



RAPTOR

90 CLASS RC HELI

MANUAL

ASSEMBLY & MAINTENANCE



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

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Instruction

Thank you very much for purchasing the Thunder Tiger/Taya "Raptor 90" 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 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 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

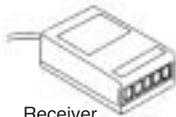
We used the latest 3D Computer Aided Design to design and manufacture the Raptor 90. Our high-tech CAD program allows simulation of all moving parts to ensure no interference. The analysis automatically analyze the weight, the mass distribution, and inertia to help us pursue a design that will provide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

OTHER ITEMS REQUIRED

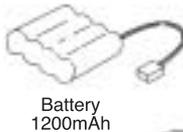
RADIO SET



Transmitter
(helicopter type only
6 or more channels)



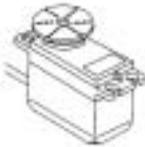
Receiver



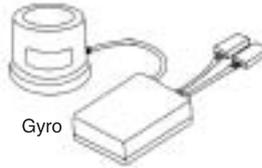
Battery
1200mAh



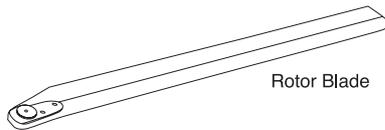
Switch harness



High Speed/Torque Servo x 5



Gyro



Rotor Blade

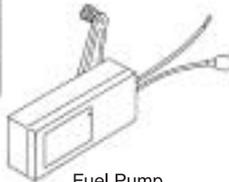
ENGINE



HELI ENGINE (90size)
9609 PRO-90H(R)



Glow Fuel(15%-30%)



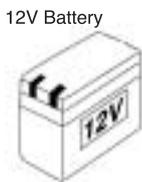
Fuel Pump



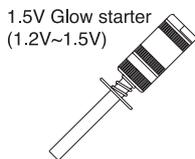
12V Electric starter

Extended 6mm Hex
Starting Tool

Glow Plug



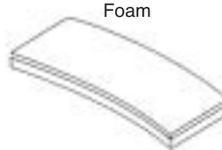
12V Battery



1.5V Glow starter
(1.2V~1.5V)



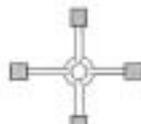
Rubber Band
(Included)



Foam



Remote Glow Plug
Extension



Glow Plug Wrench

Engine System

Use a high quality 90 size 2-stroke model helicopter engine, such as the Thunder Tiger TT PRO-90H, OS 91 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 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

Screw Driver



Needle Nose Pliers

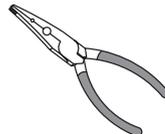


5.5mm Wrench



7mm

Ball Link Pliers



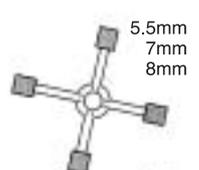
Nipper



Scissors



Metric
4-way Wrench



5.5mm
7mm
8mm

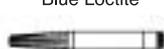
Hobby Knife



Instant Glue



Blue Loctite



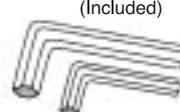
Grease



Epoxy



Hex Wrench
(Included)



Socket Drivers



5.5mm
7mm
8mm
10mm

Tools for Assembly

The Raptor 90 design has low parts count. It 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. 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. Rotary 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.

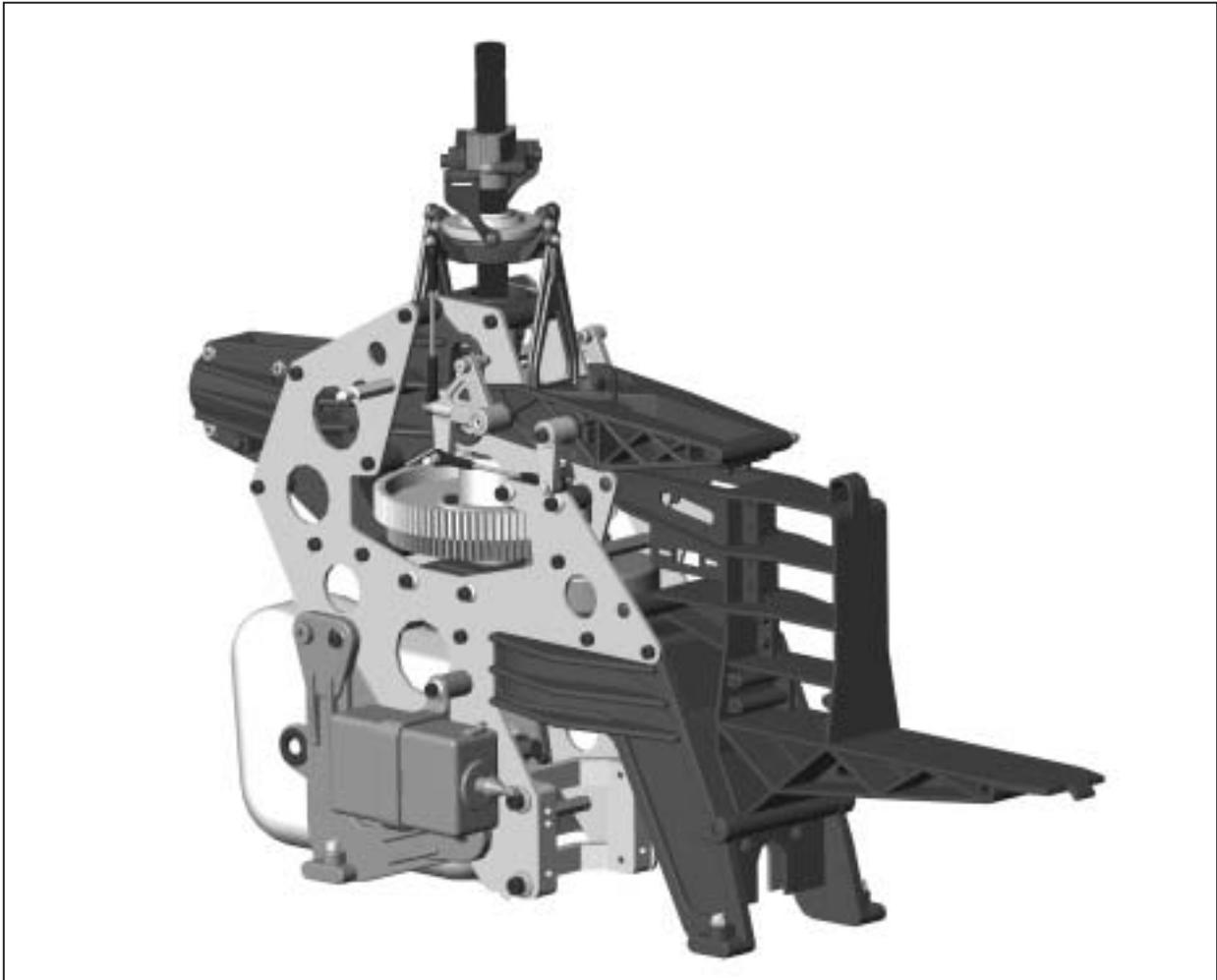
- Do not leave the model in a car for a long time. The heat in the summer or the cold in the winter and the humidity can cause damage to the model.
- Be careful and watch the sharp edges and corners on the model.

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

Main Frame, Main Rotor, Tail Rotor, Final Assembly and Radio Installation. 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

Upper Frame Assembly BAG A

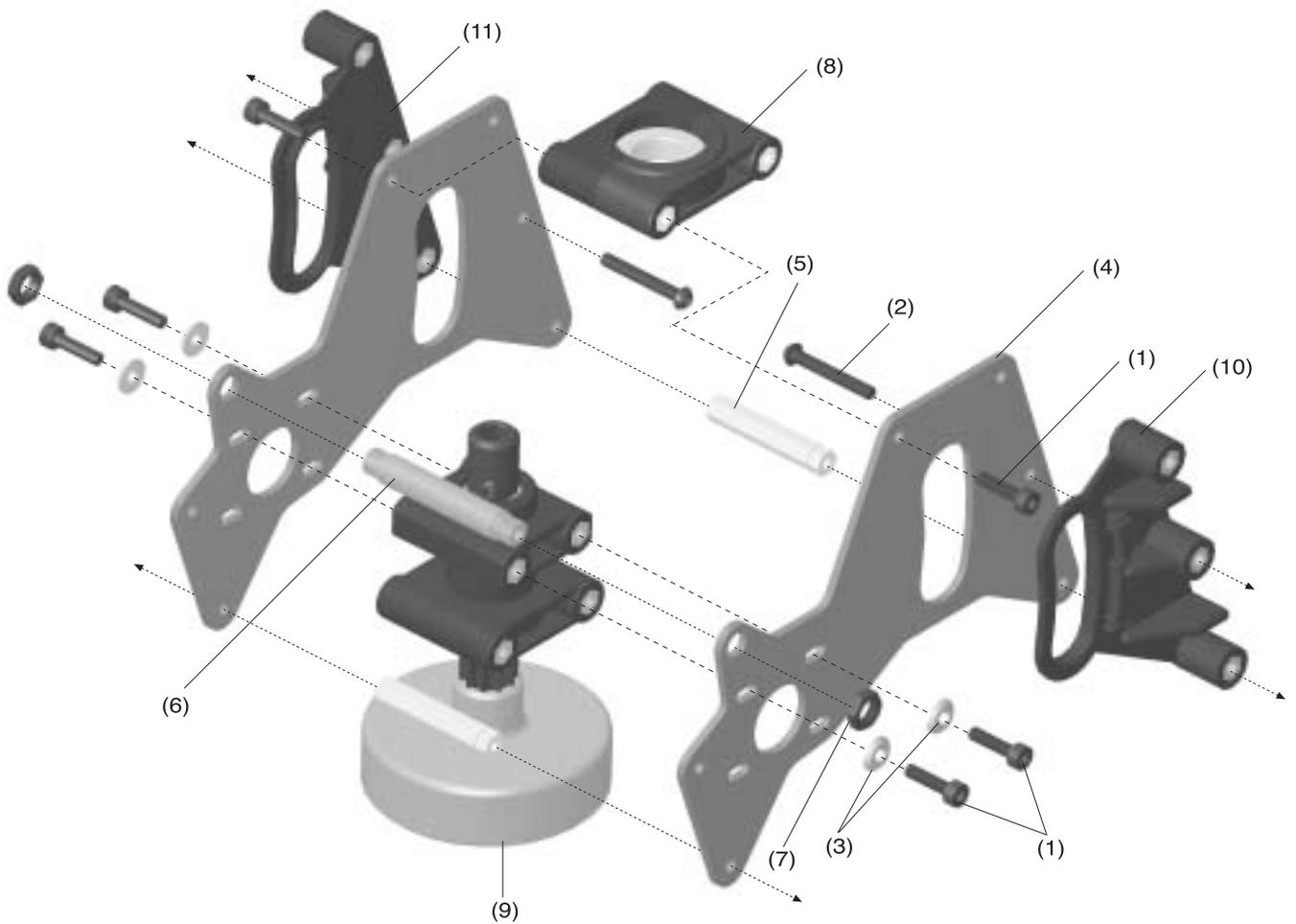
No.	Material No.	Description	Qty.
1	HMC3-12B	M3x12 Socket Screw	6
2	HSA3-22	M3x22 Button Head Socket Screw	2
3	BK0087	d3xD8x1.4 Washer	4
4	BK0375T	Metal Upper Frame	2
5	BK0659	Frame Spacer M	2
6	BK0393	Pitch Frame Cross Member	1

No.	Material No.	Description	Qty.
7	BK0394	Pitch Frame Cross Member Nut	2
8	1-1-1	Upper BRG Subassembly	1
9	1-1-2	Pinion Gear Subassembly	1
10	1-1-3	Pitch Guide L Subassembly	1
11	1-1-4	Pitch Guide R Subassembly	1

Assemble the upper main frames by starting with the two Upper Metal 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. Then attach the finished subassemblies to the Upper Metal 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 K which you will use in assembly.

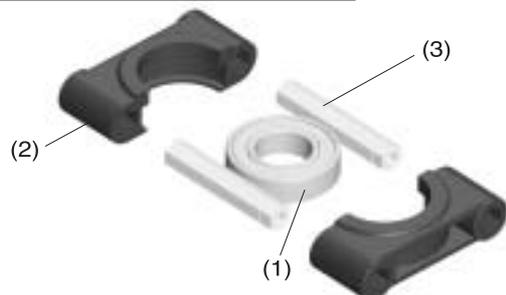
Please add a tiny drop of non-permanent type Loctite on the tip of all bolts before screwing them into the hex shaped aluminum frame spacers. Never use too much Loctite, otherwise it will become nearly impossible to remove the screw later on for servicing.

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 Upper BRG Subassembly

No.	Material No.	Description	Qty.
1	HMV6901ZZ	d12xD24x6 BRG	1
2	BK0386	Upper BRG Case	2
3	BK0659	Frame Spacer M	2

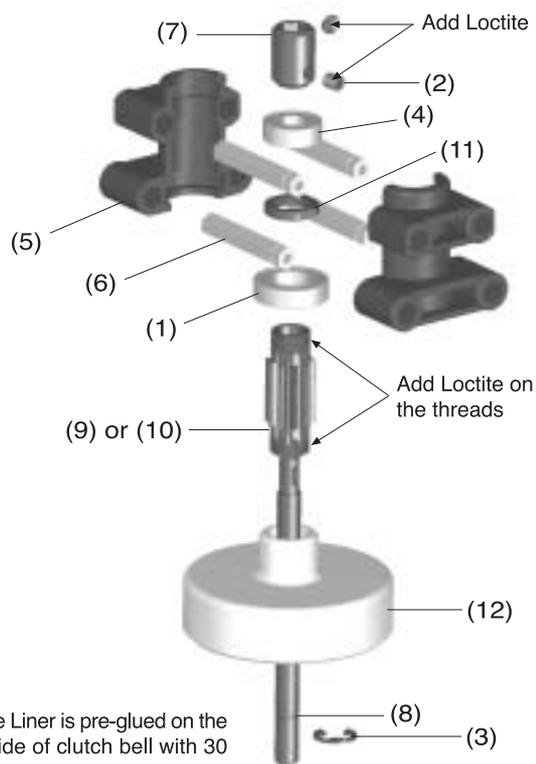


1-1-2 Pinion Gear Subassembly

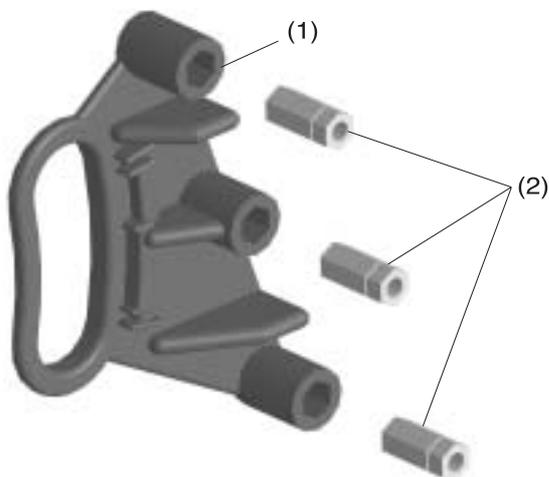
No.	Material No.	Description	Qty.
1	HMV6800	d10xD19x5 BRG	1
2	HME4-5B	M4x5 Set Screw	2
3	HMS5	M5x8 E Ring	1
4	HMV696Z	d6xD15x5 BRG	1
5	BK0388	Clutch BRG Case	2
6	BK0659	Frame Spacer M	4
7	BK0594	Starter Coupling	1
8	BK0592	Starter Shaft	1
9	BK0422	Drive Pinion11T	1
10	BK0423	Drive Pinion12T	1
11	BK0366	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 6-1 for pinion gear selection to suit your flying performance.

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



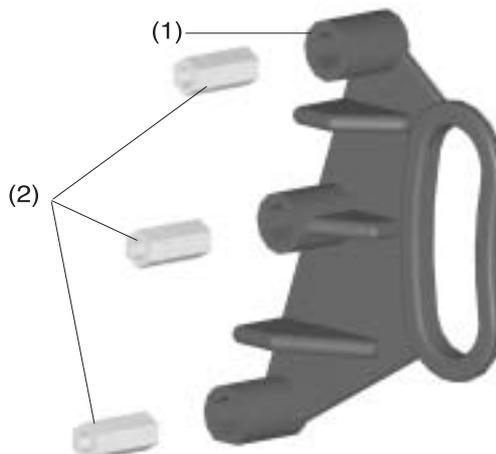
1-1-3 Pitch Guide L Subassembly



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



1-2

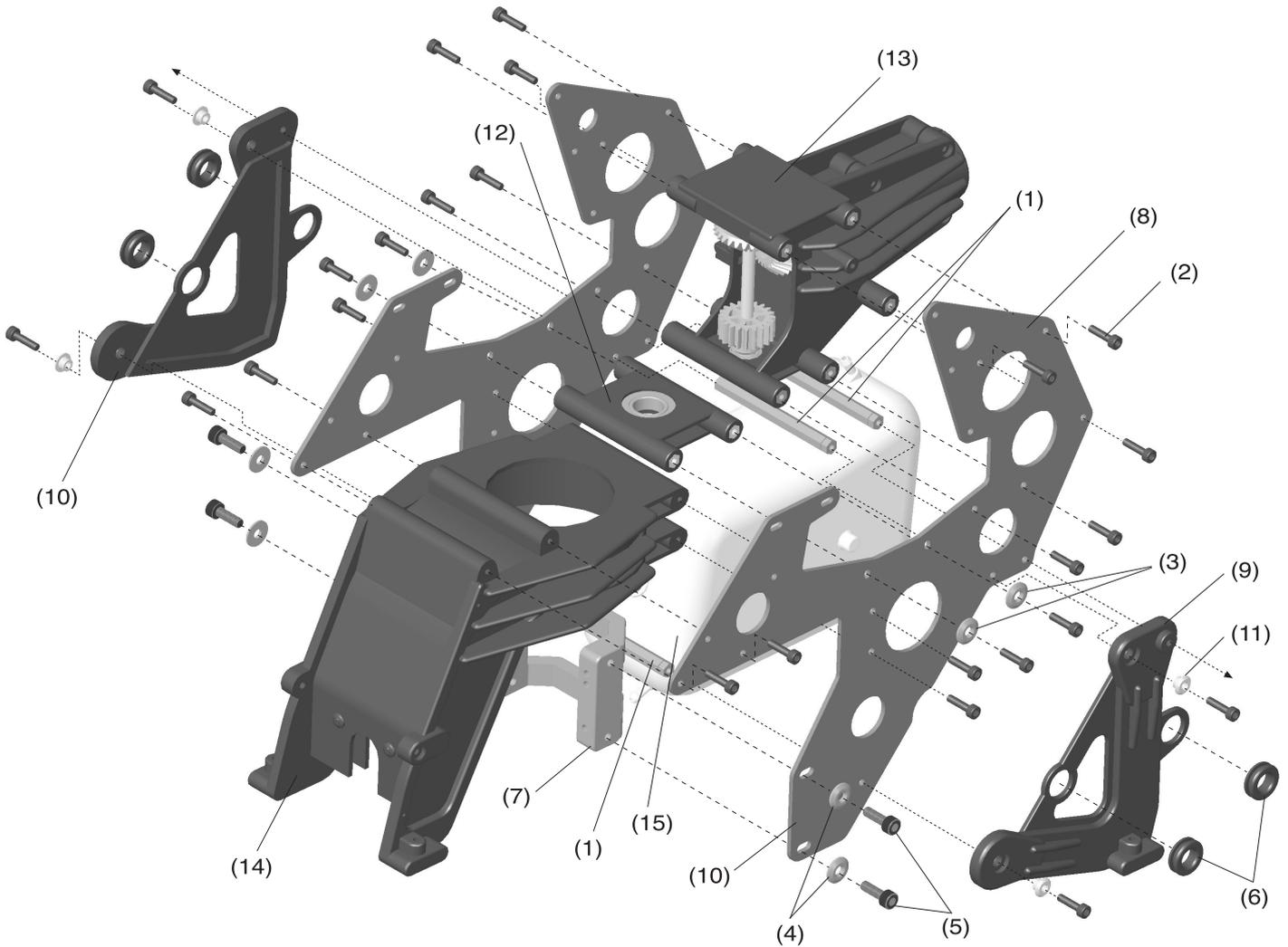
Lower Frame Assembly

BAG B

No.	Material No.	Description	Qty.
1	BK0660	Frame Spacer L	3
2	HMC3-12B	M3x12 Socket Screw	25
3	BK0087	d3xD8x1.4 Washer	4
4	BK0435	d4xD11x1.7 Washer	4
5	HMC4-12B	M4x12 Socket Screw	4
6	BK0274	Tank Rubber Grommets	4
7	BK0349	Engine Mount	1
8	BK0376T	Lower Metal Frame	2

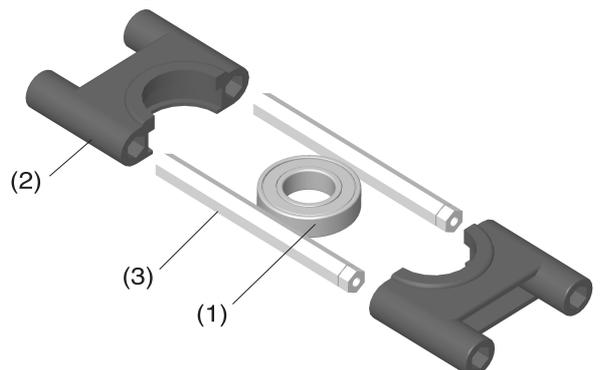
No.	Material No.	Description	Qty.
9	BK0380	Rear Frame L	1
10	BK0381	Rear Frame R	1
11	BK0629	Washer	4
12	1-2-1	Lower BRG Subassembly	1
13	1-2-2	Tail Drive Unit Subassembly	1
14	1-2-3	Cooling Fan Casing Subassembly	1
15	1-2-4	Fuel Tank Subassembly	1

Please complete subassembly steps 1-2-1 through 1-2-4 first. Then attach the subassemblies to the two Lower Metal Frames. Note that the Lower BRG Subassembly is installed upside-down. Please add a small drop of Loctite on every bolt before screwing it into the aluminum hex spacer.



