212	SOCKET SCREW,M3x10	HMC3-10B	M3x10 Socket Screw	20	
PV0213	SOCKET SCREW,M3x12	HMC3-12B	M3x12 Socket Screw	20	
PV0214	SOCKET SCREW,M3x14	HMC3-14B	M3x14 Socket Screw	20	
PV0215	SOCKET SCREW,M3x18	HMC3-18B	M3x18 Scket Screw	20	
PV0216	SOCKET SCREW,M3x25	HMC3-25B	M3x25 Scket Screw	20	
PV0217	SOCKET SCREW,M3*28	HMC3-28B	M3x28 Scket Screw	20	
PV0218	SOCKET SCREW,M3x8	HMC3-8B	M3x8 Scket Screw	20	
PV0219	SOCKET SCREW,M4x10	HMC4-10B	M4x10 Scket Screw	20	
PV0220	SOCKET SCREW,M4x12	HMC4-12B	M4x12 Scket Screw	20	
PV0221	SOCKET SCREW,M4x18	HMC4-18B	M4x18 Scket Screw	20	
PV0222	SOCKET SCREW,M4x25	HMC4-25B	M4x25 Scket Screw	20	
PV0223	SOCKET SCREW,M4x8	HMC4-8B	M4x8 Scket Screw	20	
PV0224	SET SCREW,M3x18	HME3-18B	M3x18 Set Screw	20	
PV0225	SET SCREW,M3x4	HME3-4B	M3x4 Set Screw	20	
PV0226	SET SCREW,M4x3	HME4-3B	M4x3 Set Screw	20	
PV0227	SET SCREW,M4x5	HME4-5B	M4x5 Set Screw	20	
PV0228	PHILLIPS MACHINE SCREW,M2X8	HMF2-8N	M2x8 Philip Machine Screw	20	
PV0229	SELF-TAPPING SCREW,M2x10	HMJ2-10N	M2x10 Self-Tapping Screw	20	
PV0230	SELF-TAPPING SCREW,M2x14	HMJ2-14N	M2x14 Self-Tapping Screw	20	
PV0231	SELF-TAPPING SCREW,M2x6	HMJ2-6B	M2x6 Self-Tapping Screw	20	
PV0232	SELF-TAPPING SCREW,M2x8	HMJ2-8N	M2x8 Self-Tapping Screw	20	
PV0233	SELF-TAPPING SCREW,M3x20	HMJ3-20N	M3x20 Self-Tapping Screw	20	
PV0234	NUT, M2	HML2	M2 Nut	20	
PV0235	LOCK NUT,M2.6	HMM26B	M2.6 Locknut	20	
PV0236	LOCK NUT,M3	HMM3B	M3 Locknut	20	
PV0237	LOCK NUT,M4	HMM4B	M4 Locknut	20	
PV0238	LOCK NUT,M5	HMM5Z	M5 Locknut	10	
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
PV0240	SERVO LINK ROD	BK0436	2.5x55 Link Rod	3	5-1
		BK0095	2.3x76 Link Rod	1	5-2
		BK0438	2.3x88 Link Rod	1	5-1
PV0241	ROD GUIDE COLLAR	BK0389	Rod Guide Collar	2	1-3-1
PV0243	CLUTCH BRG CASE	BK0388	Clutch BRG Case	2	1-1-2
PV0244	PINION BRG	HMV6800	d10xD19x5 BRG	2	1-1-2
PV0245	WASH OUT LINK	BK0343	Wash Out Link	2	1-6-1
PV0246	TAIL DRIVE GEAR SHAFT	BK0365	Tail Drive Gear Shaft	1	1-2-4
		BK0414	Pin 2X12	2	1-2-4
		HME3-4B	M3x4 Set Screw	2	1-2-4
PV0248	PITCH ARM CROSS MEMBER	BK0393	Pitch Frame Cross Member	1	1-1
		BK0394	Pitch Frame Cross Member Nut	2	1-1
PV0251	FUEL PLUG	BK0445	Fuel Plug	3	1-2-6
PV0253	ANTENNA PIPE 4830/4870	BE1052	Antenna Pipe	2	5-3
PV0254	INSTALLATION SET	BK0106	Two Touch Tape	2	
		BK0109	Rubber Band 5x320xT1	2	
		HNI15	Hex Wrench 1.5m/m	1	
		HNI2	HEX Wrench 2m/m	1	
		HNI25	HEX Wrench 2.5m/m	1	
		HNI3	HEX Wrench 3m/m	1	
		HNI4	HEX Wrench 4m/m	1	
		HNJ-1	Tie Band 2.5x100	3	
PV0262	BODY SUPPORT	BK0473	Budy Support	1	5-4-1
		BK0474	Rubber Cap	2	5-4-1
		HNL6	R Pin	2	5-4-1
PV0267	LOCTITE #242			1	