1-2-1 Lower BRG Subassembly

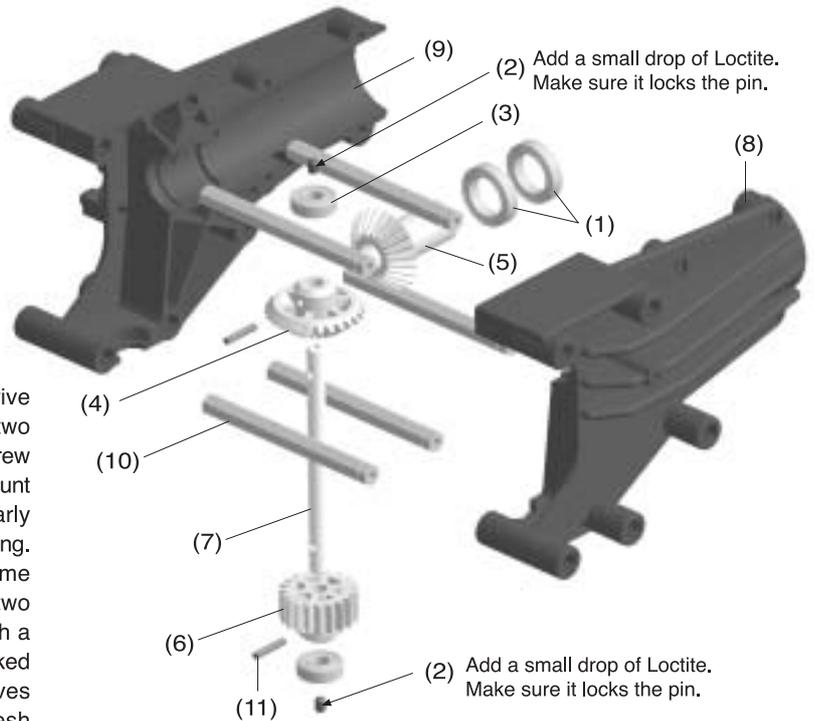
No.	Material No.	Description	Qty.
1	HMV6901ZZ	d12xD24x6 BRG	1
2	BK0387	Lower BRG Case	2
3	BK0660	Frame Spacer L	2



1-2-2 Tail Drive Unit Subassembly

No.	Material No.	Description	Qty.
1	HMV6701Z	d12xD18x4 BRG	2
2	HME3-4B	M3x4 Set Screw	2
3	HMV1350	d5xD13x4 BRG	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	BK0660	Frame Spacer L	5
11	BK0414	Pin 2x12	2

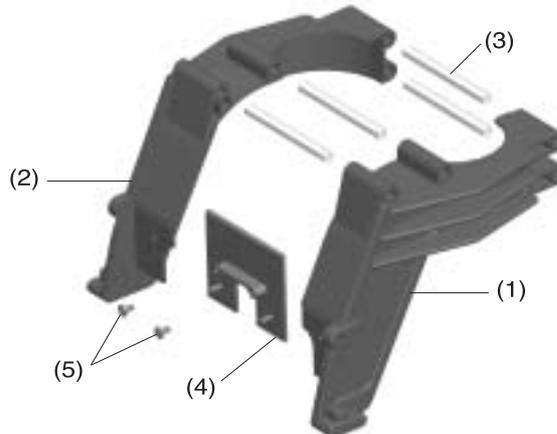
Install BK0364 and BK0362 onto BK0365 Tail Gear Drive Shaft. Then insert the two Pins and secure them with two M3x4 Set Screws. Add a tiny drop of Loctite on the set screw thread before inserting them. Always use a very small amount of Loctite liquid on the thread, otherwise it may be nearly impossible 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. 2), try push on the 2x12 pins with a small Allen wrench to make sure the set screws have locked 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).



1-2-3 Cooling Fan Casing Subassembly

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

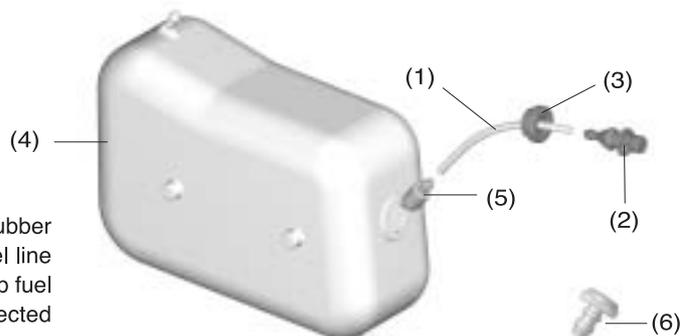
The servo tray and cooling fan shrouds on the Raptor 90 are different from the Raptor60 in order to accommodate the full head sink on the O.S 91 C-Spec. engine. If using T.T 90 or Y.S 91 or Webra 91 engine make sure to install fan shroud baffle. This will ensure optimal cooling of your engine head.



1-2-4 Fuel Tank Subassembly

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

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.



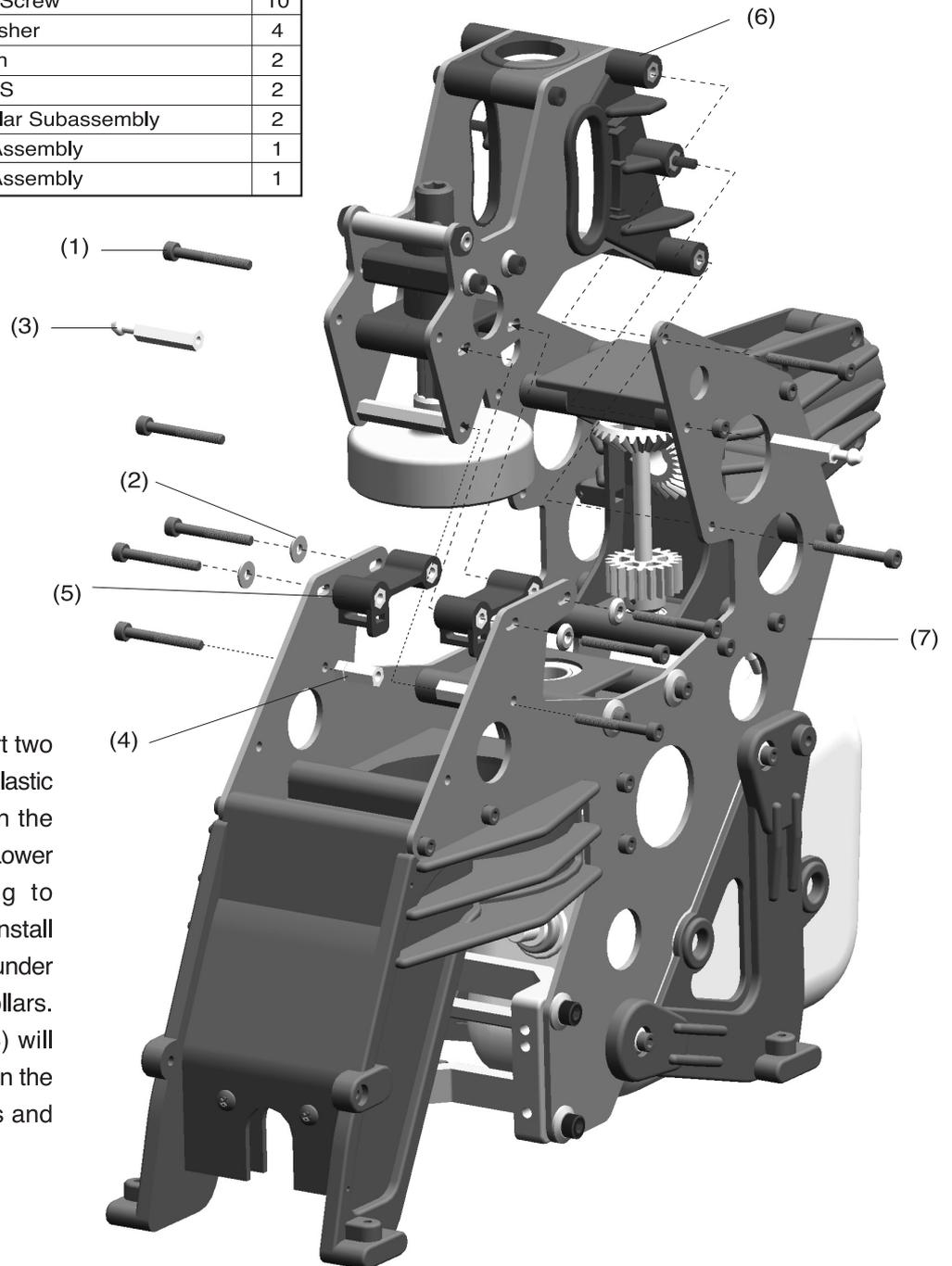
Notice there is a Fuel Plug (No.6) furnished for your convenience. You want to install a three way manifold to simplify the fueling process.

1-3

Main Frame Assembly

BAG C

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

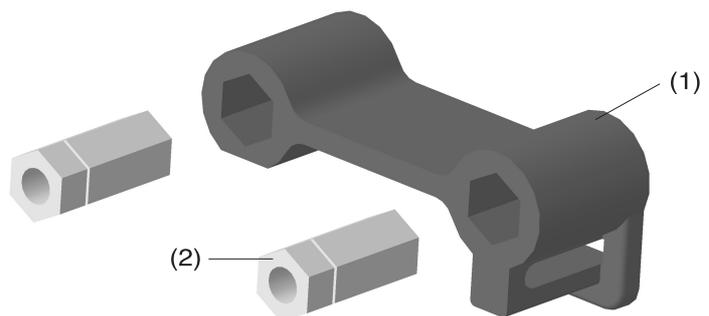


As show in Figure 1-3-1, insert two hex Frame Spacers S into the plastic Rod Guide Collars. Then join the Upper Frame Assembly to the Lower Frame Assembly according to drawing 1-3. Do not forget to install the four taper washers (No. 2) under the bolts for the Rod Guide Collars.

The two Body Pins (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

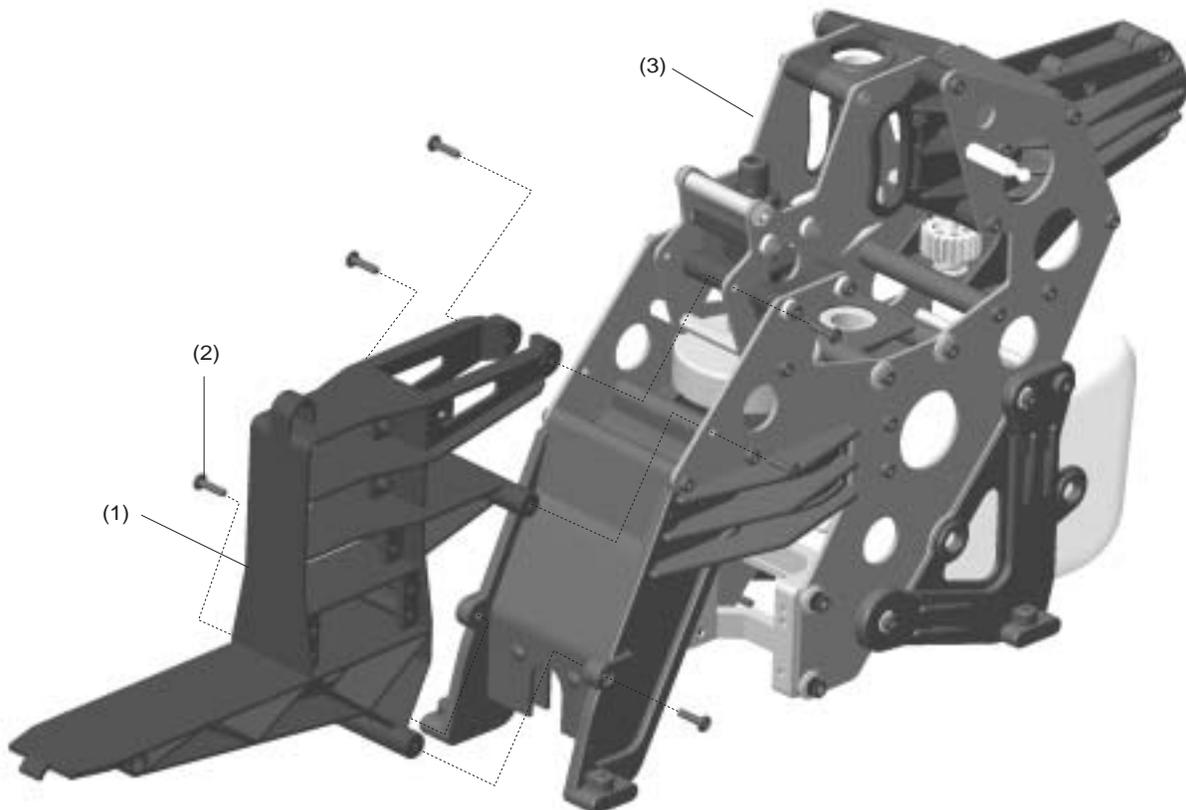


1-4

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.



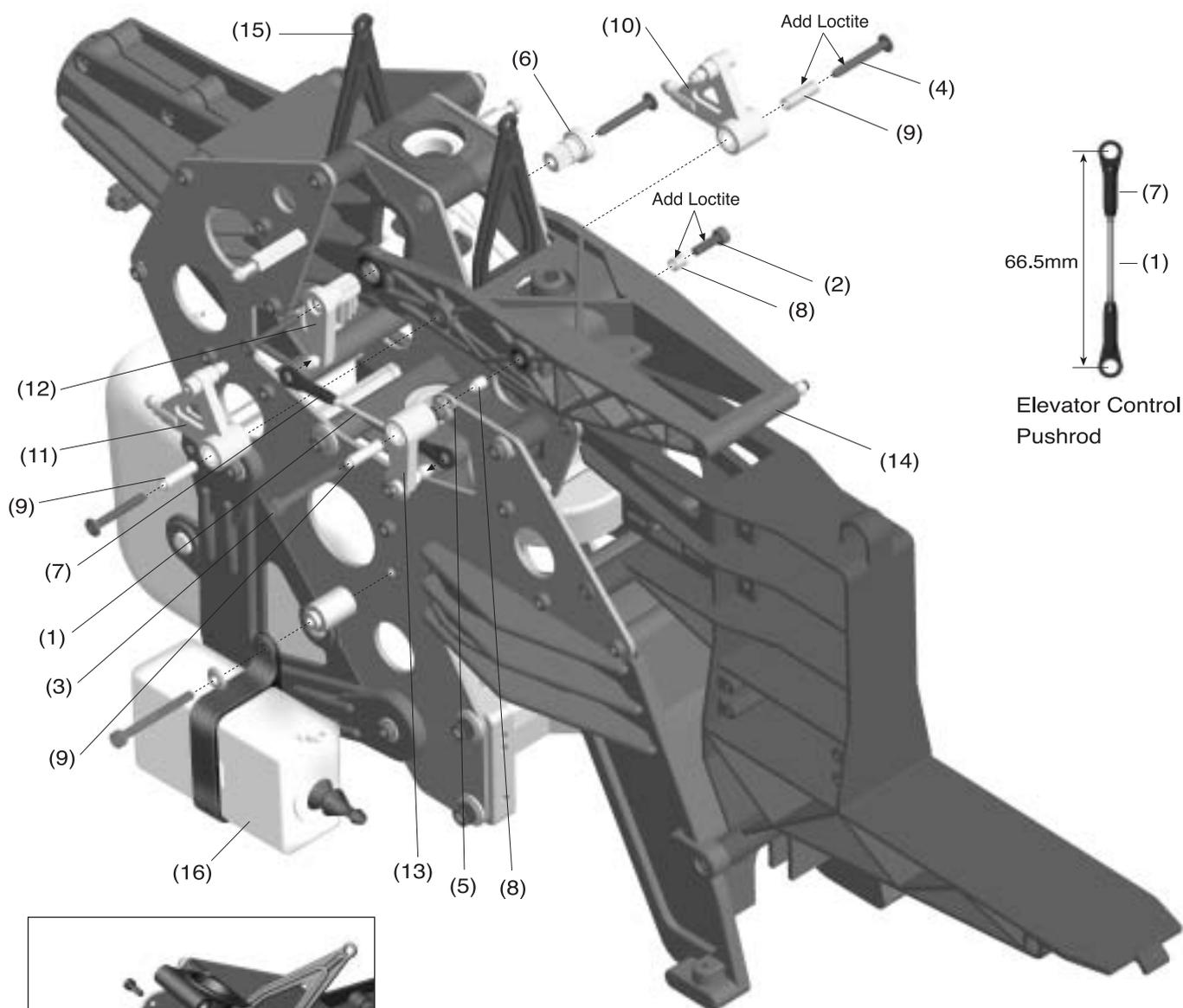
1-5

Installation of Pitch Frame BAG D

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	BK0093	2x46 Link Rod	1	9	BK0410	Collar d3xD4x13	3
2	HMC3-10B	M3x10 Socket Screw	1	10	1-5-1	Aileron Lever L Subassembly	1
3	HMC3-25B	M3x25 Socket Screw	1	11	1-5-1	Aileron Lever R Subassembly	1
4	HMJ3-20N	M3x20 Self Tapping Screw	4	12	1-5-2	Elevator Parallel Lever Subassembly	1
5	BK0088	d3xD5x0.5 Washer	1	13	1-5-3	Elevator Control Lever Subassembly	1
6	BK0020	Elevator Arm Shaft	1	14	1-5-4	Pitch Control Frame Subassembly	1
7	BK0086	Ball link 4.8x20	2	15	1-5-5	Elevator Control Arm Subassembly	1
8	BK0407	Collar d3xD4x4.5	2	16	1-5-6	Header Tank Subassembly	1

Please complete subassemblies 1-5-1 through 1-5-5 first, then add them to the Main Frame. Insert the completed Elevator Control Arm Subassembly in between the Upper Metal Sideframes first. Then fit the plastic Pitch Control Frame Subassembly. Next insert Items No. 6 Elevator Arm Shaft and No. 12 Elevator Parallel Lever Subassembly. Then secure the plastic Pitch Control Frame using No. 2 Socket Screw and No. 8 Collar on the left side and then No. 8 Collar, No. 5 Washer, No. 13 Elevator Control Lever, No. 9 Collar and No. 3 Socket Screw for the right side. Adjust the two bolts (No. 2 and No. 3) 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 51 for actual measurement.)

Before installing the Aileron Levers (No. 10 and No. 11), please add a small drop of Loctite on the M3x20 Self Tapping Screw (No. 4) and on the outside of the collar d3xD4x13 (No. 9). Please do the same for parts No. 2 and No. 8 and No. 3 and No. 9.

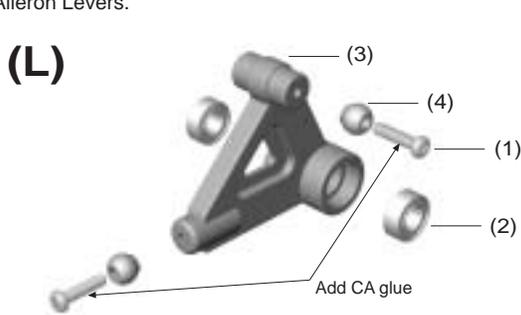


When installing the elevator control arm subassembly, temporarily remove the two screws that hold the rear of the upper BRG subassembly in place and move it up out of the way.

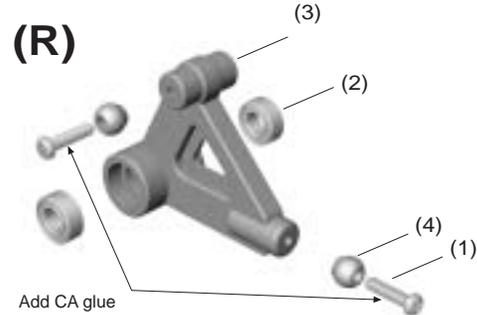
1-5-1 Aileron Lever Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	2
2	HMV840ZZ	d4xD8x3 BRG	2
3	BK0340	Aileron Control Arm	1
4	BK0075	Link Ball 4.8	2

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.

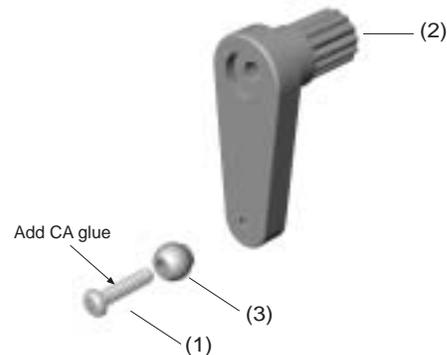


No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	2
2	HMV840ZZ	d4xD8x3 BRG	2
3	BK0340	Aileron Control Arm	1
4	BK0075	Link Ball 4.8	2



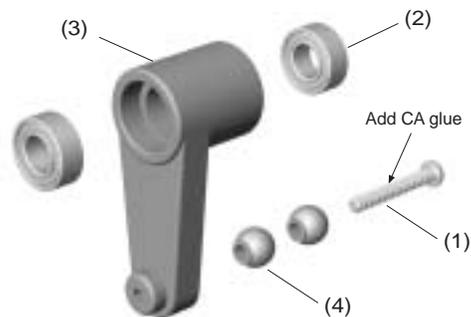
1-5-2 Elevator Parallel Lever Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	1
2	BK0337	Elevator Arm Parallel Lever	1
3	BK0075	Link Ball 4.8	1



1-5-3 Elevator Control Lever Subassembly

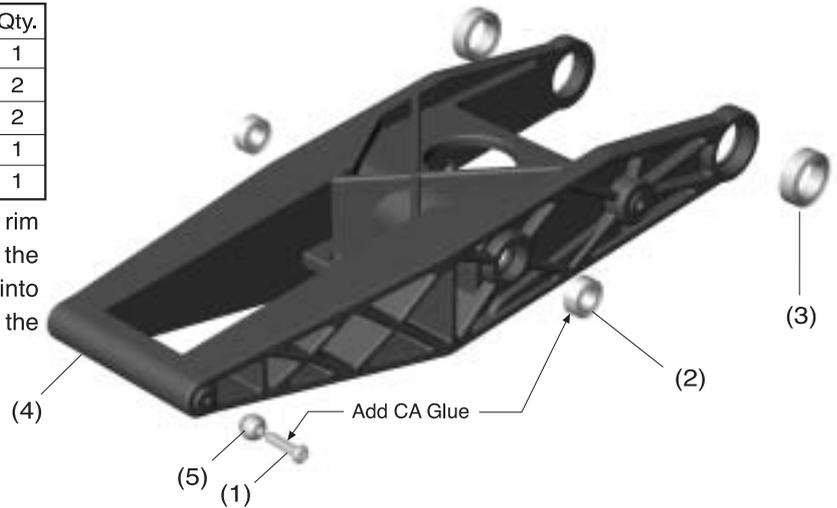
No.	Material No.	Description	Qty.
1	HMJ2-14N	M2x14 Self-Tapping Screw	1
2	HMV840ZZ	d4xD8x3 BRG	2
3	BK0338	Elevator Control Lever	1
4	BK0075	Link Ball 4.8	2



1-5-4 Pitch Control Frame Subassembly

No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Self-Tapping Screw	1
2	HMV840ZZ	d4xD8x3 BRG	2
3	HMV1280	d8xD12x3.5 BRG	2
4	BK0336	Pitch Frame	1
5	BK0075	Link Ball 4.8	1

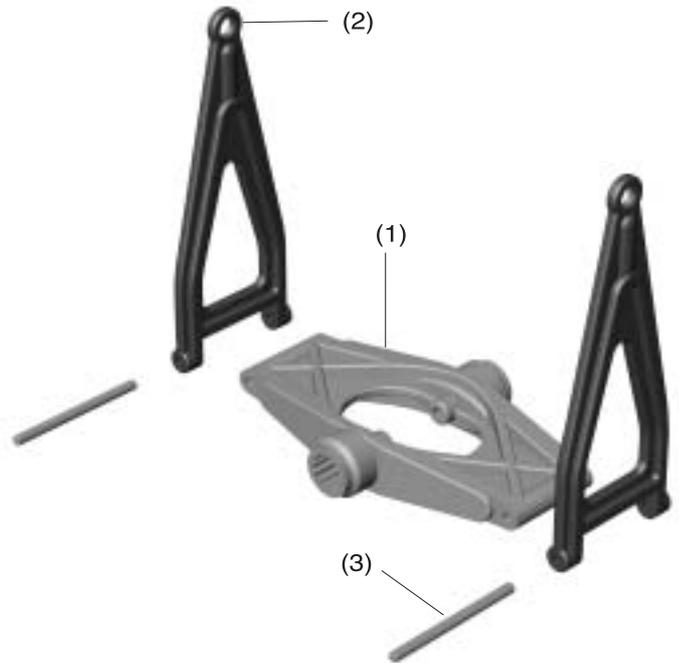
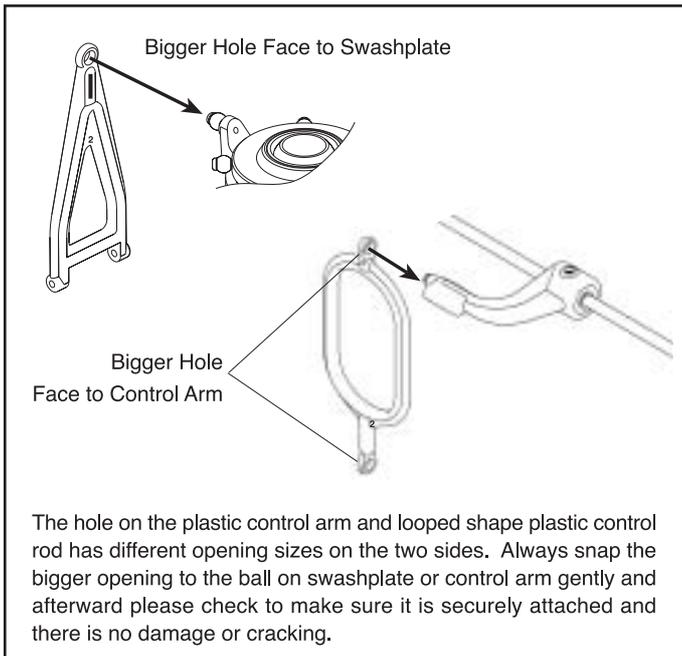
Optional: add a tiny drop of thick CA on the outside rim of the four ball bearings before inserting them into the plastic Pitch Frame. Be careful not to get any glue into the ball bearings. Add a tiny drop of thick CA glue at the tip of the M2x10 self-tapping screw (No. 1) before screwing it into the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



1-5-5 Elevator Control Arm Subassembly

No.	Material No.	Description	Qty.
1	BK0339	Elevator Control Arm	1
2	BK0663	Elevator Arm Link	2
3	BK0413	Pin 2x29	2

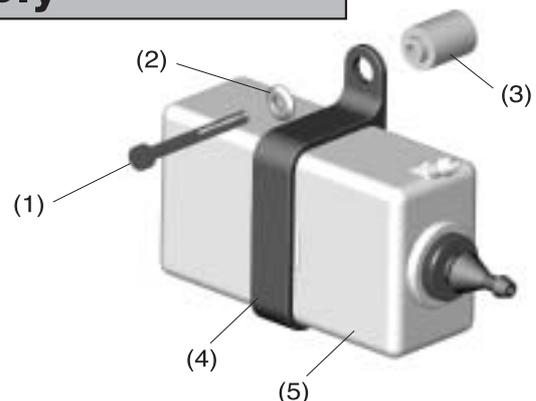
INSTALLATION OF THE RODS



1-5-6 Header Tank Subassembly

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

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



1-6

Installation of Main Shaft BAG E

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	BK0093	2x46 Link Rod	2	6	BK0234	Lock Ring	1
2	HMC3-6B	M3x6 Socket Screw	2	7	BK0086	Ball Link 4.8x2.0	4
3	HMM4B	M4 Locknut	1	8	1-6-1	Wash Out Subassembly	1
4	BK0617	M4x25 Bolt	1	9	1-6-2	Swashplate Subassembly	1
5	BK0547	Hardened Main Shaft	1	10	1-6-3	Main Gear Subassembly	1

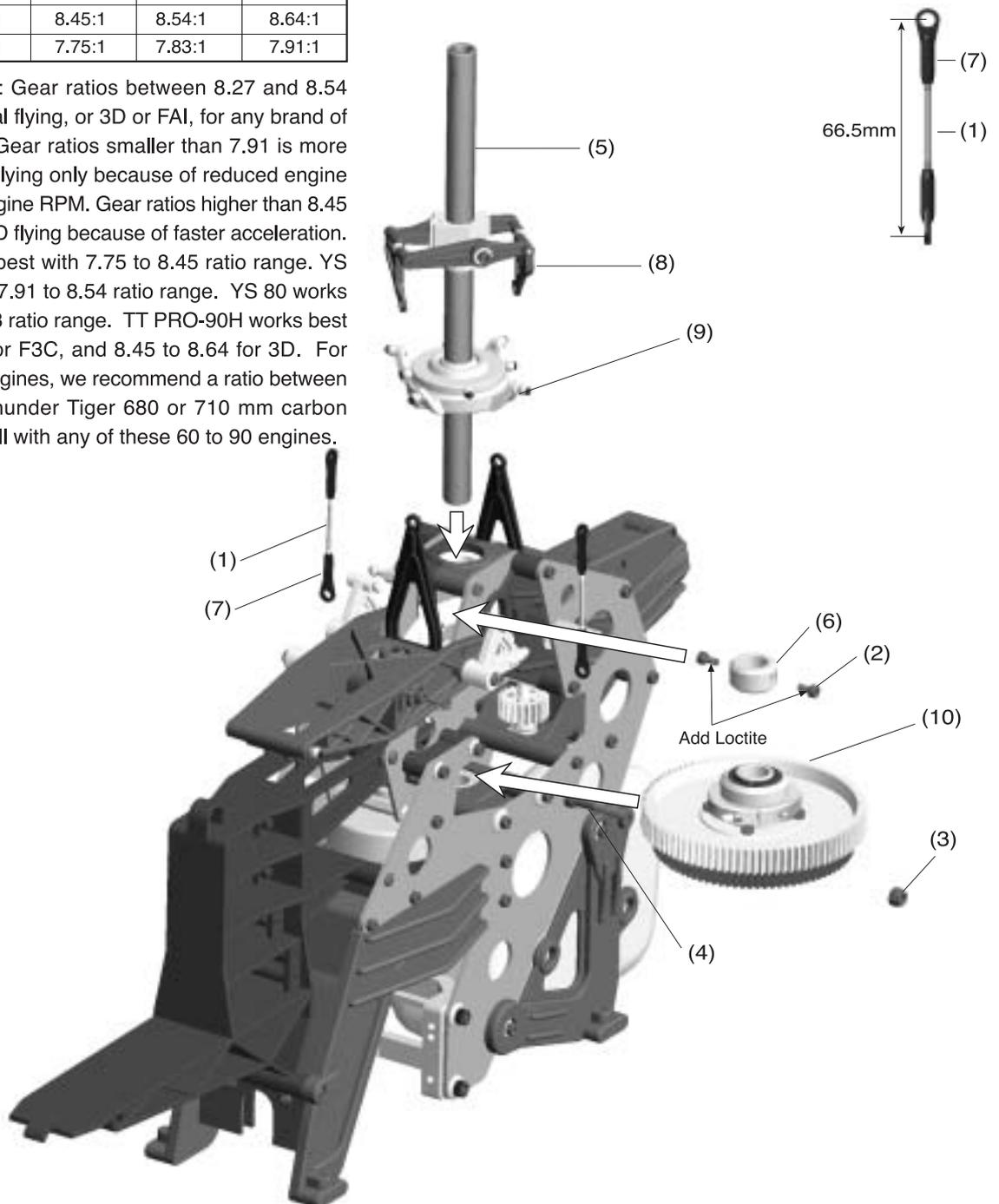
Assemble the constant drive Main Gear Subassembly according to Figure 1-6-3 first. Then build-up the Wash Out Subassembly and Swashplate Subassembly according to 1-6-1 and 1-6-2. Insert the No.5 Main Shaft into the bearings and then add the No.6 Lock Ring and slide in the Main Gear Subassembly. Add two M3x6 Socket 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 rotor, 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.

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.

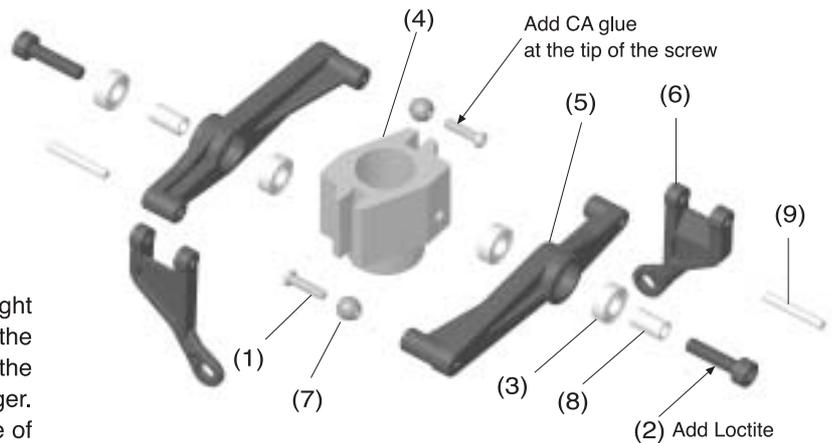


1-6-1 Wash Out Subassembly

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	BK0472	Wash Out Base	1
5	BK0342	Flybar Control Lever	2
6	BK0343	Wash Out Link	2
7	BK0075	Link Ball 4.8	2
8	BK0409	Collar d3xD4x7	2
9	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 slop free control system. Do not let the Loctite seep into the bearing. Adjust the tightness of the M3x12 bolts so the mixing arms can move freely but without wobble or ratcheting 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. 5).

1-6-2 Swashplate Subassembly

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

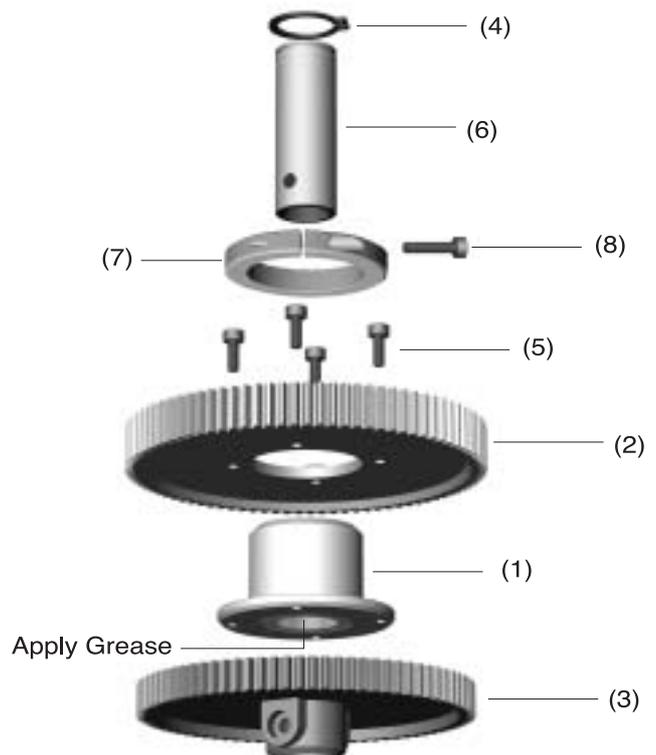
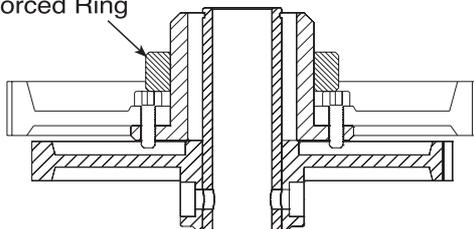


1-6-3 Main Gear Subassembly

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

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

Reinforced Ring



2

ROTOR HEAD ASSEMBLY



2-1

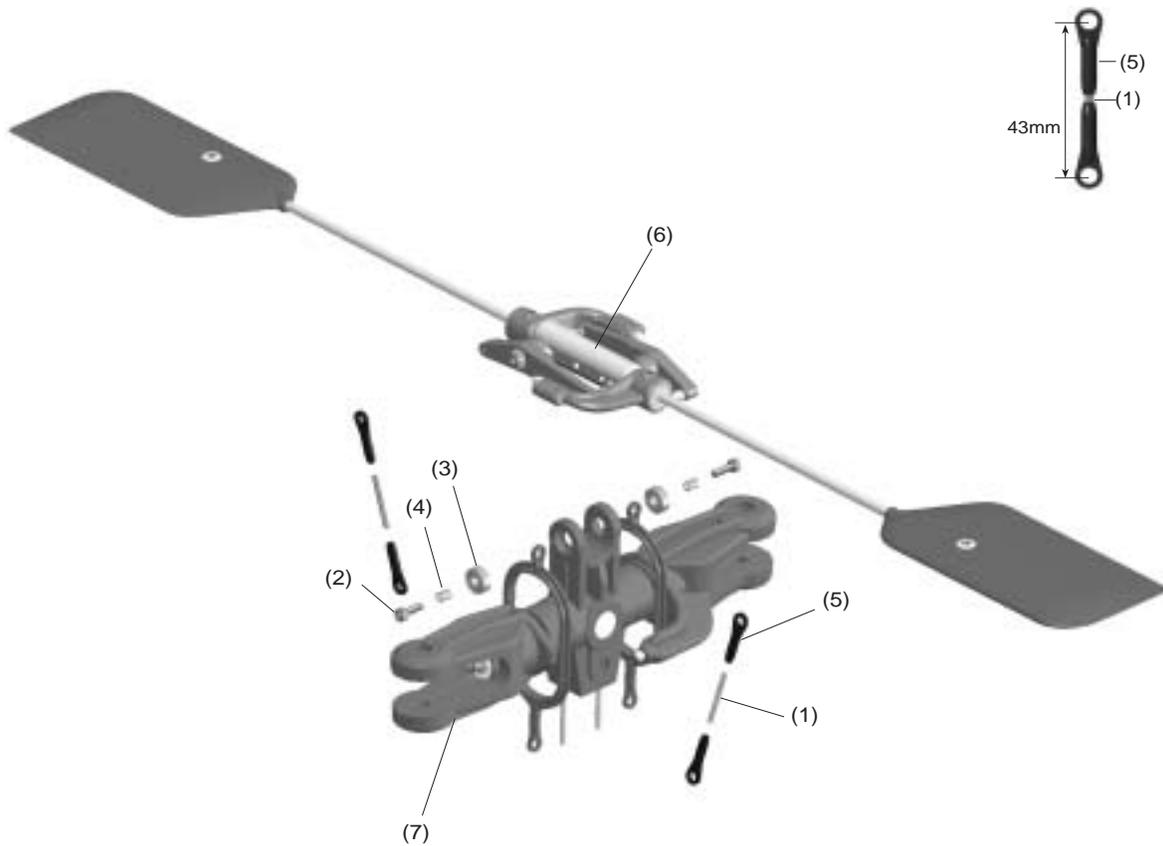
Rotor Head Assembly

BAG F

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	BK0292	2.3x24 Link Rod	2	5	BK0086	Ball Link 4.8	4
2	HMC3-10B	M3x10 Socket Screw	2	6	2-1-1	Flybar Seesaw Subassembly	1
3	HMV694ZZ	d4xD11x4 BRG	2	7	2-1-2	Main Rotor Hub Subassembly	1
4	BK0408	Collar d3xD4x5.5	2				

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 No.2 Socket Screws, No. 3 Bearing. Please add a small drop of Loctite along the entire length of the M3x10 Socket Screw (No.2) and on the outside of the collar d3xD4x5.5(No.4).

Link the pushrod onto the Rotor Grip and Mixing Lever (See illustration in P.28)



2-1-1 Flybar Seesaw Subassembly

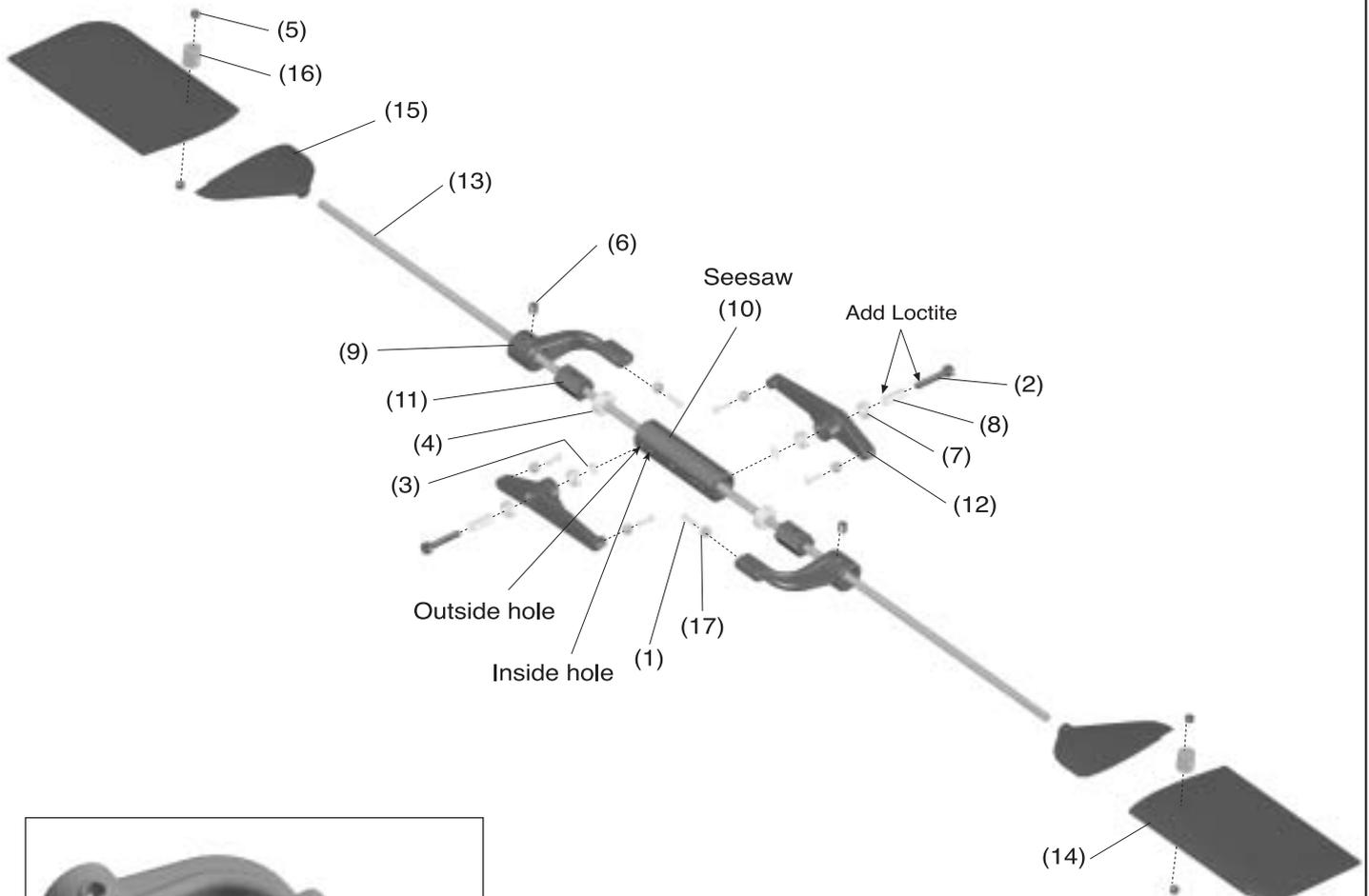
No.	Material No.	Description	Qty.
1	HMJ2-10N	M2x10 Selfing-Tapping Screw	6
2	HMC3-18B	M3x18 Socket Screw	2
3	BK0088	d3xD5x0.5 Washer	2
4	HMV694ZZ	d4xD11x4 BRG	2
5	HME4-3B	M4x3 Set Screw	4
6	HME4-5B	M4x5 Set Screw	2
7	HMV840ZZ	d4xD8x3 BRG	4
8	BK0410	Collar d3xD4x13	2
9	BK0655	Flybar Control Arm	2

No.	Material No.	Description	Qty.
10	BK0322	Flybar Seesaw Hub	1
11	BK0323	Flybar Arm Bushing	2
12	BK0324	Mixing Lever	2
13	BK0640	Flybar Rod	1
14	BK0432	Flybar Paddle	2
15	BK0406	Paddle Root	2
16	BK0416	Paddle Stopper	2
17	BK0075	Link Ball 4.8	6

Begin by attaching six No.17 Link Balls to the No.9 Flybar Control Arms and No.12 Mixing levers using No.1 Screws. Slide No.4 BRG, No.11 Fly Arm Bushing and No.9 Flybar Control Arm onto the No.12 Flybar Rod. From the other end of the Flybar Rod, slide on the No.10 Seesaw Hub and the other No.4, 9, 11. Make sure the Flybar has equal protruding from each side of the Seesaw Hub, then install and tighten the No.6 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.5 set screws.

Assemble and install the No.12 Mixing Levers and No.7 Bearings according to the drawing using No.8 Collar so it will stay with the inside surface of the ball bearing. Be careful do not let the Loctite seep into the bearings.

Note: Before installing the Mixing Lever (No.12), please add a small drop of Loctite along the entire length of the M3x18 socket screw (No.2) and on the outside of the collar d3xD4x13 (No.8). 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 plastic flybar control arm.



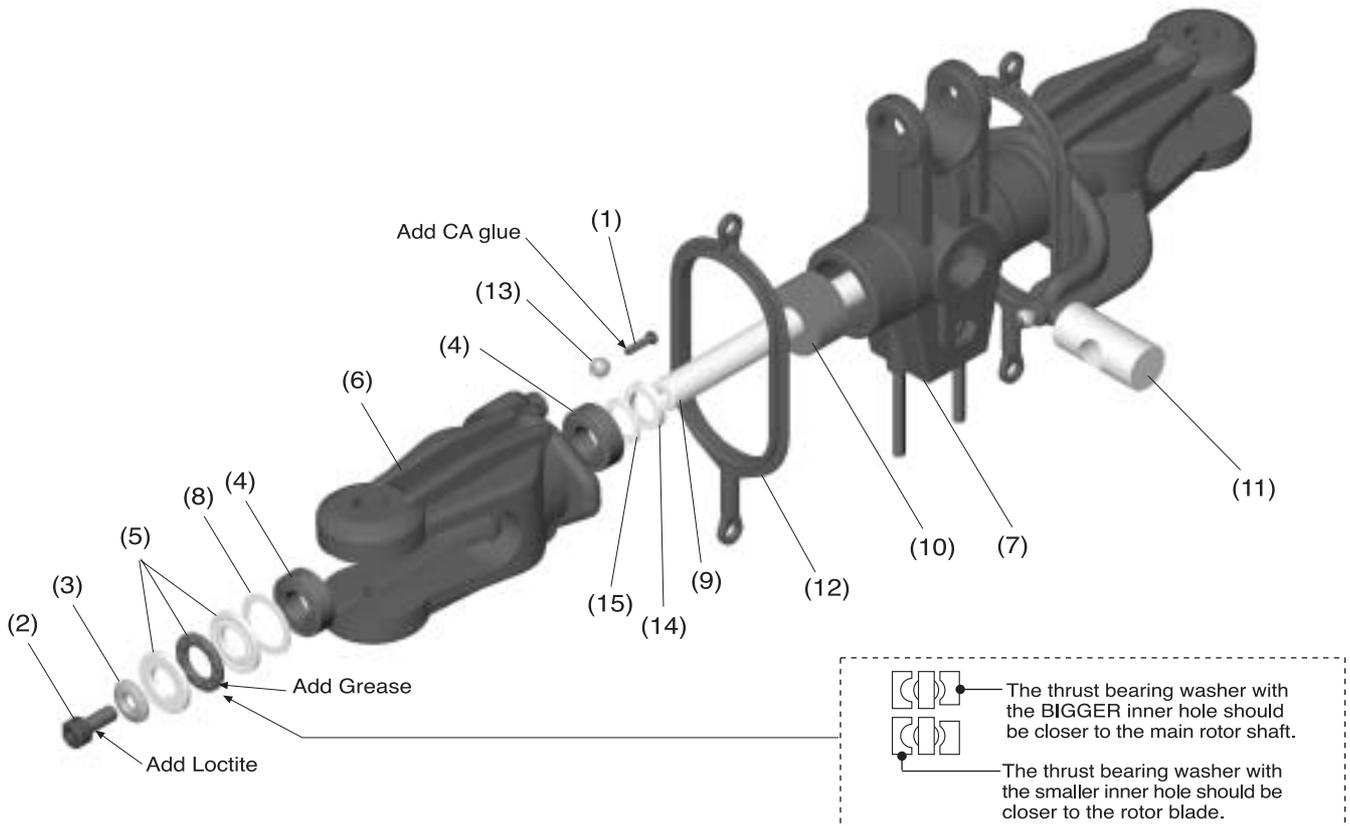
Install the Link Ball at the inside hole is recommended for 3D flying.
For FAI or less control sensitivity then use outside hole.