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0268	LOCTITE #262			1	
PV0269	PLASTIC GEAR GREASE			1	
PV0270	THRUST BEARING GREASE			1	
PV0283	METAL SIDEFAME STIFFENER	BK0507	Metal Sideframe Stiffener (Left)	1	1-2-2
		BK0508	Metal Sideframe Stiffener (Right)	1	1-2-3
		BK0390	Frame Spacer L	2	1-2
		BK0435	Washer	4	1-2
		HMC3-12B	Socket Screw M3x12	16	1-2
		HMC3-16B	Socket Screw M3x16	2	1-2
		HMC4-18B	Socket Screw M4x18	4	1-2
		HMM3Z	Locknut M3	8	1-2
PV0284	METAL SWASH PLATE	BV0504	Metal Swash Plate	1	1-6-2
PV0286	MACHINED ELEVATOR ARM LINK	BK0459	Machined Elevator Arm Link	2	1-1-5
		BK0086	Ball Link 4,8x20	2	1-1-5
		BK0270	Elevator Link Shaft	2	1-1-5
		BK0292	Link Rod 2,3xL24	2	1-1-5
		HMS15	E Ring	6	1-1-5
PV0291	WASH OUT BASE	BK0472	Wash Out Base	1	1-6-1
PV0299	CARBON GRAPHITE HORIZONTAL FIN	BK0465	Carbon Stabilizer Fin	1	3-1
		BK0087	Washer	2	3-1
		BK0278	POM Washer	2	3-1
		HSE3-12B	Self-Tapping Screw M3x12	2	3-1
PV0300	CARBON GRAPHITE VERTICAL FIN	BK0466	Carbon Vertical Fin	1	3-1
		BK0087	Washer	2	3-1
		BK0278	POM Washer	2	3-1
		HMC3-32B	Socket Screw M3x32	2	3-1
		HMM3Z	Locknut M3	2	3-1
PV0306	TAIL SUPPORT	BK0510	Carbon Tail Support Rod	2	4-4-1
		BK0280	Metal Tail Support Rod End	4	4-4-1
PV0310	FUEL TANK 550C,C	BV0503	Fuel Tank	1	1-2-6
PV0321	REAR MOUNTED TAIL SERVO TRAY	BK0539	Carbon Rear Servo Plate	1	4-4
		BK0087	Washer	2	4-4
		BK0104	Servo Mounting Plate	2	5-1
		HMC2616B	Socket Screw M2,6x16	4	5-1
		HMC3-30B	Socket Screw M3x30	2	4-4
		HMM3B	Locknut M3	2	5-1
		HMM26B	Locknut M2.6	4	5-1
PV0322	HEAVY DUTY CLUTCH	BV0521	Heavy Duty Clutch	1	4-2-1
PV0324	HEAVY DUTY CLUTCH LINER	BK0523	H.D Clutch Linear	1	1-1-2
PV0327	CARBON GRAPHITE BASE PLATE	BK0529	Carbon Base Plate	1	4-3
PV0335	METAL MAIN ROTOR GRIP SET	BK0562	Metal Main Rotor Grip	2	2-1-3
		BK0563	Metal Main Rotor Plate	2	2-1-3
		BK0565	Metal Main Rotor Grip Post	2	2-1-3
		BK0297	Grip Collar	4	2-1-3
		BK0075	Link Ball 4,8	2	2-1-3
		HMV1680	BRG,d8*D16*W5	4	2-1-3
		HMX0816	Thrust BRG,d8*D16*W5	2	2-1-3
		HMF2-10N	Phillip Machine Screw M2x10	2	2-1-3
		HMC3-10B	Socket Screw M3x10	10	2-1-3
PV0350	HARDENED MAIN SHAFT	BK0547	Harden Main Shaft	1	1-6
PV0351	ONE WAY CLUTCH REINFORCED RING	BK0613	One Way Clutch Reinforced Ring	1	1-6-3
		HMC3-14B	M3x14Socket Screw	1	1-6-3
PV0360	STARTER SHAFT	BK0592	Starter Shaft	1	1-1-2
		HME4-5B	M4x5 Set Screw	2	1-1-2
		HMS5	M5x8 E Ring	1	1-1-2
PV0361	STARTER COUPLING	BK0594	Starter Couling	1	1-1-2
		HME4-5B	M4x5 Set Screw	2	1-1-2
PV0385	ROTOR GRIP PLATE SET	BK0075	Link Ball 4,5	2	2-1-3
		BK0563	Metal Main Rotor Plate	2	2-1-3
		BK0565	Metal Main Rotor Grip Post	2	2-1-3
		HMC3-10B	M3x10 Socket Screw	2	2-1-3
		HMF2-10N	Phillip Machine Screw M2x10	2	2-1-3
PV0386	ROTOR HUB SLIDER RING	BV0549	Washout Base Guidance Ring	1	2-1-2
PV0395	SUS FLYBAR ROD	BK0640	SUS FlyBar Rod	1	2-1-1