2-1-2 Main Rotor Hub Subassembly

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HMJ2-12N	M2x12 Selfing-Tapping Screw	2	9	BK0326	Spindle	1
2	HMC4-10B	M4x10 Socket Screw	2	10	BK0656	70 Durometer Flap Damper	2
3	BK0435	d4xD11x1.7 Washer	2	11	BK0330	Main Rotor Hub Pin	1
4	HMV1680	d8xD16x5 BRG	4	12	BK0664	Flybar Control Rod	2
5	HMX0816	d8x16x5 Thrust Bearing	2	13	BK0075	Link Ball 4.8	2
6	BK0319	Main Rotor Pitch Housing	2	14	BK0477	Washer	2
7	BV0321	Main Rotor Hub	1	15	BK0703	Flap Damper Washer 0.4mm	6
8	BK0325	Thrust Washer	2				

Push two No.11 Main Rotor Pin into the No.7 Main Rotor Hub then add the two No.10 Flap Dampers. (It might need to apply silicone grease for easy installation). Push the No.9 Feathering Spindle into the dampers and the rotor hub. Add No. 12 Flybar Control Rod (see page 16 installation of the rods). Install No.13 Link Ball on the Main Rotor Grip using a No.1 screw. Next install two No. 4 bearings into the Main Rotor Grip followed by No.8 Thrust Washer and No.5 Thrust bearings. When installing the Thrust Bearing, please onto the two metal discs for the thrust bearing have different inner hole sizes. Find out the inner hole size by sliding them one at a time onto the feathering spindle. The disc with the "larger" inner hole will be placed closer to the main rotor hub. The disc with the smaller inner hole should be placed outboard, means closer to the main rotor blades. This is critical. Slide both finished Main Rotor Grip onto the feathering spindle and the secure with two M4x10 bolts and washers according to the drawing.

Please add some grease on the thrust bearing balls (No.5). Add a small drop of Loctite on the threads of M4x10 socket screw (No.2). Add a tiny drop of thick CA glue at the tip of the M2x10 Self-tapping screw (No.1) before screwing it into the Main Rotor Grip.



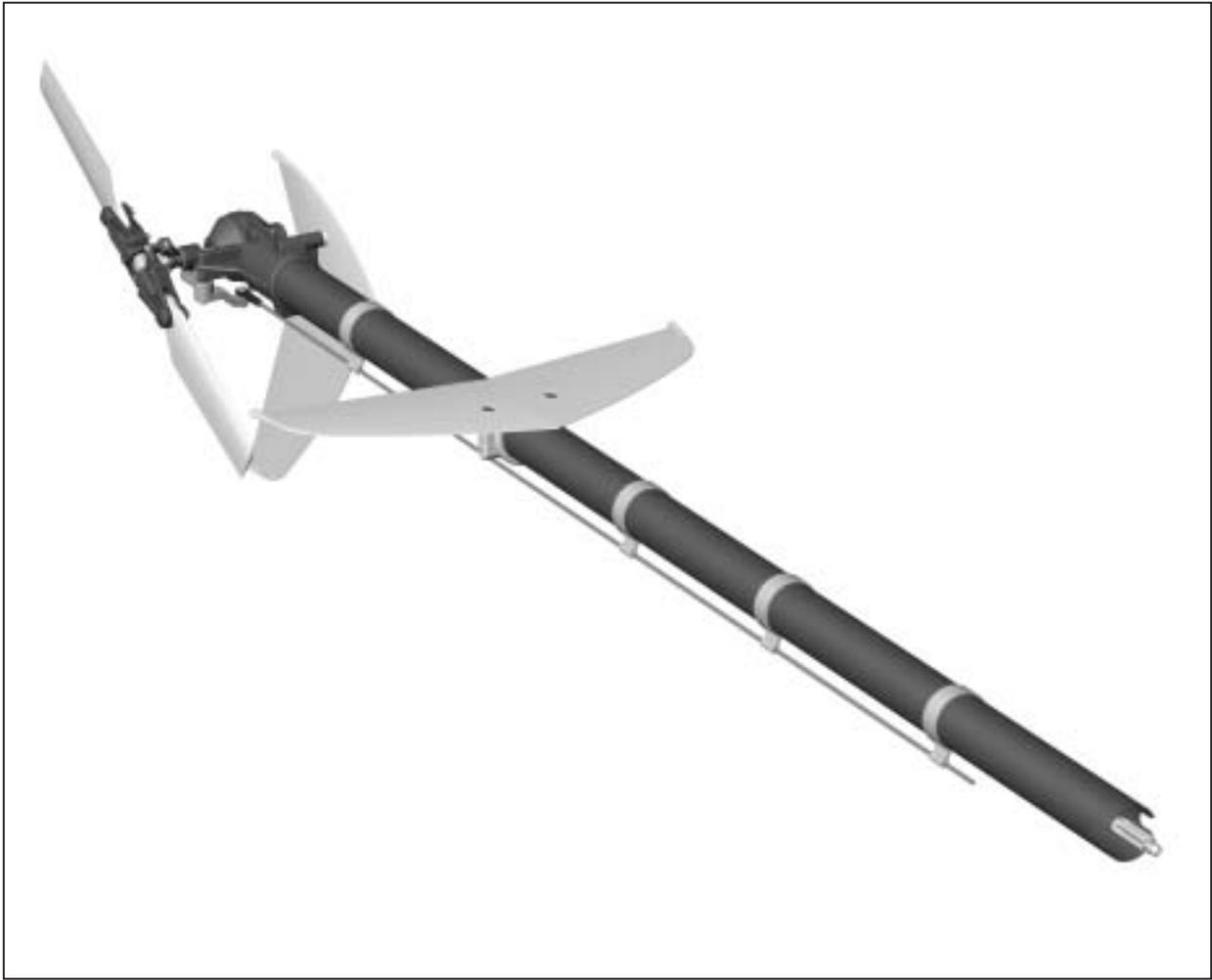
Important Note:

The stock Raptor 90 kits come with blue color flap damper that are of 70 degree durometer stiffness. This is good for F3C and beginner to advance 3D flying. For very aggressive 3D flying, the pilot may choose to experiment adding from one up to three 0.4mm thick shim (No.15) washers between the collar (No.14) and bearing (No.4) to further stiffen the main rotor flapping. There is also an optional red 80 degree durometer hard damper for 3D flying.

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 optional Thunder Tiger metal rotor hub, the cyclic response will be even quicker, and the fuselage oscillation RPM region will be raise up to around 1650 RPM . 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 above the oscillation RPM. Note, this oscillation characteristic exists for all helicopters, except when the stock blue dampers are used, the resonant rotor speed is below 1400 RPM, that is why it is not noticed. 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.

3

TAIL ASSEMBLY



3-1

Tail Assembly

BAG G

No.	Material No.	Description	Qty.
1	HMM3B	M3 Locknut	4
2	HSE3-12B	M3x12 Self-Tapping Screw	2
3	HMC3-14B	M3x14 Socket Screw	2
4	HMC3-30B	M3x30 Socket Screw	2
5	BK0653	Tail Control Rod B	1
6	BK0650	Tail Boom	1
7	BK0403	Rod Guide	4
8	BK0399	Vertical Fin	1

No.	Material No.	Description	Qty.
9	BK0400	Stabilizer Fin	1
10	BK0401	Stabilizer Fin Bracket	1
11	BK0404	Tail Rotor Blade	2
12	BK0086	Ball Link 4.8x20	1
13	3-1-1	Tail Transmission Subassembly	1
14	3-1-2	Tail Rotor Subassembly	1
15	3-1-3	Tail Drive Shaft Subassembly	1

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

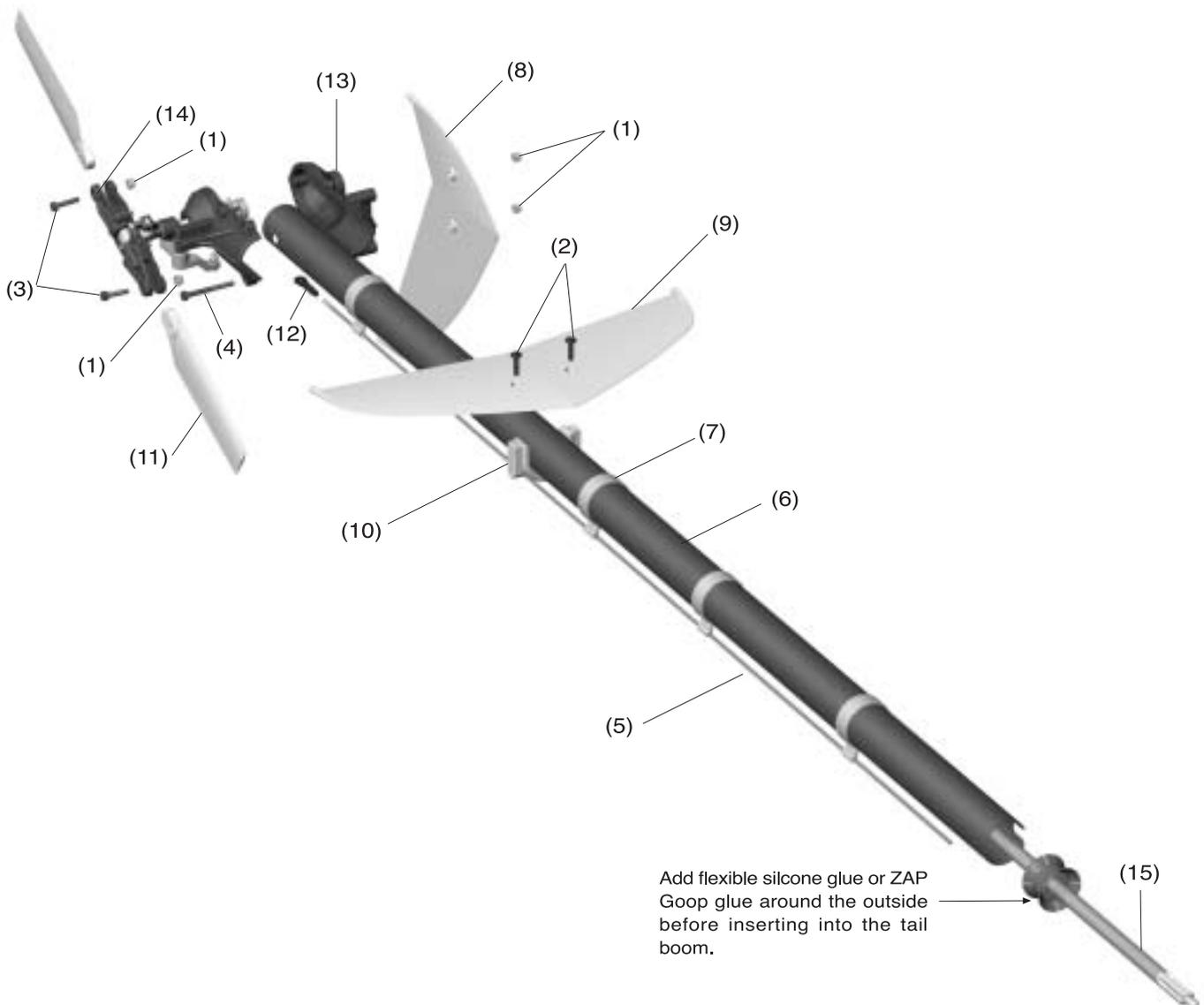
When installing the tail transmission make sure the housings match the hole on to the tail boom. Tighten the five 3 mm bolts. Add the No. 8 vertical fin and nuts.

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. 7 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.

Secure the No. 9 Stabilizer Fin and No. 10 Bracket now. Secure the No. 11 Tail Rotor Blades using No. 3 Bolts and No. 1 Locknut.



3-1-1 Tail Transmission Subassembly

No.	Material No.	Description	Qty.
1	HMV6701Z	d12xD18x4 BRG	2
2	HMJ2-8N	M2x8 Self-Tapping Screw	1
3	HMM3B	M3 Locknut	3
4	HME3-4B	M3x4 Set Screw	1
5	HMC3-10B	M3x10 Socket Screw	3
6	BK0414	Pin 2x12	1
7	HMJ3-20N	M3x20 Self-Tapping Screw	1
8	BK0088	d3xD5x0.5 Washer	1
9	HMV740ZZ	d4xD7x2.5 BRG	2

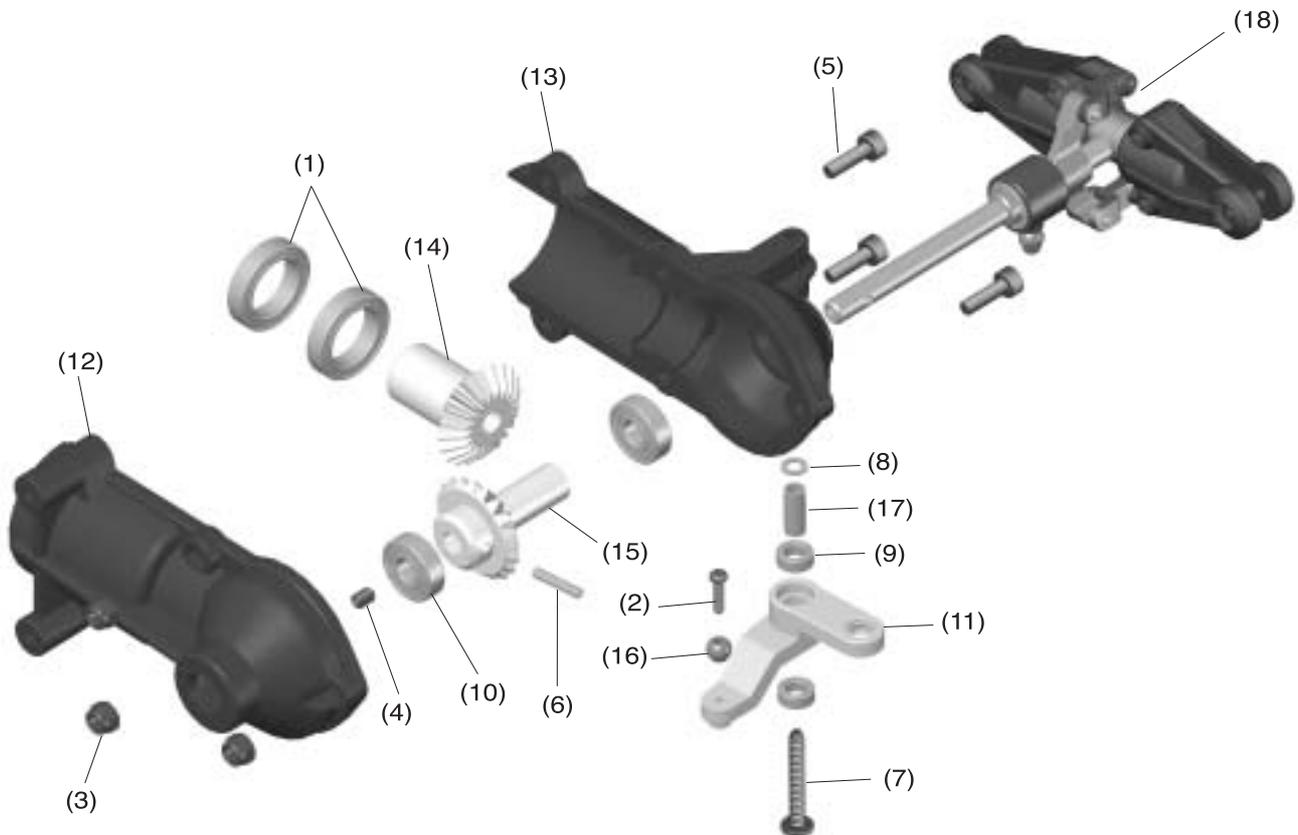
No.	Material No.	Description	Qty.
10	HMV1350	d5xD13x4 BRG	2
11	BK0346	Tail Pitch Control Lever	1
12	BK0370	Tail Case L	1
13	BK0371	Tail Case R	1
14	BK0372	Tail Input Bevel Gear	1
15	BK0373	Tail Output Bevel Gear	1
16	BK0075	Link Ball 4.8	1
17	BK0076	Collar d3xD4x10	1
18	3-1-2	Tail Rotor Subassembly	1

Install bearings No. 1 and 10 into the No. 12/13 Tail Cases. Install No. 15 Tail Bevel Gear onto the Tail Shaft. Gently tap the No. 6 Pin into the Bevel Gear and Tail Shaft. Then secure the pin with a No. 4 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. 14 and No. 15. If the gears mesh too tight, then a 5 mm i.d. washer should be added to move the gear No. 15 further out. If there exists too much freeplay, then a 5 mm i.d. washer to push gear No. 15 closer to gear No. 14.

Install the No. 11 Tail Pitch Control Lever as shown with No. 7 Self-Tapping Screw, No. 16 Bushing, and No. 8 Washer, with two No. 9 Bearings. Attach a No. 16 Link Ball with a No. 2 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	HMJ2-8N	M2x8 Self-Tapping Screw	1
2	HSE2-10B	M2x10 Self-Tapping Screw	2
3	HMC26-10B	M2.6x10 Socket Screw	4
4	HMM26B	M2.6 Locknut	4
5	HMM3B	M3 Locknut	2
6	HME3-18B	M3x18 Set Screw	2
7	HMV1050	d5xD10x4 BRG	4
8	HMV1060	d6xD10x3 BRG	2
9	BK0302-1	Tail Pitch Housing A	2
10	BK0303-1	Tail Pitch Housing B	2

No.	Material No.	Description	Qty.
11	BK0307	Tail Rotor Hub	1
12	BK0545	Metal Tail Pitch Control Fork	1
13	BK0026	Tail Pitch Control Link	2
14	BK0027	Tail Pitch Control Slider	1
15	BK0345	Tail Pitch Control Slide Bushing	1
16	BK0374	Tail Shaft	1
17	BK0075	Link Ball 4.8	1
18	BK0082	Collar d2xD3x4	2
19	BK0546	Pin 2mm	2
20	HMS15	E Ring	4

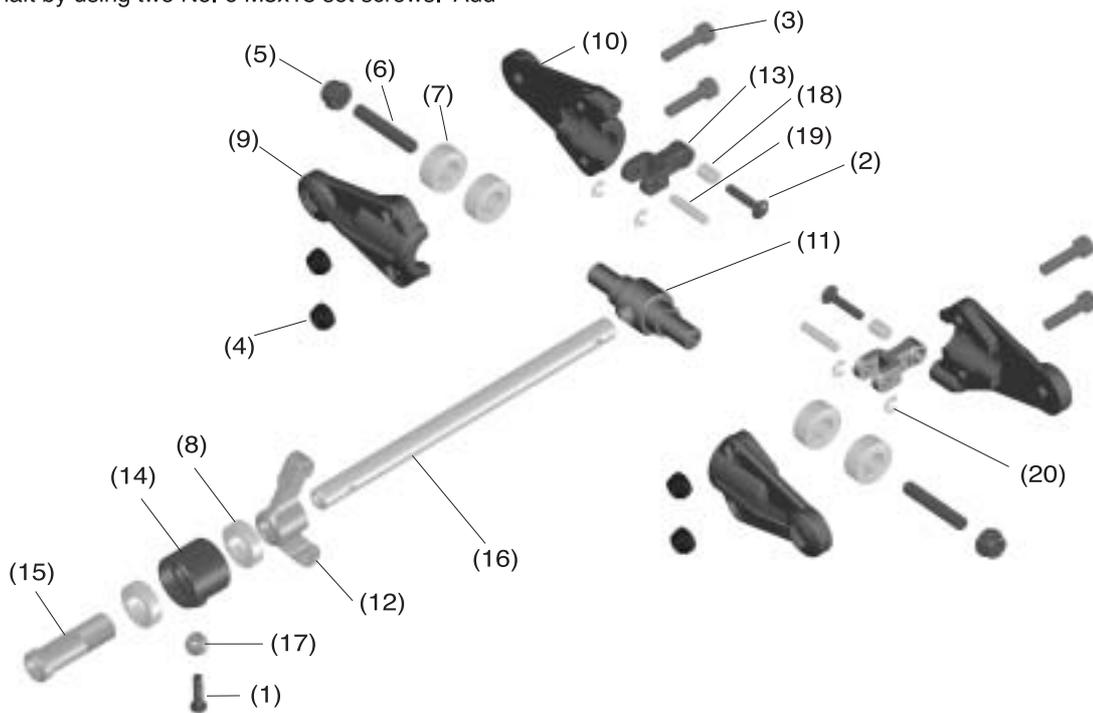
Assemble the Tail Pitch Control Slider and Pitch Control Fork according to the drawing as follows. Insert bearings No. 8 Bearings into No. 14 Tail Pitch Control Slider. Add a tiny drop of Loctite on the "outside" surface of No. 15 Tail Pitch Control Bushing, then slide it into the two bearings in the No. 14 Tail Pitch Control Slider. Thread the No. 12 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. 17 Link Ball with a No. 1 Screw. Then slide the finished pitch slider onto the tail shaft.

Now assemble the Tail Blade Grip System. First install the No. 11 Tail Rotor Hub onto the No. 16 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. 6 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. 7 Bearings. Then slide two No. 7 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. 6 set screw.

Now add the two piece plastic No. 9/10 Tail Pitch Housings. Install No. 13 Tail Pitch Control Links, No. 18 Collars, and No. 2 Screws according to the drawing.

Attach the Tail Pitch Control Links No. 13 to the Pitch Fork using the small pins, No. 19 with E-Ring No. 20.

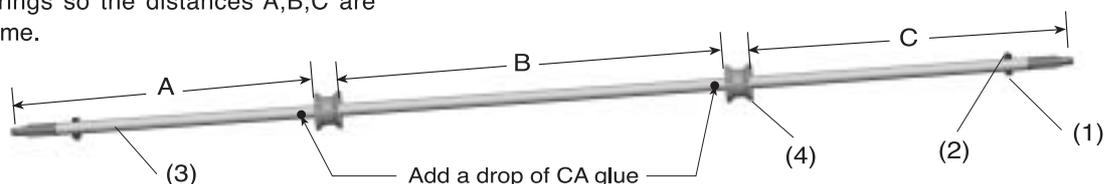


3-1-3 Tail Drive Shaft Subassembly

No.	Material No.	Description	Qty.
1	HMC2612B	M2.6x12 Socket Screw	2
2	HMM26B	M2.6 Locknut	2
3	BV0651	Tail Drive Shaft	1
4	BV0423	Tail Drive Shaft BRG	2

First slide the two support bearings over the stainless steel 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

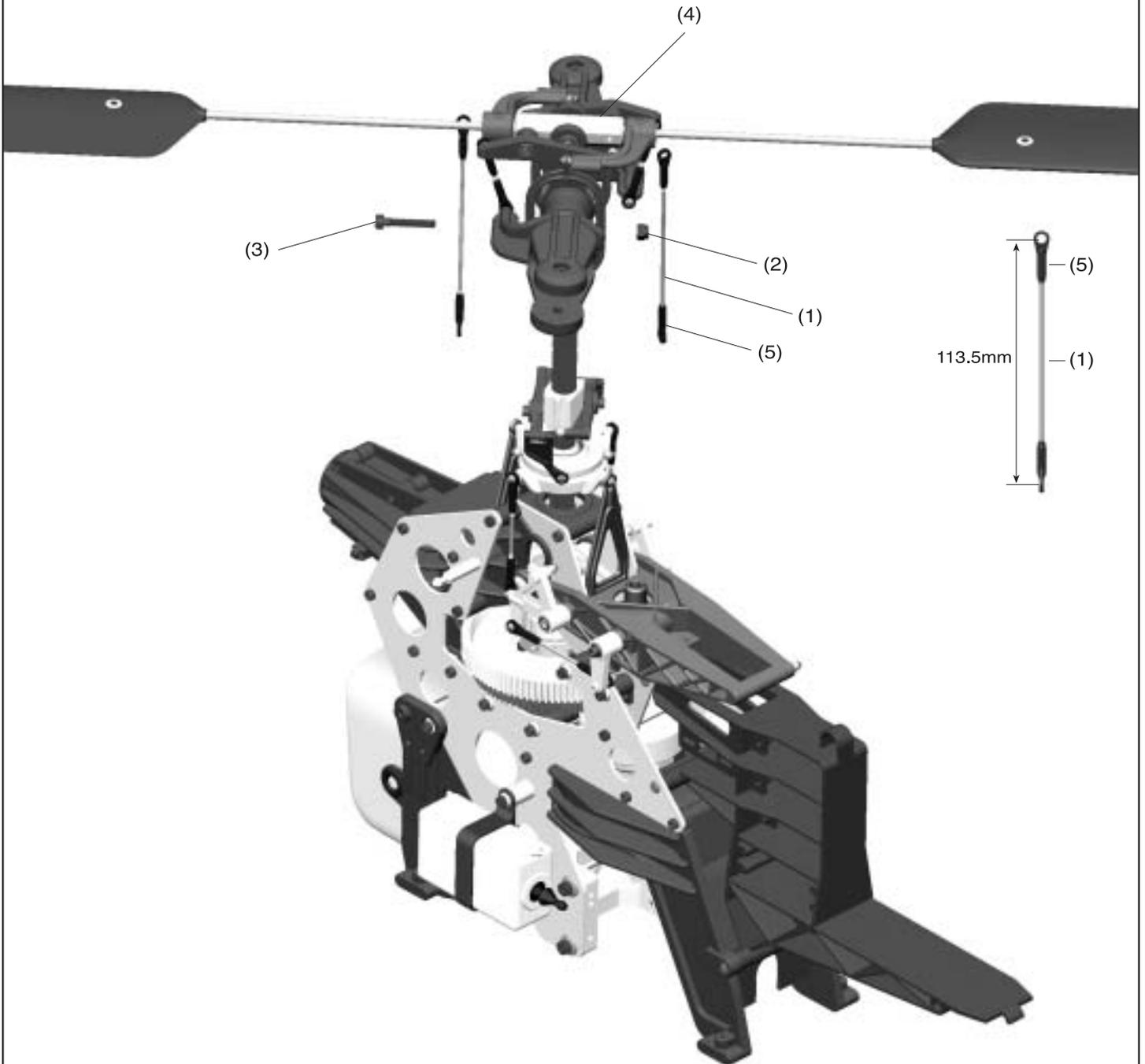


4-1

Installation of Rotor Head BAG H

No.	Material No.	Description	Qty.
1	BK0318	2.3x95 Link Rod	2
2	HMM4B	M4 Locknut	1
3	BK0617	M4 Bolt	1
4	2-1	Rotor Head Assembly	1
5	BK0086	Ball Link 4.8x20	4

Congratulation, we are almost done. Install the finished main rotor head onto the 12 mm rotor main shaft. Secure it with a No. 3 M4x25 Bolt and No. 2 4 mm locknut. Make up two 113.5 mm long pushrods and attach them to the Bell-Hiller mixing arm.

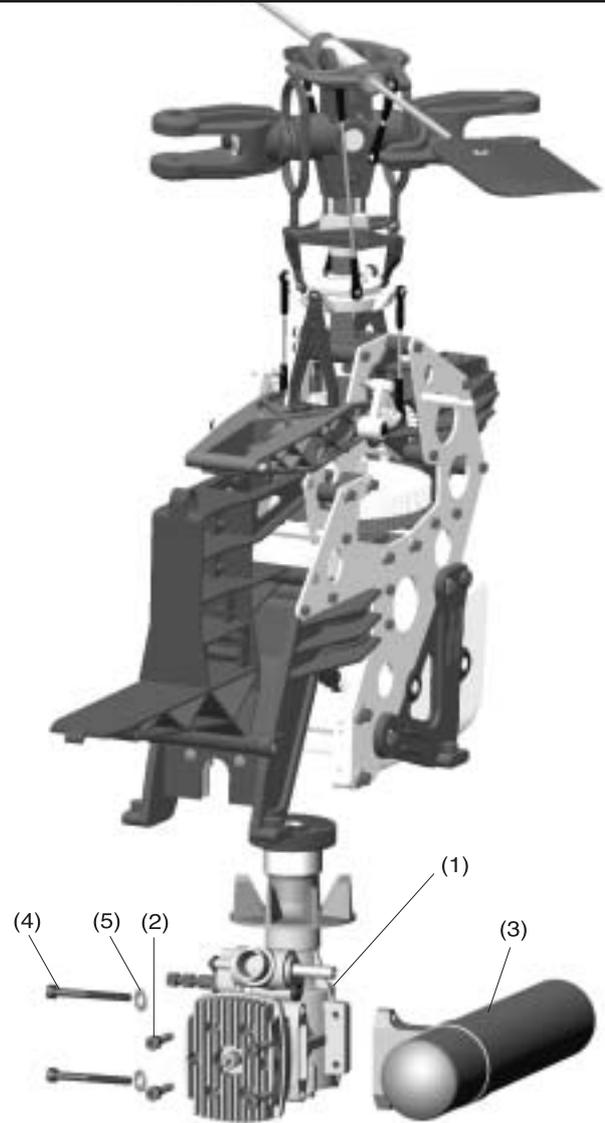


4-2

Installation of Engine

No.	Material No.	Description	Qty.
1	4-2-1	Engine Subassembly	1
2	HMC4-18B	M4x18 Socket Screw	4
3	BK0704	Muffler (90)	1
4	HMC4-42B	M4x42 Muffler Bolt	2
5	HMT4B	Spring Washer	2

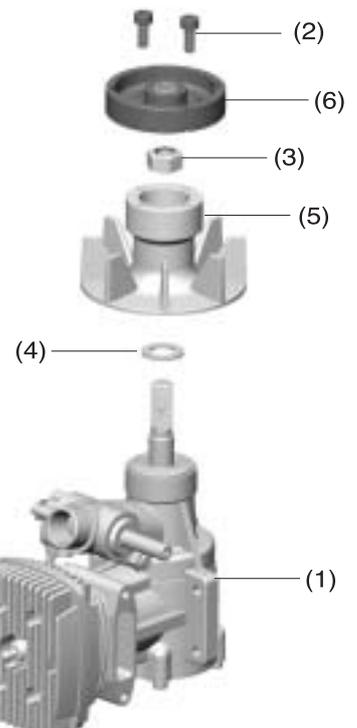
Insert the engine into the side frames, using four M4x18 bolts and four washers, but do not tighten until Section 6-1.



4-2-1 Engine Subassembly

No.	Material No.	Description	Qty.
1	*****	Heli Engine	1
2	HMC4-8B	M4x8 Socket Screw	2
3	*****	Nut (Comes With Heli Engine)	1
4	HMO10	d9.5xD16x1 Washer	1
5	BV0380	Cooling Fan	1
6	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. 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 otherwise heating of crank and Fan Hub will be required in order to remove. Tighten the engine nut using a socket head wrench while grabbing the plastic fan with a towel. The nut should be tightened securely, but do not over torque it because you may damage the plastic fan, or the plastic fan may come apart from the aluminum fan hub. 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 fan hub with threads for the YS engine(PV0198YS). Thunder Tiger also make optional CNC machined precision metal cooling fans (PV0293 and PV0293YS) for the ultimate in performance and aesthetic.

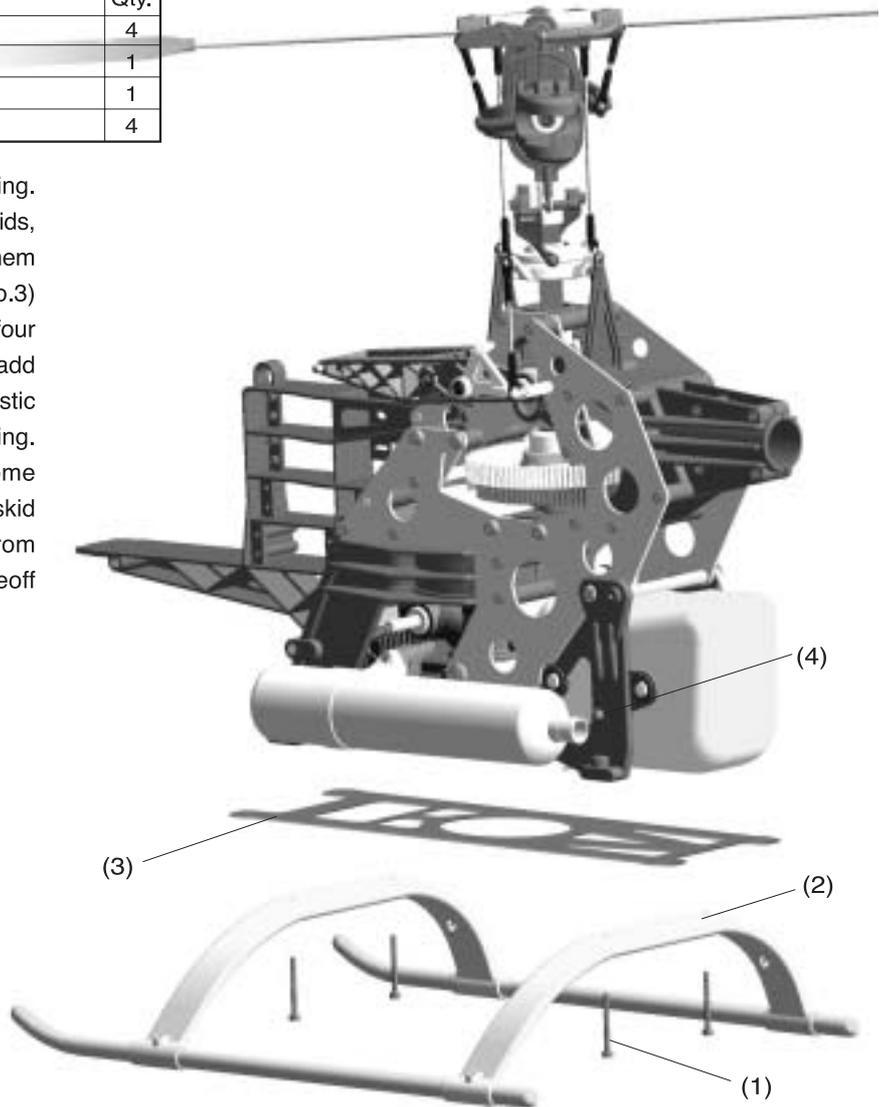


4-3

Installation of Landing Skid

No.	Material No.	Description	Qty.
1	HMC3-30B	M3x30 Socket Screw	4
2	4-3-1	Skid Subassembly	1
3	BK0529	Carbon Base Plate	1
4	HMM3B	M3 Locknut	4

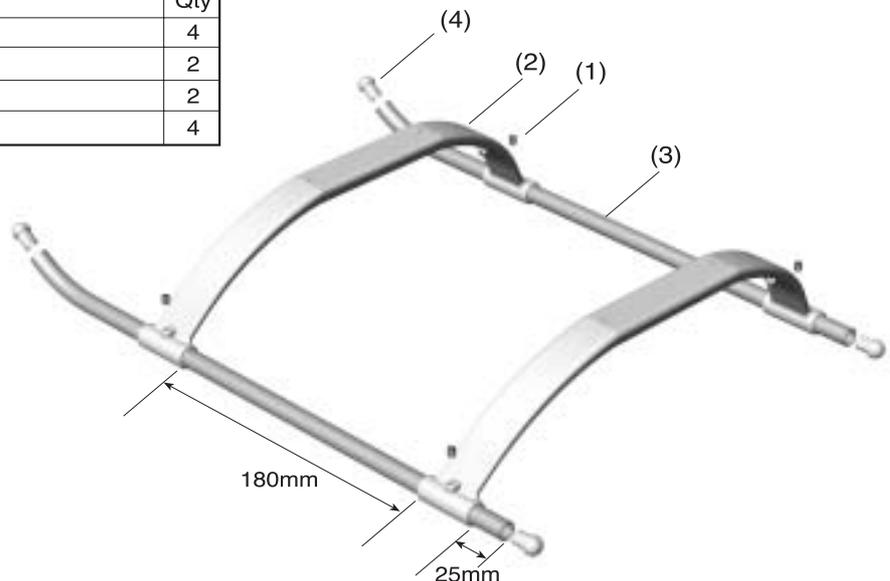
Make up the landing gear according to the drawing. After inserting the four plastic end caps into the skids, add some CA glue around the edges to prevent them from rotating. Please add Carbon Base Plate (No.3) before assembly the skid to the helicopter using four Socket Screws with Locknuts. You may 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	M4x5 Set Screw	4
2	BK0397	Skid Brace	2
3	BK0668	Skid Pipe	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.

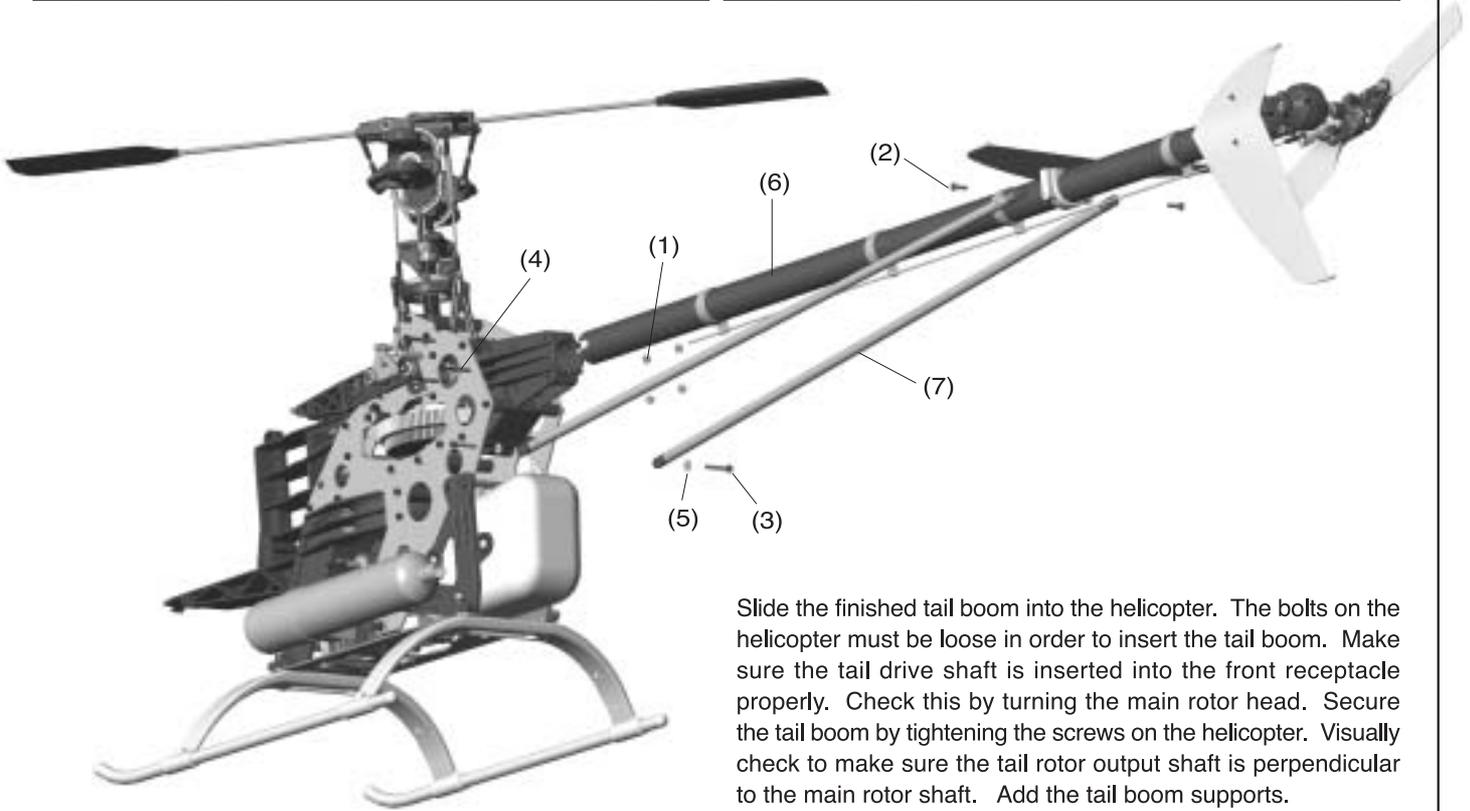


4-4

Installation of Tail Assembly

No.	Material No.	Description	Qty.
1	HMM3B	M3 Locknut	4
2	HSE3-12B	M3x12 Self-Tapping Screw	2
3	HMC3-20B	M3x20 Socket Screw	2
4	HMC3-25B	M3x25 Socket Screw	4

No.	Material No.	Description	Qty.
5	BK0087	d3xD8x1.4 Washer	2
6	3-1	Tail Assembly	1
7	4-3-1	Tail Support Subassembly	2



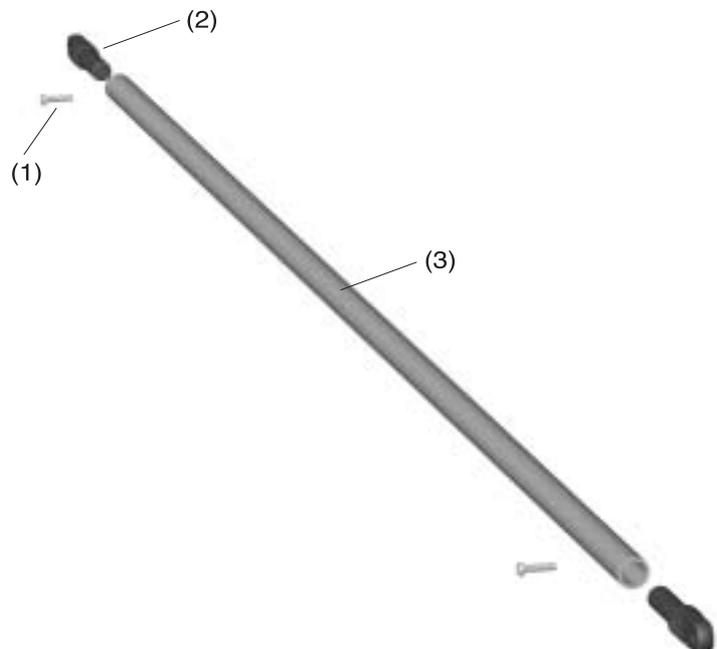
Slide the finished tail boom into the helicopter. The bolts on the helicopter must be loose in order to insert the tail boom. Make sure the tail drive shaft is inserted into the front receptacle properly. Check this by turning the main rotor head. Secure the tail boom by tightening the screws on the helicopter. Visually check to make sure the tail rotor output shaft is perpendicular to the main rotor shaft. Add the tail boom supports.

4-4-1 Tail Support Subassembly

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

Secure the two plastic ends to the aluminum tube with two 2 mm self tap screws, making sure the two plastic ends are parallel to each other.

After tightening the M2x8 screws, you may add a drop of thin CA glue around the seam between the plastic ends and the aluminum tube.



5

INSTALLATION OF PERIPHERAL EQUIPMENT

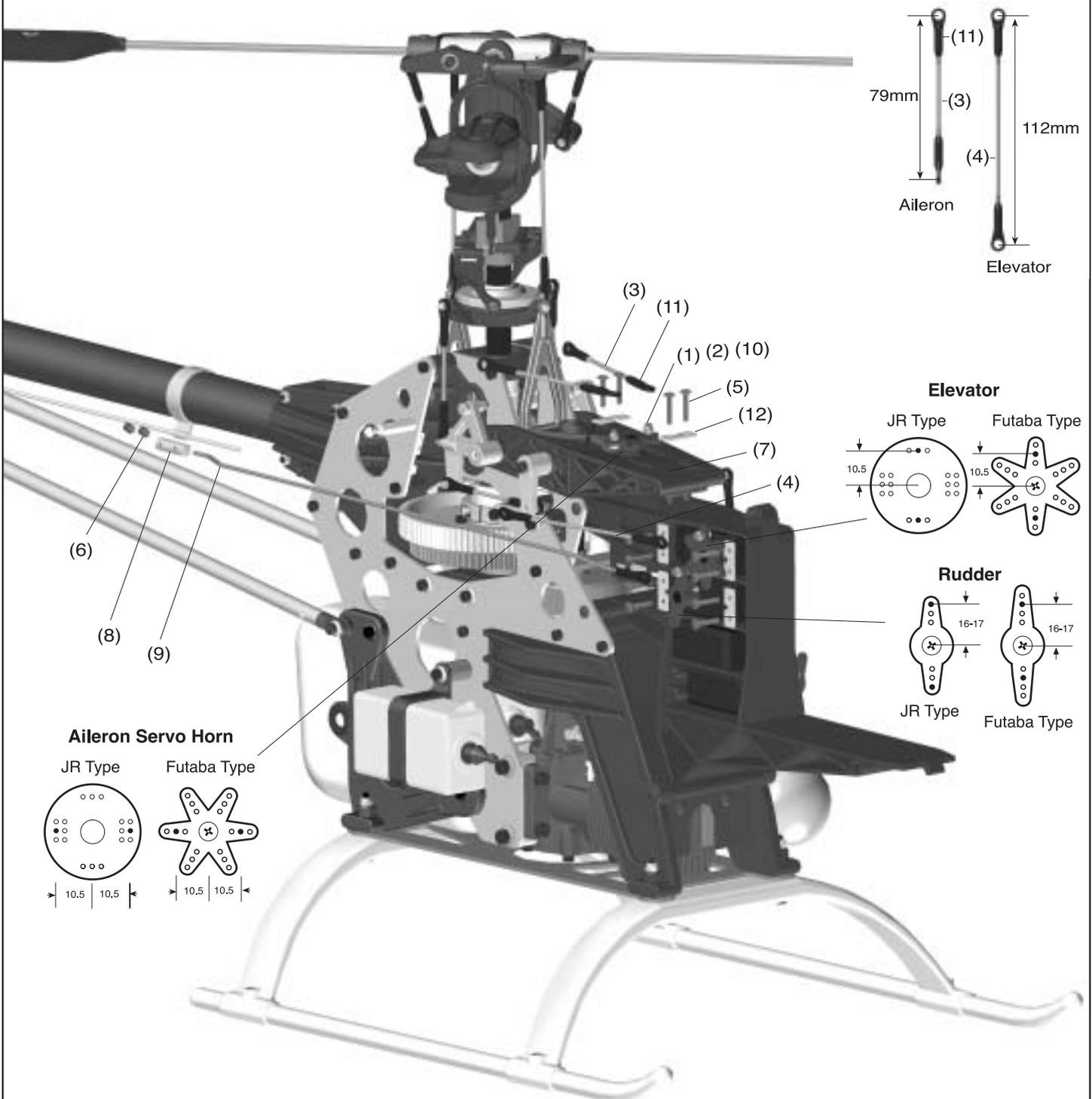


5-1

Installation of Servo-Part 1 BAG I

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	HML2	M2 Nut	4	7	*****	Servo	5
2	HMF2-8N	M2x8 Philip Machine Screw	4	8	BK0105	Rod Joint	1
3	BK0436	2.3x55 Link Rod	2	9	BK0347	Tail Control Rod A (In BAG O)	1
4	BK0438	2.3x88 Link Rod	1	10	BK0075	Link Ball 4.8	4
5	HSE2614N	2.6x14 Self Tapping Screw	12	11	BK0086	Ball Link 4.8x20	7
6	HME4-5B	M4x5 Set Screw	2	12	BK0104	Servo Mounting Plate	6

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 to suit your personal flying style.