No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
PV0396	METAL FLYBAR CONTROL ARM SET	BK0633	Flybar Control Frame	2	2-1-1
		BK0634	Flybar Control Arm	2	2-1-1
		BK0075	Link Ball 4.8	2	2-1-1
		HMC3-10B	Socket Screw M3x10	2	2-1-1
		HME4-5B	Set Screw M4x5	2	2-1-1
		HMF2-8N	Philip Machine Screw M2x8	2	2-1-1
PV0397	SIM-CARBON CANOPY	BK0699	Sim-Carbon Canopy	1	5-4-1
		HMJ2-6B	Self-Tapping Screw M2x6	6	5-4-1
PV0400	METAL MAIN ROTOR GRIP POST	BK0565	Metal Main Rotor Grip Post	2	2-1-3
		BK0075	Link Ball 4.5	2	2-1-3
		HMC3-10B	M3x10 Socket Screw	2	2-1-3
		HMF2-10N	Philip Machine Screw M2x10	2	2-1-3
PV0404	70 DUROMETER FLAP DAMPER	BK0656	70 Durometer Flap Damper	2	2-1-2
PV0405	80 DUROMETER FLAP DAMPER	BK0657	80 Durometer Flap Damper	2	2-1-2
PV0406	FLYBAR CONTROL LEVER SET	BK0342	Flybar Control Lever	2	1-6-1
		BK0075	Link Ball 4.8	2	1-6-1
		BK0343	Wash Out Link	2	1-6-1
		BK0409	Collar d3xD4x7	2	1-6-1
		BK0412	Pin 2x14.5	2	1-6-1
		HMC3-12B	M3x12 Socket Screw	2	1-6-1
		HMJ2-10N	M2x10 Self-Tapping Screw	2	1-6-1
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 4.5	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
PV0408	HEAVY DUTY CLUTCH BELL	BV0522-1	Heavy Duty Clutch Bell Set	1	1-1-2
PV0409	ONE WAY CLUTCH	BV0368	Autorotation Clutch	1	1-6-3
		HMC3-8B	M3x8 Socket Screw	4	1-6-3
PV0412	FAN CASING SET	BK0665	Fan Casing L	1	1-2-5
		BK0666	Fan Casing R	1	1-2-5
		BK0662	Fan Caseing Plate	1	1-2-5
		HME3-6B	M3x6 Set Screw	2	1-2-5
PV0413	SERVO FRAME	BK0667	Servo Frame	1	1-4
		HSE3-12B	M3x12 Self-Tapping Screw	6	1-4
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	
PV0423	TAIL ROD GUIDE	BK0403	Rod Guide	4	3-1
PV0424	METAL FORK	BK0545	Metal Fork	1	3-1-2
		BK0546	Pin 2mm	2	3-1-2
		HMS15	E Ring	6	3-1-2
PV0425	TAIL PITCH CONTROL SLIDE BUSHING	BK0345	Tail Pitch Control Slide Bushing	1	3-1-2
PV0429	METAL ELEVATOR LEVER SET	BK0455	Metal Elevator Control Arm	1	1-1-5
		BK0456	Metal Elevator Parallel Lever	1	1-5-2
		HMF2-8N	Philip Machine Screw M2x8	1	1-5-2
		BK0075	Link Ball 4.8	1	1-5-2
		HMY2-10	Pin 2x10	1	1-5
		HMS4	E Ring	1	1-5
		HME3-3B	Set Screw M3x3	1	1-5
PV0430	METAL UPPER BEARING BLOCK	BK0488	Metal Upper BRG Block	1	1-1-1
		HMV6001Z	BRG d12xD28x8	1	1-1-1
		HSA3-6B	Button Head Socket Screw M3x6	2	1-1-1
PV0431	METAL LOWER BEARING BLOCK	BK0489	Metal Lower BRG Block	1	1-2-1
		HMV6901ZZ	BRG d12xD24x6	1	1-2-1
		HSA3-6B	Button Head Socket Screw M3x6	2	1-2-1
PV0432	CARBON GRAPHITE COLLECTIVE CONTROL ARM	BK0078	Collar,d3xD4x4	2	1-5
		BK0088	Washer	4	1-5
		BK0464	Carbon Collective Pitch Sideframe	2	1-5-4
		BK0469	Metal Front Servo Base	1	4-5-4
		BK0470	Metal Rear Servo Base	1	1-5-4
		BK0471	Metal Spacer	2	1-5-4
		BK0486	Link Ball	1	1-5-4