5-2

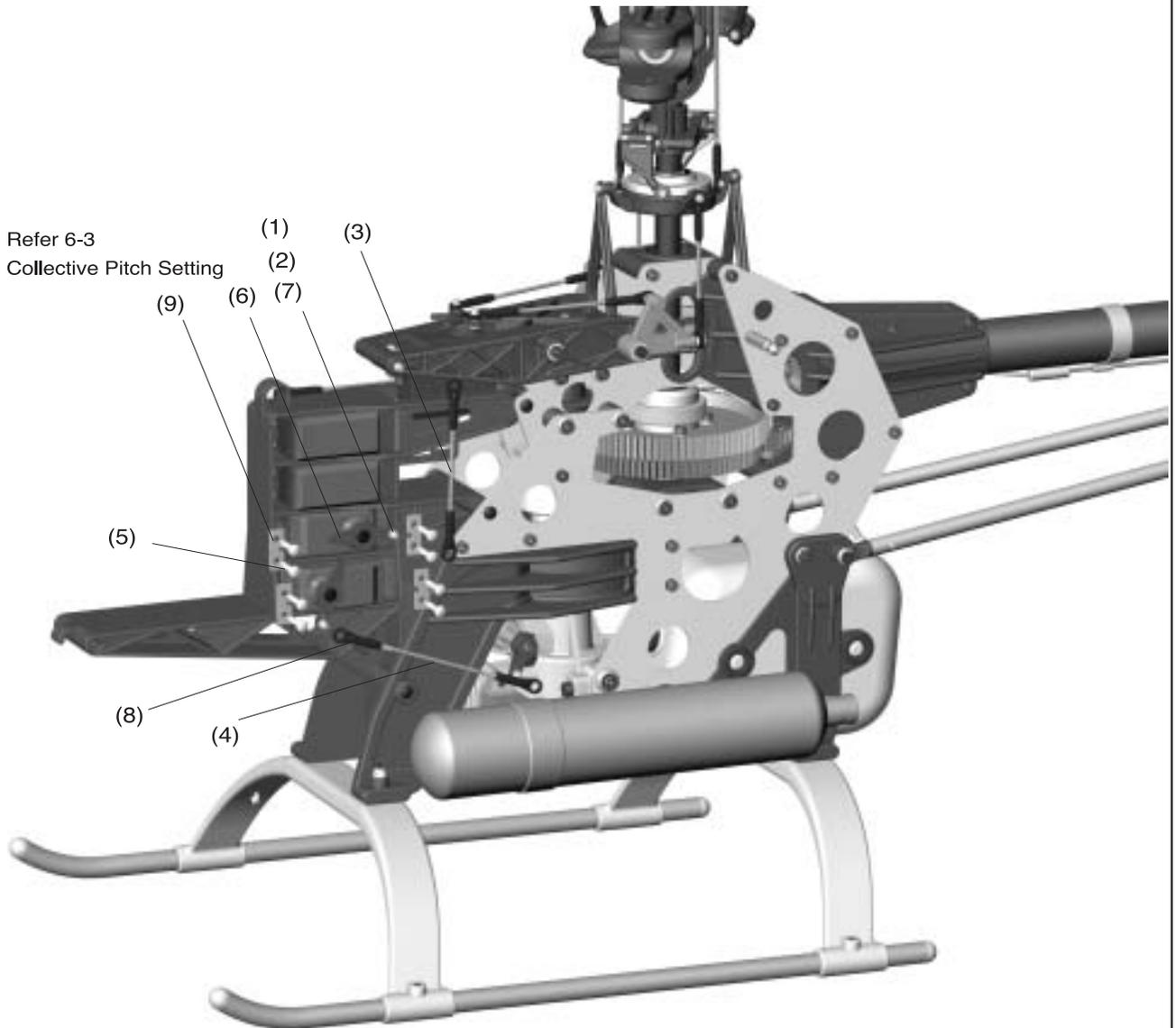
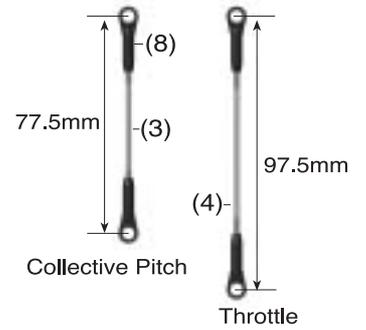
Installation of Servo-Part 2 BAG I

No.	Material No.	Description	Qty.
1	HML2	M2 Nut	3
2	HMF2-8N	M2x8 Philip Machine Screw	3
3	BK0436	2.3x55 Link Rod	1
4	BK0095	2.3x76 Link Rod	1
5	HSE2614N	2.6x14 Self-Tapping Screw	8

No.	Material No.	Description	Qty.
6	*****	Servo	2
7	BK0075	Link Ball 4.8	3
8	BK0086	Ball Link 4.8x20	4
9	BK0104	Servo Mounting Plate	4

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

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

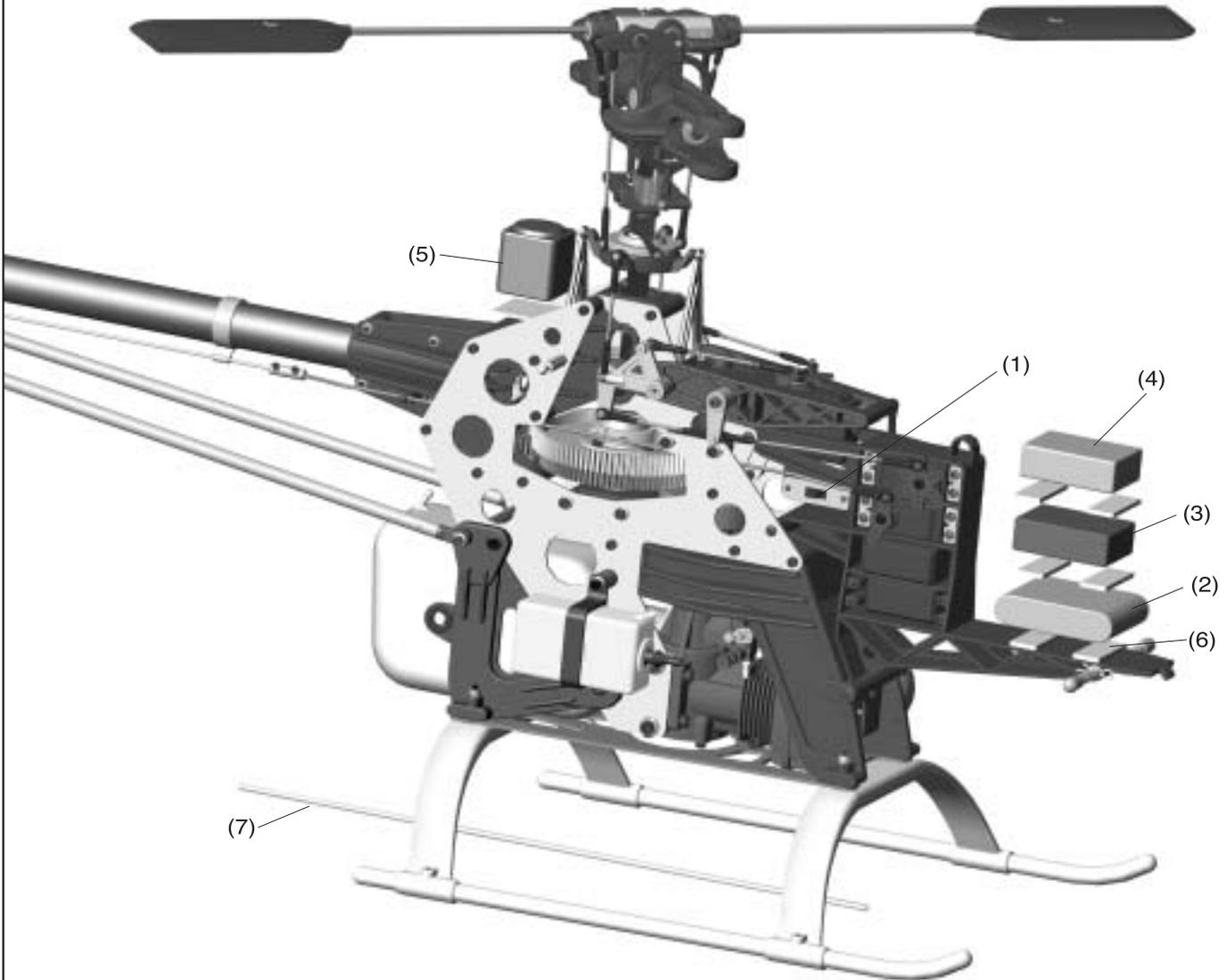


5-3

Installation of Receiver & Gyro

No.	Material No.	Description	Qty.	No.	Material No.	Description	Qty.
1	****	Switch JRType	1	5	****	Gyro	1
2	****	Battery(Recommend 1200mA)	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.



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

5-4

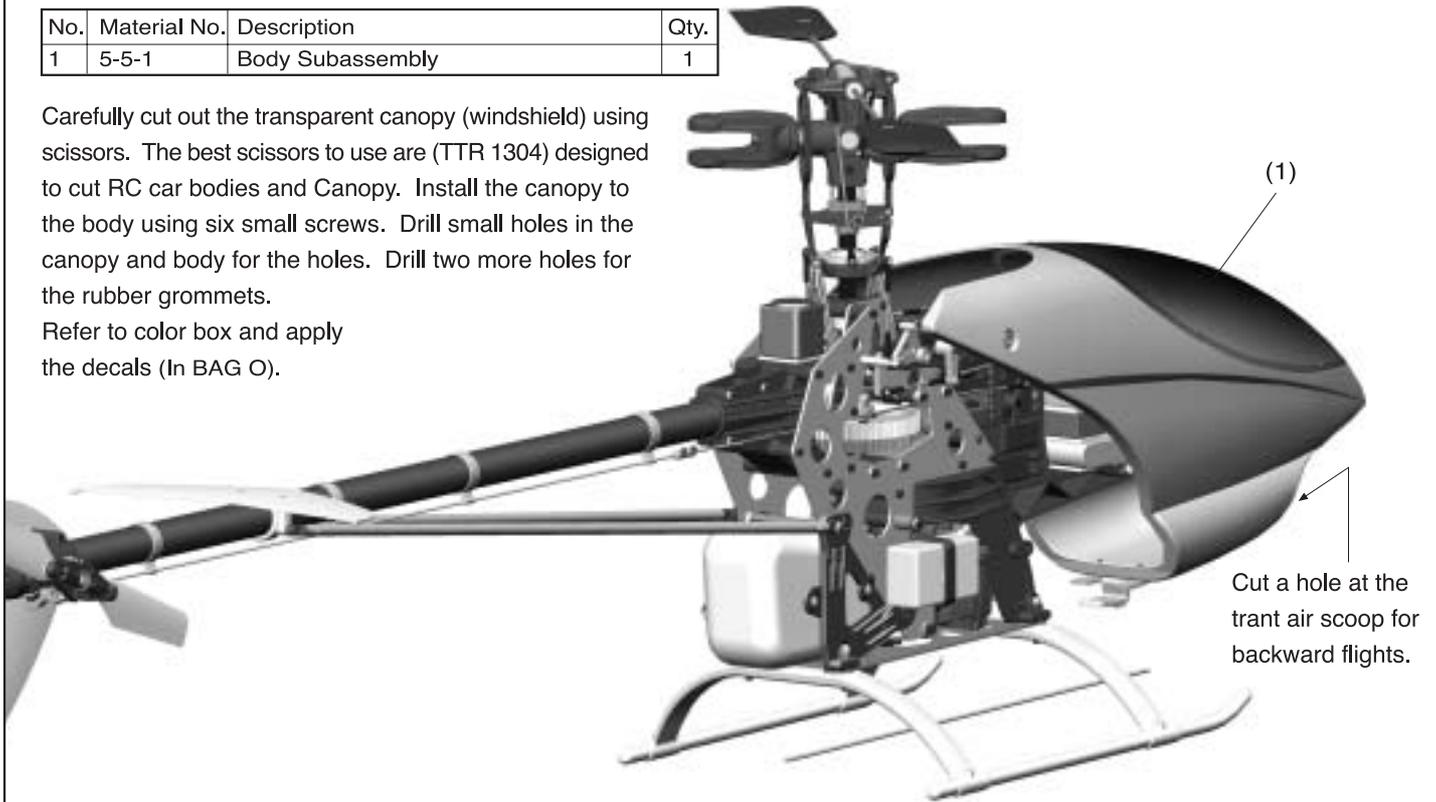
Installation of Body

BAG J

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

Carefully cut out the transparent 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 O).



5-4-1 Body Subassembly

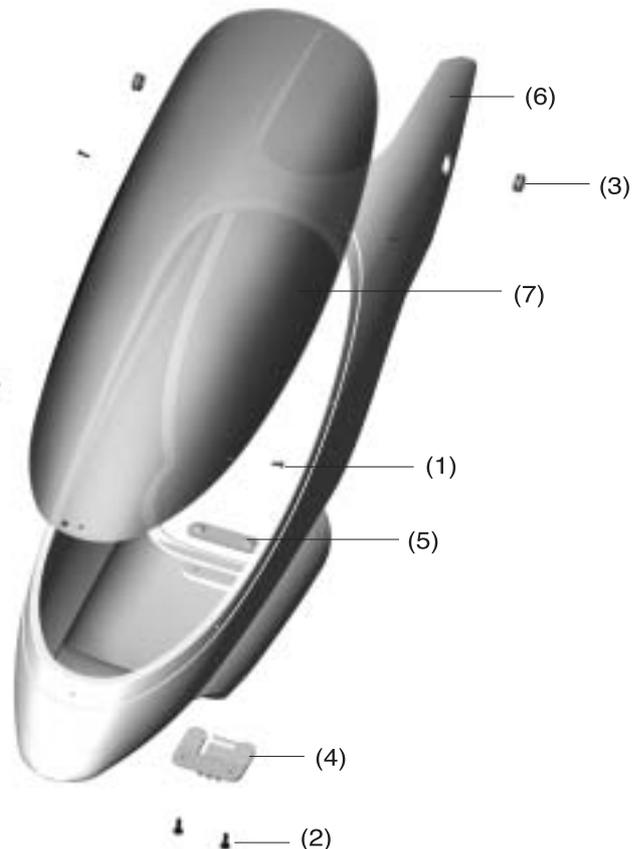
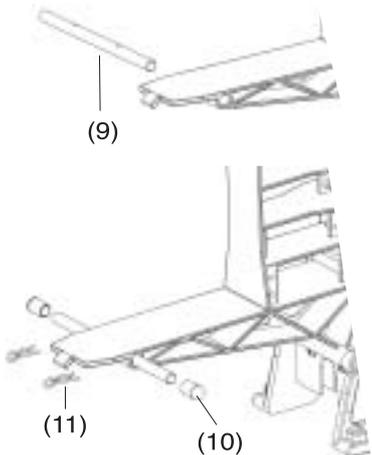
No.	Material No.	Description	Qty.
1	HMJ2-6B	M2x6 Self-Tapping Screw	6
2	HSE3-12B	M3x12 Self-Tapping Screw	2
3	BK0102	d3xD6x11Grommet	2
4	BK0098	Body Clip A	1
5	BK0099	Body Clip B	1
6	BK0429	Body	1
7	BK0428	Canopy	1
8	JV0131	Decal	1
9	BK0473	Body Support	1
10	BK0474	Rubber CAP	2
11	HNL6	R Pin	2

BODY SUPPORT INSTALLATION

Insert the aluminum support tube through the servo frame.

It may be necessary to drill out the hole in the servo frame to 1/4" (6.1mm)

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 body.



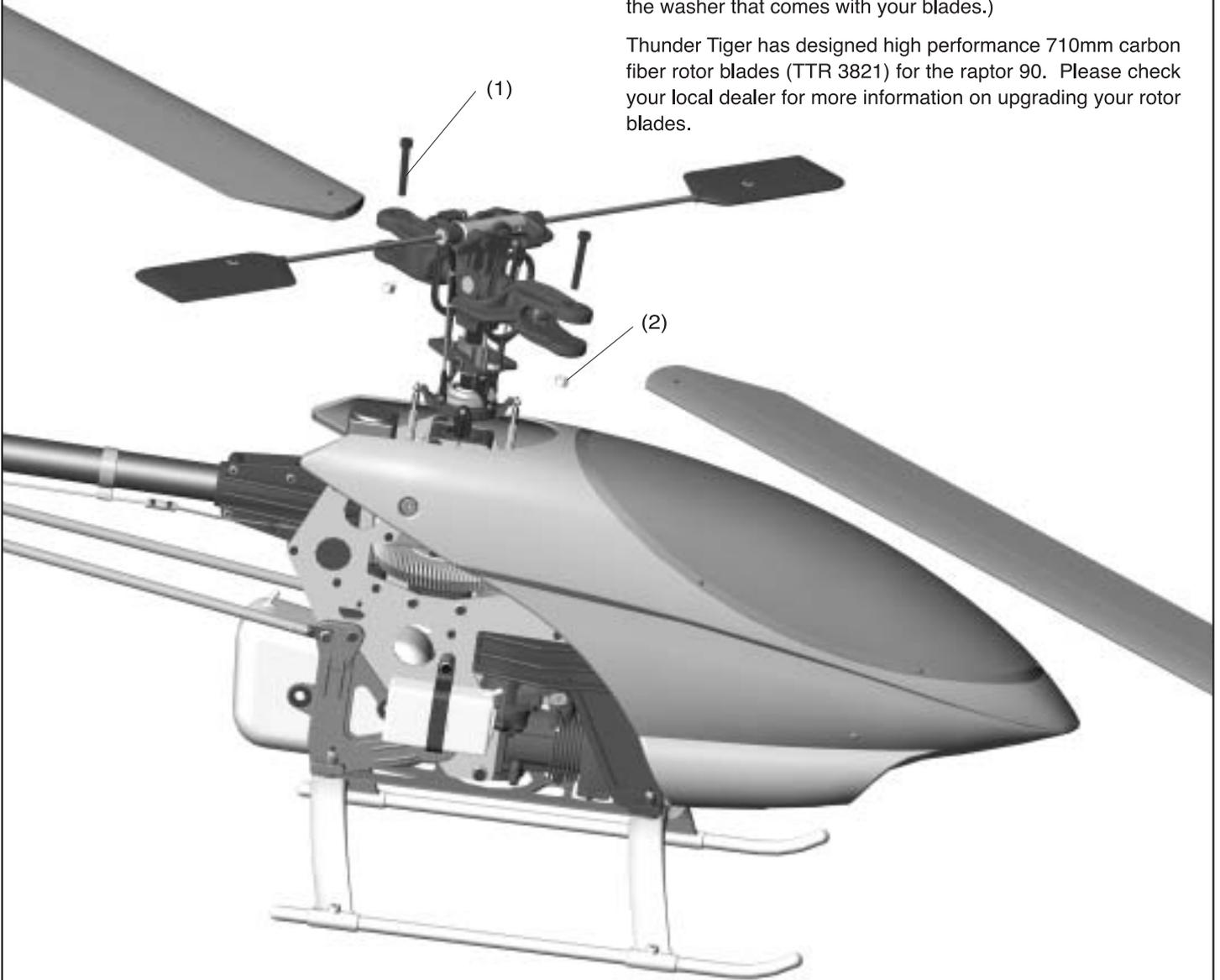
5-5

Installation of Rotor Blades BAG K

No.	Material No.	Description	Qty.
1	BK0446	M5x35 Rotor Bolt	2
2	HMM5Z	M5 Locknut	2
3	BK0478	Rotor Spacer	2

Since there are many after-market carbon fiber and fiberglass blades on the market now with a 12 mm thick blade root, Thunder Tiger has now added a complimentary Blade Grip Spacer with each Raptor 90 Kit. This spacer is specially designed for carbon fiber or fiberglass blades with a 12mm thick blade root. The spacer **SHOULD NOT** be used on any brand or type of wood rotor blades because the space do not provide strength: it is just a spacer. To install the spacer, simply bend it over and put it in place. If the blade root is more than 12 mm, then do not use this spacer and use the washer that comes with your blades.)

Thunder Tiger has designed high performance 710mm carbon fiber rotor blades (TTR 3821) for the raptor 90. Please check your local dealer for more information on upgrading your rotor blades.

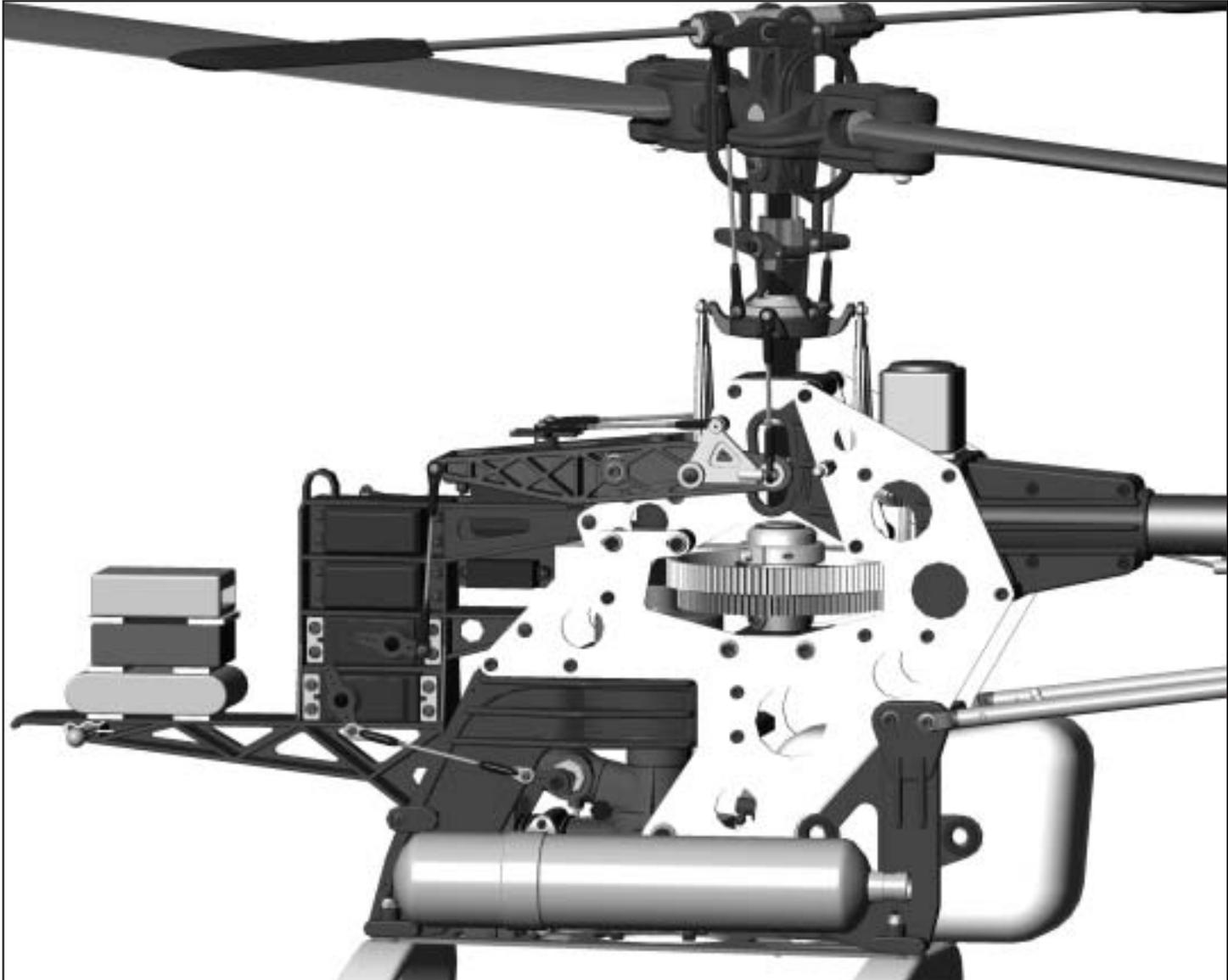


Raptor 90 Blade Grip Spacer for 12 mm Blade Roots



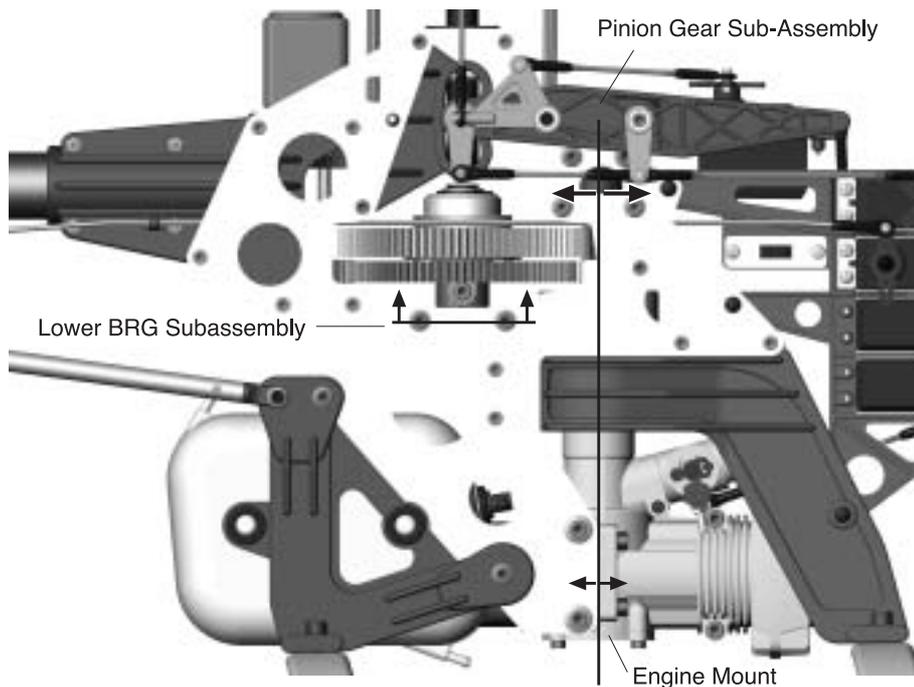
6

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.

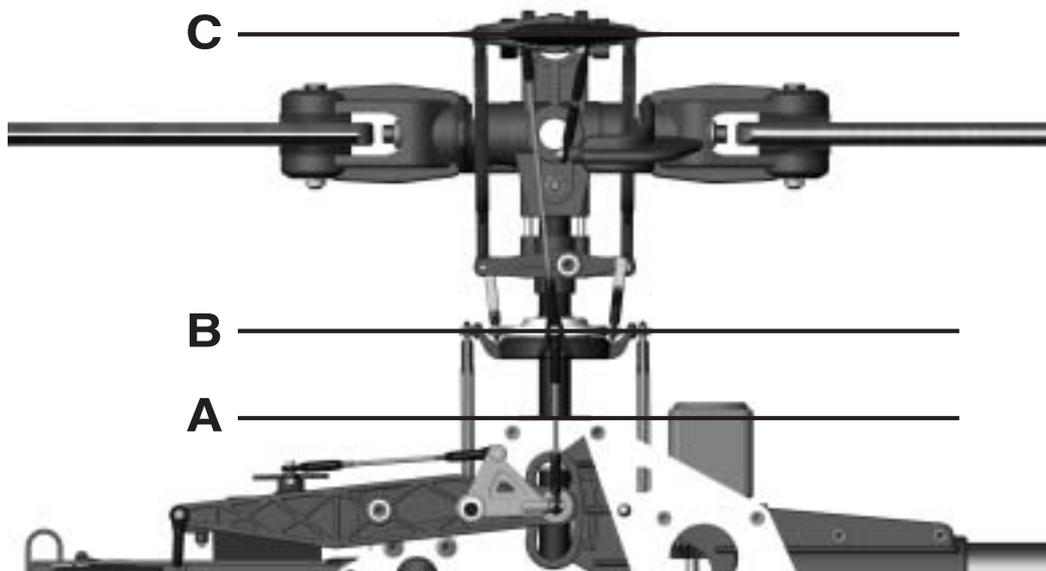
The Raptor 90 is designed to accept a diverse gear ratio to suit different flying needs. Currently the main gear is available with 91,93,94 and 95 teeth. The clutch pinion is available with 10,11 and 12 teeth. This gives the pilot a choice of twelve different gear ratios ranging from 7.6 to 9.5 to one. 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 90 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.

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

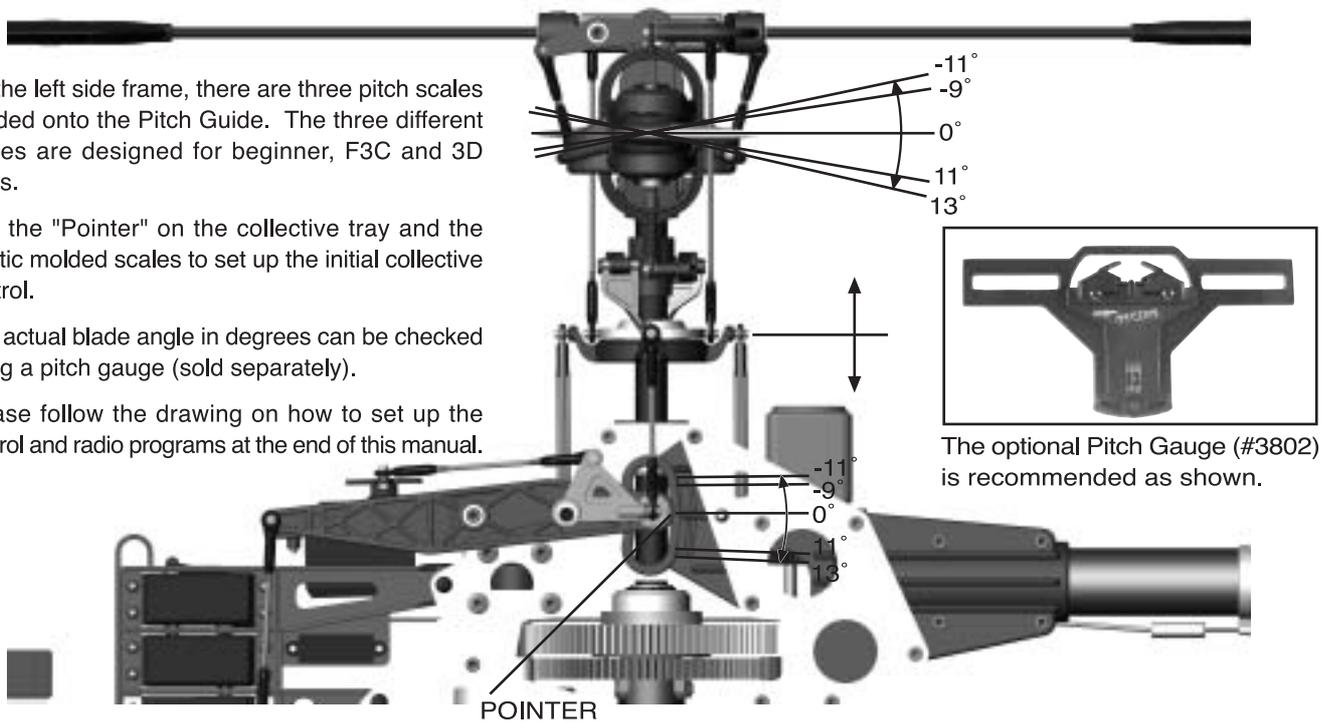
Setting up of Blade Pitch Angle

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 rotorspeed 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.

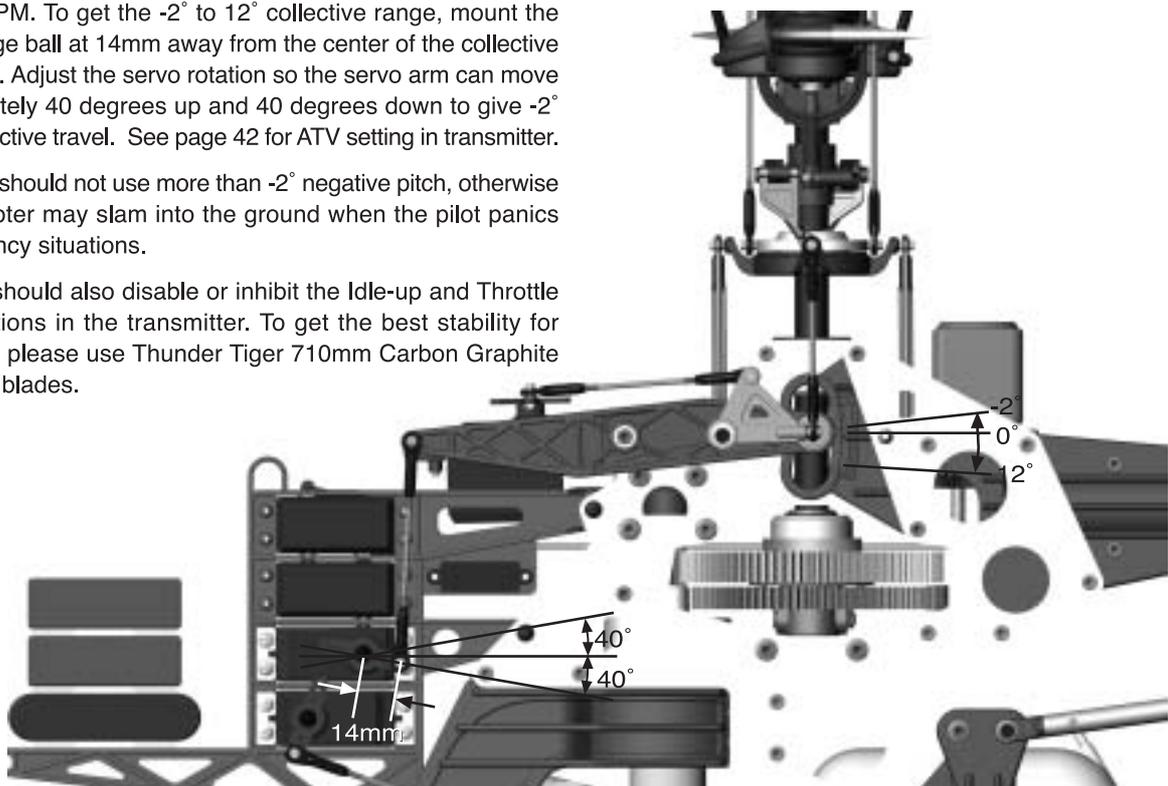
6-3-1

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.

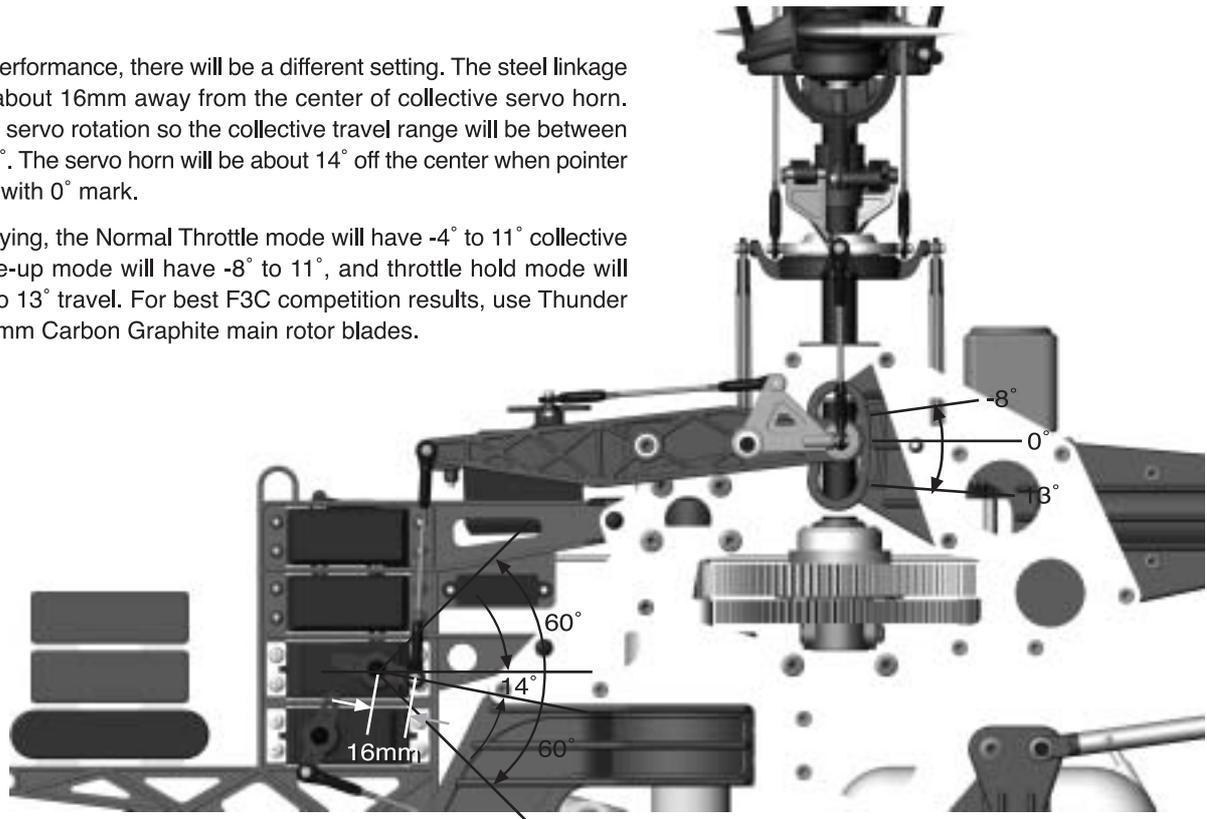


6-3-2

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.

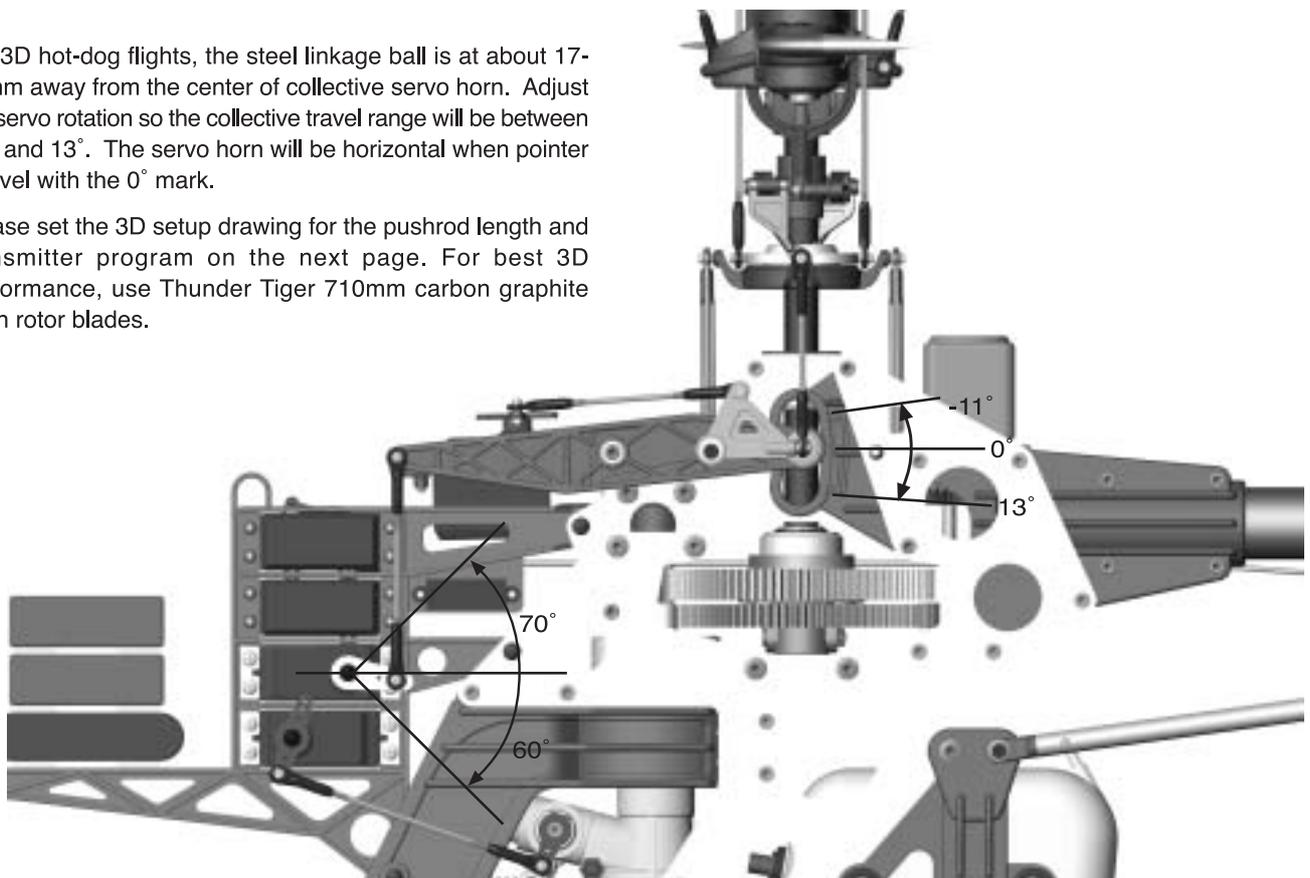


6-3-3

Collective Travel for 3D

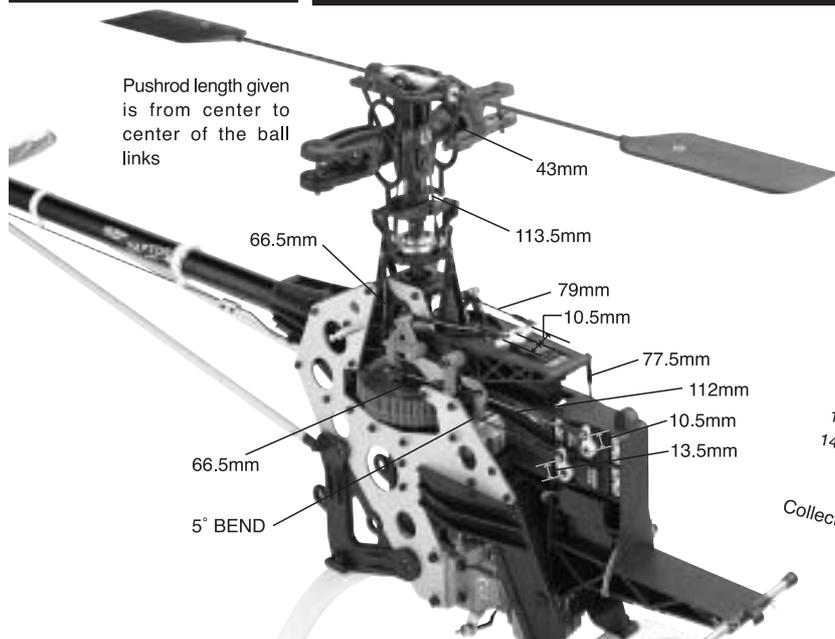
For 3D hot-dog flights, the steel linkage ball is at about 17-18mm away from the center of collective servo horn. Adjust the servo rotation so the collective travel range will be between -11° and 13° . The servo horn will be horizontal when pointer is level with the 0° mark.

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.



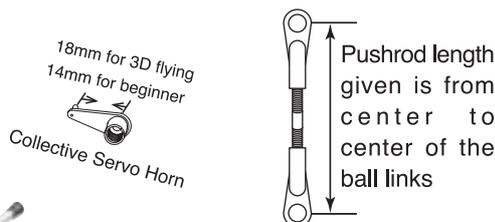
6-3-4

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 Angles	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.

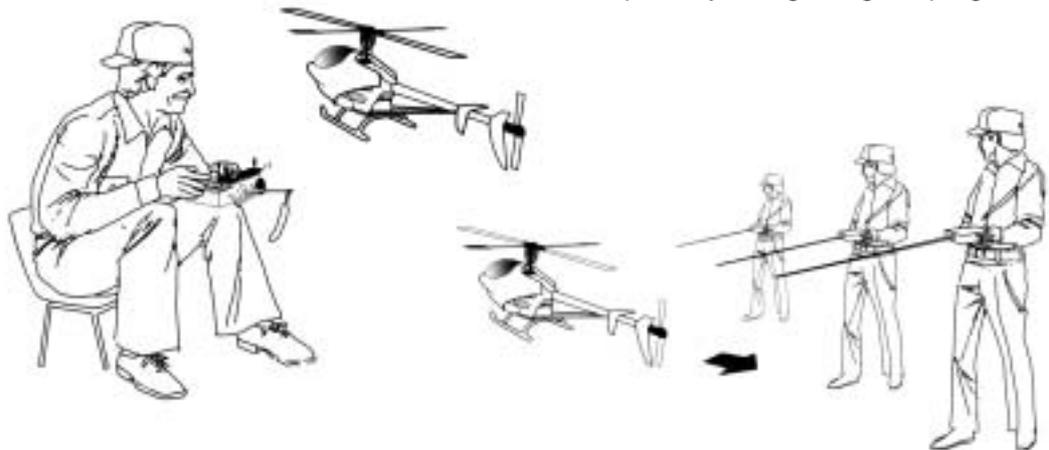
Warning (For Storage)

- 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.

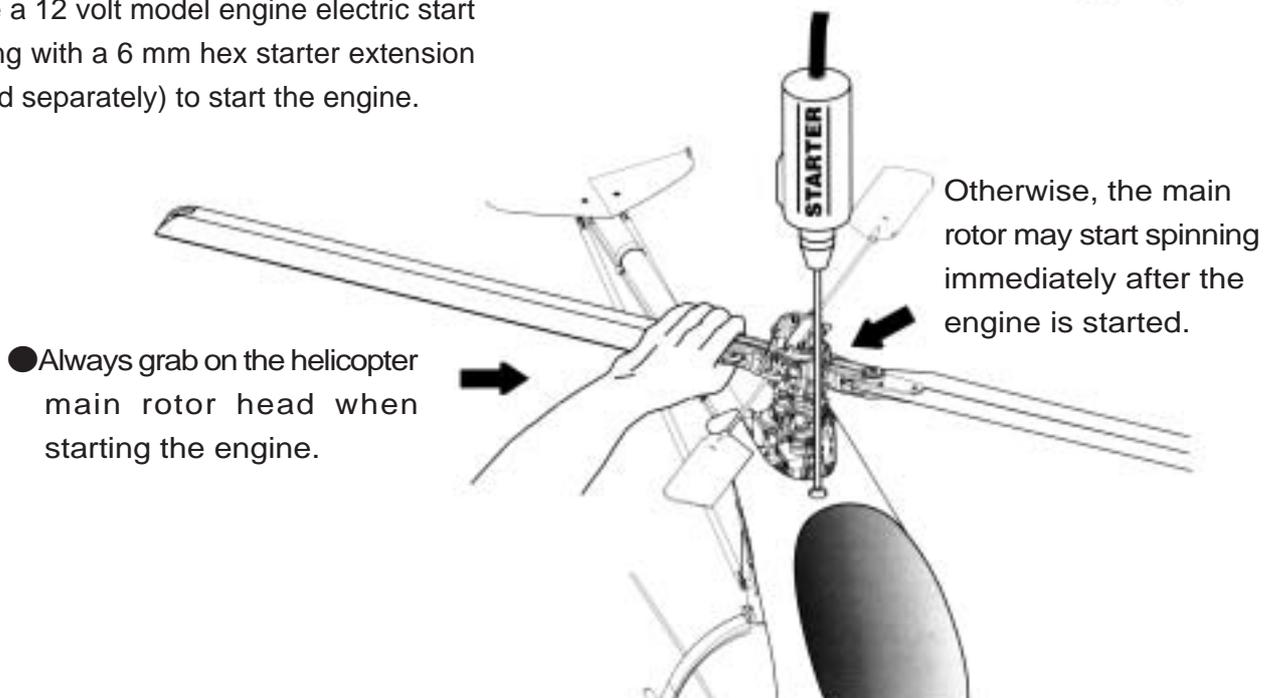
Preflight Checklist and Starting Procedure

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.