No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
		BK0536	Collective Pitch Sideframe Collar	2	1-5-4
		HMC3-6B	Socket Screw M3x6	12	1-5-4
		HMC26-14B	Socket Screw M2.6x14	4	5-1
		HMM3Z	Locknut M3	2	1-5-4
		HSA3-25	Button Head Socket Screw M3x25	2	1-5-4
		HSH840Y	BRG,LF-840ZZ	2	1-5-4
		HSH1280Y	BRG,LF-1280ZZ	2	1-5-4
PV0435	METAL COOLING FAN	BK0457	Metal Cooling Fan	1	4-2-1
PV0438	METAL HORIZONTAL FIN BRACKET	BK0530	Stabilizer Fin Bracket (Upper)	1	3-1
		BK0531	Stabilizer Fin Bracket (Lower)	1	3-1
		BK0087	Washer	2	3-1
		HMC3-8B	Socket Screw M3x8	4	3-1
		HMC3-10B	Socket Screw M3x10	2	3-1
PV0453	REAR SERVO ROD, 4890	BK0086	Ball Link 4.8x20	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
PV0458	METAL BUTTON MAIN ROTOR HUB	BK0706	Metal Button Main Rotor Hub	1	2-1-2
		BV0549	Washout Base Guidance Ring	1	2-1-2
		BK0656	70 Durometer Flap Damper	2	2-1-2
		BK0657	80 Durometer Flap Damper	2	2-1-2
		HMV2112Z	BRG d12xD21xW5	2	2-1-2
		HMV694ZZ	BRG d4xD11xW4	2	2-1-2
		HMC3-12B	Socket Screw M3x12	1	2-1-2
		HMC4-20B	Socket Screw M4x20	1	2-1-2
PV0461	CARBON TAIL BOOM	BK0511	Carbon Tail Boom(814mm)	1	3-1
PV0462	CARBON DRIVE SHAFT	BK0652	Carbon Tail Drive Shaft	1	3-1-3
		BK0247	Tail Drive Coupling	2	3-1-3
		BV0423	Tail Drive Shaft BRG	2	3-1-3
		HMC2616B	Socket Screw M2.6x16	2	3-1-3
		HMM26B	Locknut M2.6	2	3-1-3
PV0467	CARBON COLLECTIVE PITCH SIDEFRAME BRG	HSH1280Y	BRG	2	1-5-4
PV0468	CARBON COLLECTIVE PITCH SIDEFRAME BRG	HSH840Y	BRG	2	1-5-4
PV0469	MAIN SHAFT LOCK RING, R90 SE	BK0234	Lock Ring	1	1-6
		HSA3-6B	Button Head Socket Screw M3x6	2	1-6
PV0470	MAIN SHAFT BRG, R90 SE	HMV6001Z	BRG d12xD28x8	1	1-1-1
		HMV6901ZZ	BRG d12xD24x6	1	1-2-1
PV0471	BODY, R90 SE	BK0098	Body Clip A	1	5-4-1
		BK0099#	Body Clip B	1	5-4-1
		BK0102	Grommet d3xD6x11	2	5-4-1
		BK0429	Body	1	5-4-1
		BK0699	Sim-Carbon Canopy	1	5-4-1
		HSE3-12B	Self-Tapping Screw M3x12	2	5-4-1
		HMJ2-6B	Self-Tapping Screw M2x6	6	5-4-1
PV0472	LANDING SKID	BK0276	Skid Pipe	2	4-3-1
		BK0397	Skid Brace	2	4-3-1
		BK0398	Skid Pipe End Cap	4	4-3-1
		HME4-5B	Set Screw M4x5	4	4-3-1
PV0473	DECAL, R90 SE	JV0139	Decal R90 SE	1	
PV0474	CARBON GRAPHITE UPPER SIDEFRAME	BK0467	Carbon Upper Frame	2	1-1
		BK0087	Washer	4	1-1
		HMC3-10B	Socket Screw M3x10	2	1-1
		HSE3-12B	Self-Tapping Screw M3x12	2	1-1
PV0475	CARBON GRAPHITE LOWER SIDEFRAME	BK0468	Carbon Lower Frame	2	1-2-3
		BK0087	Washer	36	1-2
		HMC3-10B	Socket Screw M3x10	22	1-2
		HMC3-25B	Socket Screw M3x25	10	1-2
		HSE3-12B	Self-Tapping Screw M3x12	2	1-2
PV0476	ENGINE MOUNT	BK0349	Engine Mount	1	1-2
		BK0435	d4xD11x1.7 Washer	4	1-2
		HMC4-18B	M4x18 Socket Screw	8	1-2

RAPTOR 90 SE OPTIONAL PARTS



PV0298 91T MAIN SPUR GEAR



PV0308 CARBON GRAPHITE HILLER PADDLE



PV0309 CARBON GRAPHITE LANDING SKID



PV0334 METAL MAIN ROTOR HUB



PV0384 WIRE CLAMP, HELI



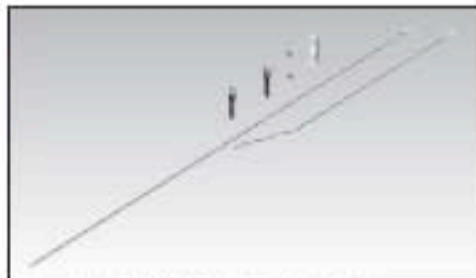
PV0388 HELI THROTTLE LEVER (L)



PV0391 MUFFLER, .90 (YS)



PV0396-L FLYBAR CONTROL ARM (BL)



PV0416 TAIL CONTROL ROD



PV0429-L ELEVATOR LEVER SET (BL)



PV0430-L METAL UPPER BEARING BLOCK (BL)



PV0431-L METAL LOWER BEARING BLOCK (BL)



PV0432-L CARBON GRAPHITE COLLECTIVE CONTROL ARM(BL)



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



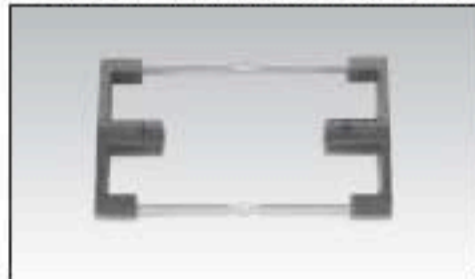
PV0434 METAL AILERON LEVER SET
PV0434-L METAL AILERON LEVER SET (BL)



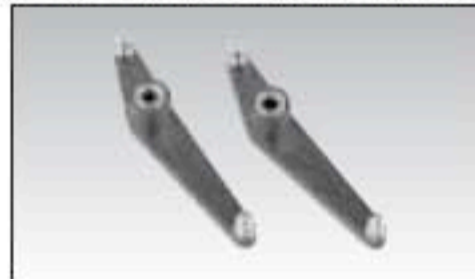
PV0435-L METAL COOLING FAN (BL)
PV0435YS-L METAL COOLING FAN,YS(BL)



PV0435YS METAL COOLING FAN,YS



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



PV0437 METAL B-H. MIXING ARM SET
PV0437-L METAL B-H. MIXING ARM SET (BL)



PV0438-L METAL HORIZONTAL FIN BRACKET (BL)



PV0452 MUFFLER, .90 (OS. T.T)



PV0457 METAL TAIL PITCH SLIDER



PV0459 METAL CLUTCH BRG BASE



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



PV0466-L METAL TAIL PITCH FORK (BL)



9609 HELI ENGINE,PRO-90H(R)



Specification:

Full Length of Fuselage: 55 1/2"(1410 mm)

Full Width of Fuselage: 7 1/2"(190 mm)

Total Height : 18 3/4"(476 mm)

Main Rotor Dia: 63 1/4"(1605 mm)

Tail Rotor Dia: 10 1/4"(260 mm)

Gear Ratio : 8.45 :1: 4.65

Full Equipped Weight : 4900g / 10.8 lbs



THUNDER TIGER CORPORATION

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