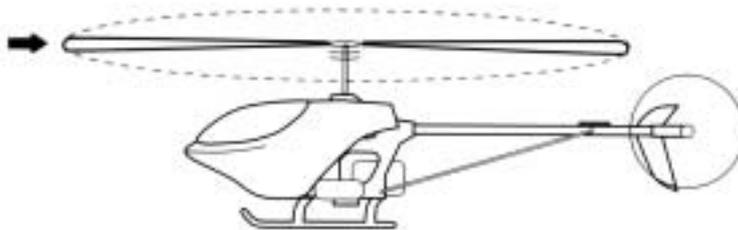
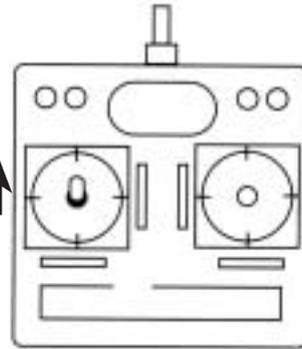
Flying Adjustments (1)

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

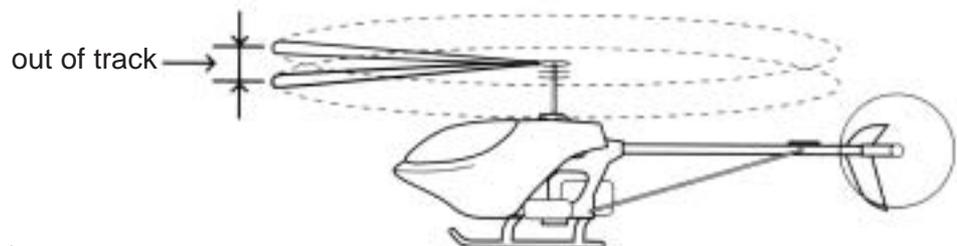
(1) Rev up the motor until the helicopter becomes light on its skids.

(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

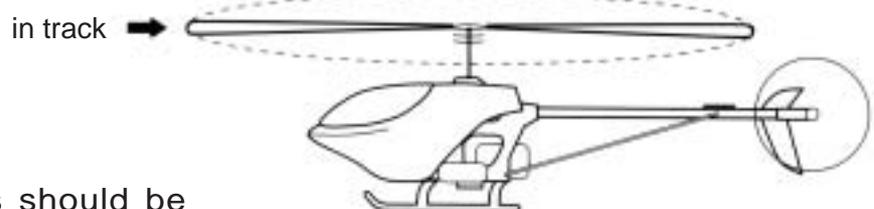


(3) When two blades are in track, the blade tips will appear overlapped as one look at the rotor tip path plane from the edge.



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.

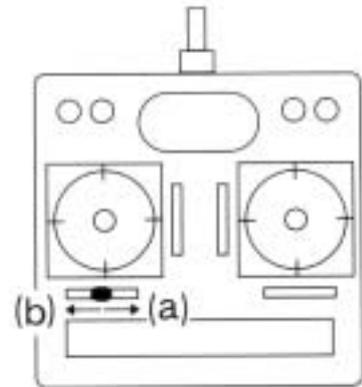
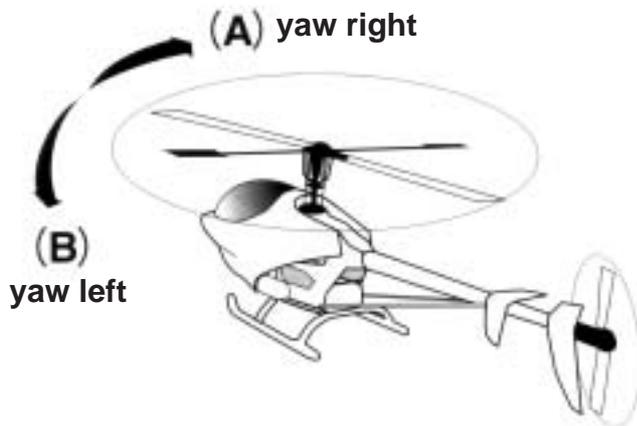


In hover, the main blades should be around 5.5 to 6 degrees in pitch.

Flying Adjustments (2)

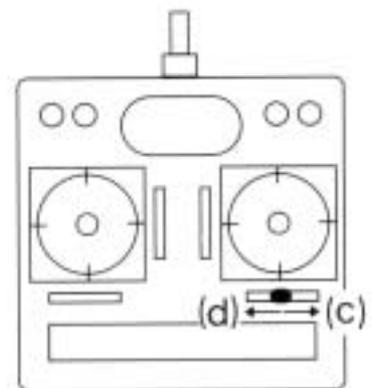
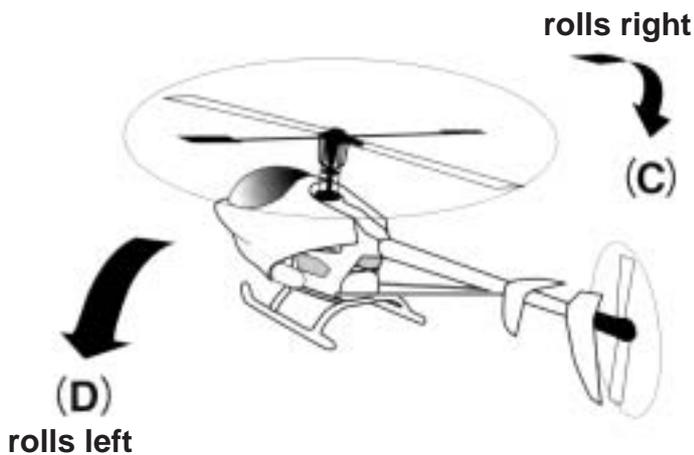
Trimming All helicopters are inherently unstable. But when a helicopter is properly trimmed, it will not drift away or yaw by itself quickly. Use the following procedure to trim your helicopter.

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



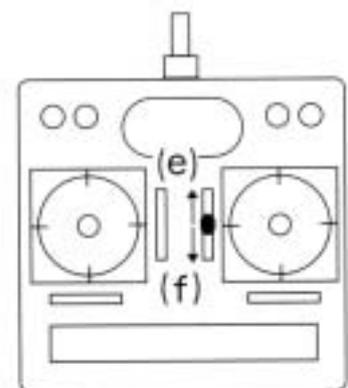
(A) situation: move to (b)
(B) situation: move to (a)

(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)

Hover Training (1)

Hovering is when the helicopter is floating in a stationary position in the air. Hovering is the fundamental maneuver to learn first. Here is the procedure to practice hovering:

- (1) Make sure there is no spectator anywhere near the model helicopter. You, the pilot, should stand at least 10 meters (30 feet) behind and slightly to the side of the model helicopter.



- (2) Prior to lifting off, while the main rotor is spinning and the helicopter is on the ground, check the main rotor fore/aft and left/right cyclic to make sure the main rotor is tilting in the correct direction according to your cyclic command. Move the tail rotor control stick to make sure the helicopter nose will swing in the desired direction accordingly.

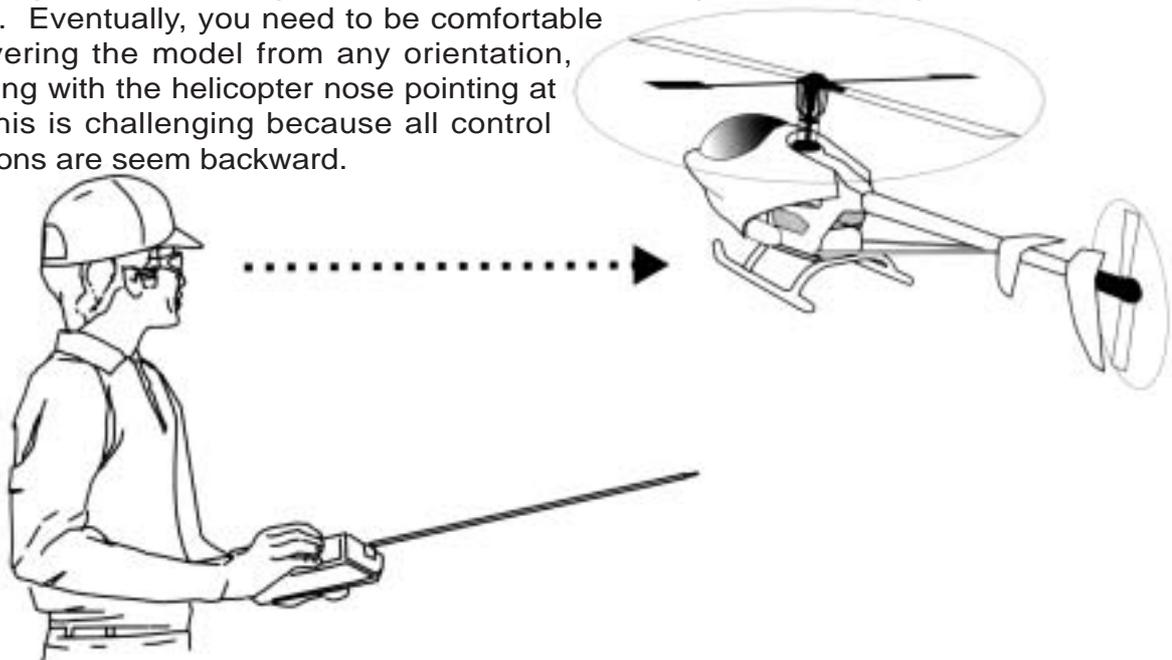


- (3) Increase the throttle/collective to lift the model helicopter skids off the ground to no more than 10 cm(4 inches). Initially, it will be very difficult to control the model to prevent it from moving. For a beginner it will also be difficult to determine whether the helicopter is in trim or not. But with repeated practice close to the ground you will develop a feel for the controls. It is recommended to let a more experienced model helicopter pilot trim out your new model before you attempt to learn to hover.

- (4) It will take a few hours of hover practice with the helicopter skids at 10 to 20 cm (4-8 inches) off the ground in order to comfortably control the model. Do not try to lift the model to more than 10 to 20 cm(4-8 inches) in the beginning because then the model may tip over readily when the beginner panics and an incorrect command is given. Once you can keep the model at one place, then it is time to slowly increase the height a few centimeters (inches) in each flight. Soon, you will be able to hover the helicopter confidently at few feet high. Beginners should always practice hovering close to the ground because in an emergency panic, throttle and collective can be reduced rapidly without causing a large drop or damage to the model. If the model was hovering at beyond one meter(3 feet) altitude, then always descend slowly. A panic drop can damage the helicopter.



- (5) Always stand behind the model helicopter when learning how to hover because then you can watch the nose of the helicopter, and a left tail rotor command will yaw the helicopter nose to the left, and a right command will yaw to the right. Similarly, a left cyclic command will cause the helicopter to translate left. After you can comfortably hover the model at one meter high without drifting, then start practice hovering while standing to either side of the model. Eventually, you need to be comfortable at hovering the model from any orientation, including with the helicopter nose pointing at you, this is challenging because all control directions are seen backward.

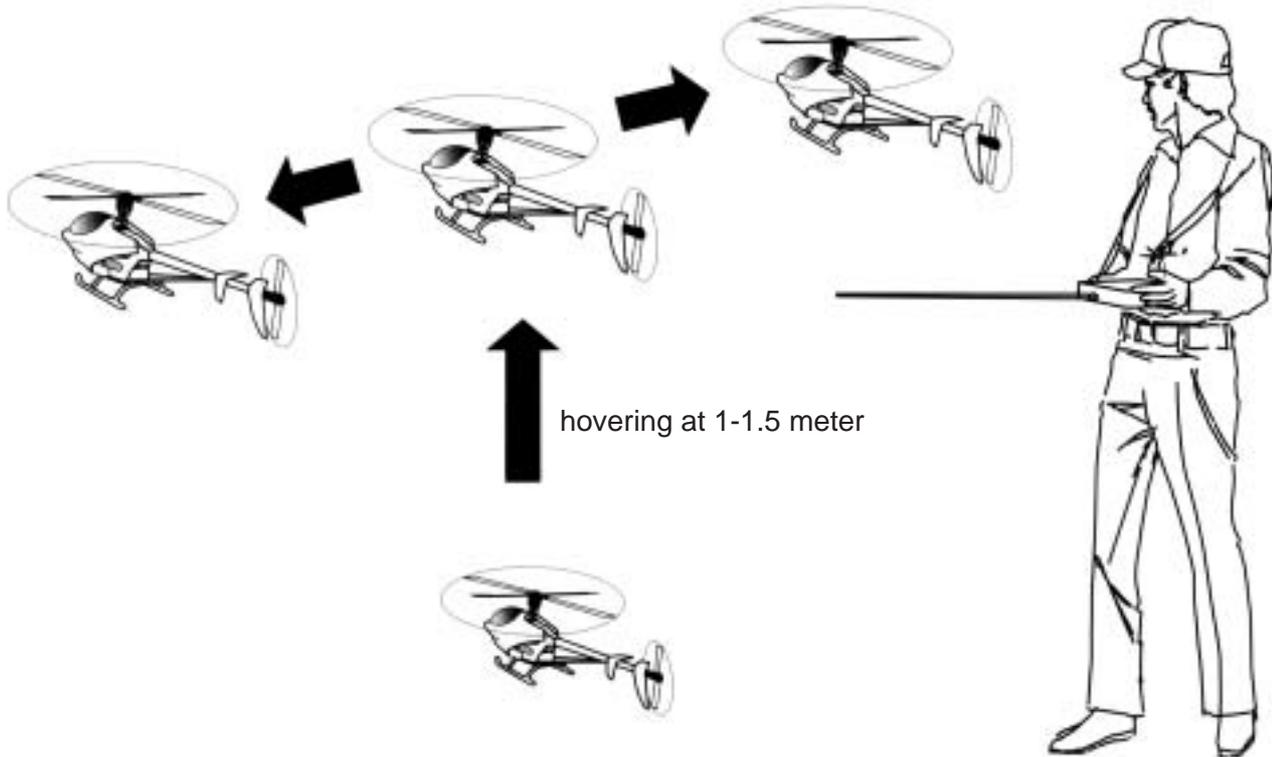


- (6) Once you can confidently hover a model helicopter at any altitude and at any orientation, then congratulate yourself because you have mastered 80% of the fundamental control movements of a helicopter.

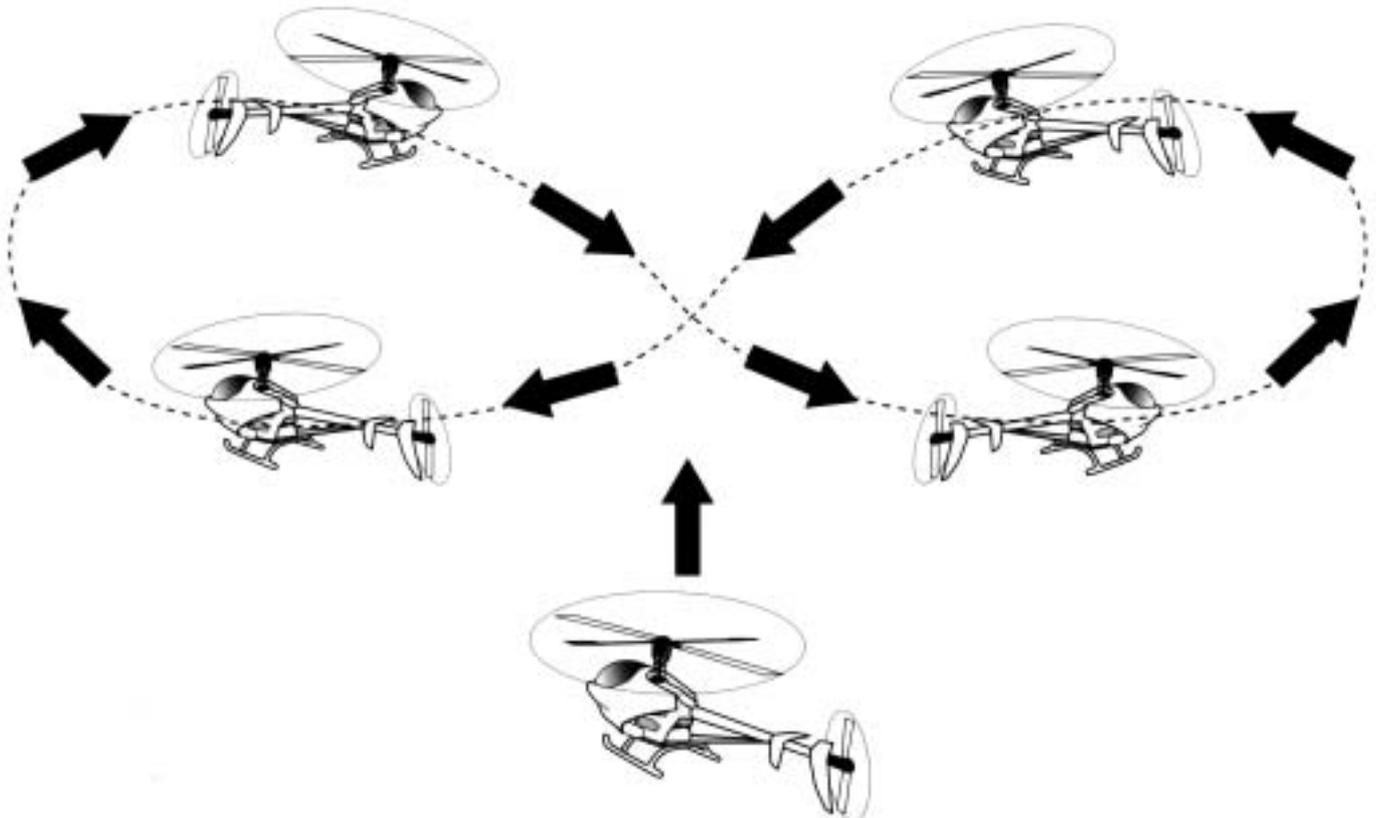
Forward Flight Training

After mastering hovering flight:

- (1) Start practicing moving the helicopter laterally to the left or right slowly from a 1.5 meter (60 inches) high hover. This is the beginning exercise of translational flight.



- (2) After a few hours of practicing step (1) and you are comfortable with translational movement, start using some tail rotor control so the helicopter nose will point slightly to the left or right as you fly it to the left or right. Eventually, this pattern will become a figure-eight in front of you. Please visualize these movements in your mind.



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.

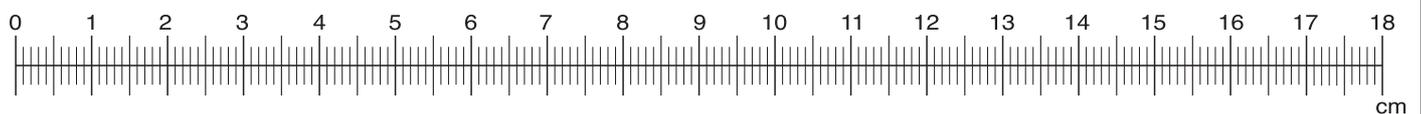
* The helicopter shakes.

- (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.

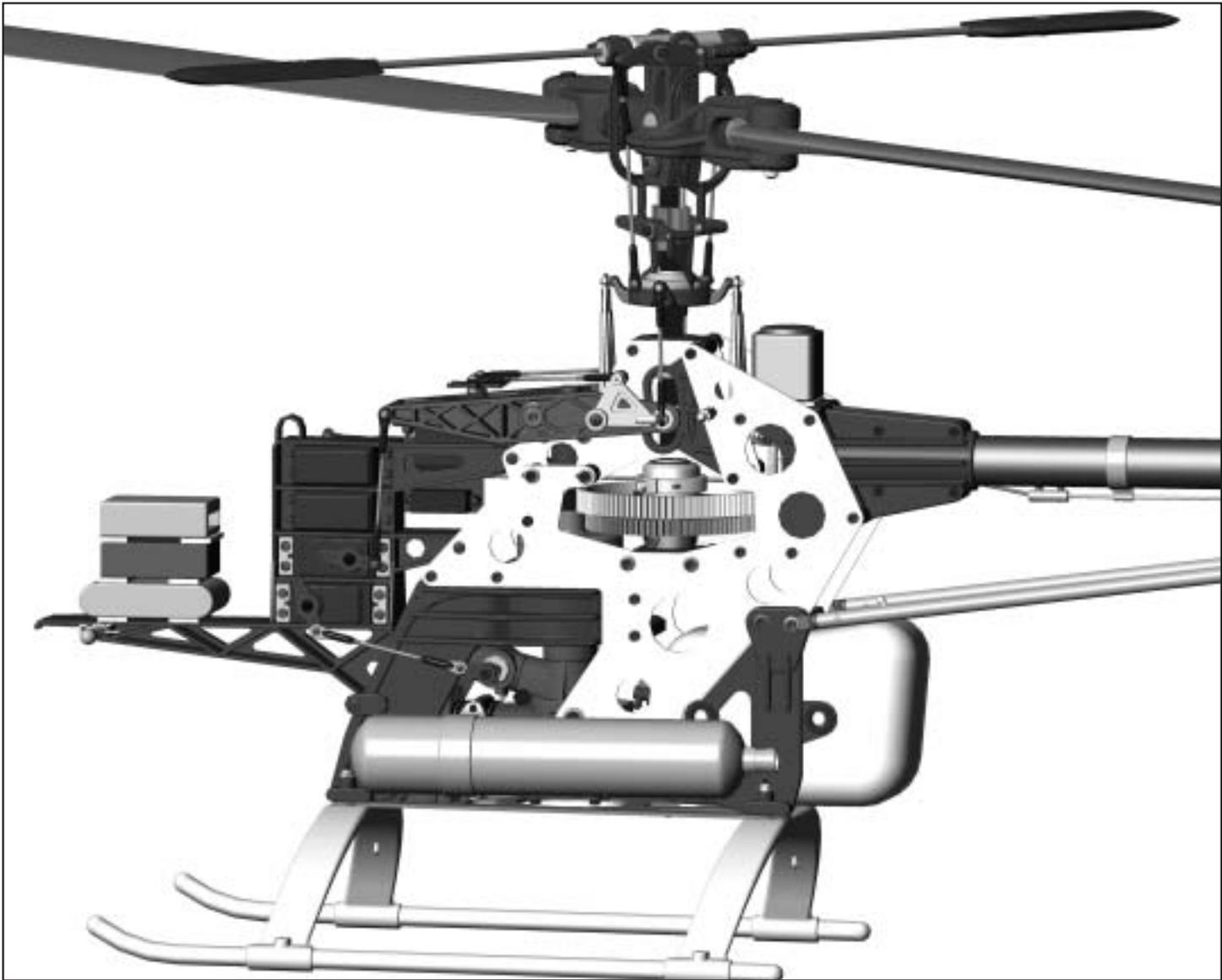
Inspect the flybar, rotor shaft and the blade spindle to make sure they are not bent at all. If any item is damaged, it must be replaced by a new part to ensure safe operation. Do not glue any broken or damaged plastic part. Do not repair broken rotor blades. Always inspect the following items immediately:

- (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 EXCLUSIVE PARTS



PV0041 BALL LINK



PV0046 ELEVATOR ARM BRG



PV0048 BRG: PITCH FRAME ROTOR HUB SEESAW 4830 / LEVER & PITCH ARM 4870



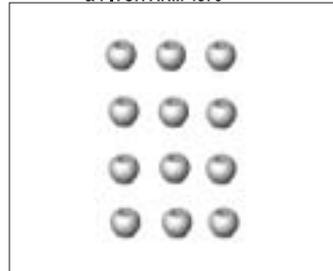
PV0050 BRG: FEATHERING 4830 / TAIL SHAFT BRG 4870



PV0052 TAIL SLIDER BRG



PV0054 SERVO MOUNTING PLATE



PV0058 LINK BALL



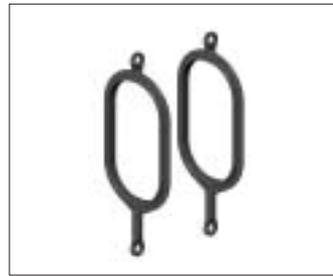
PV0062 BODY MOUNT RUBBER GROMMETS



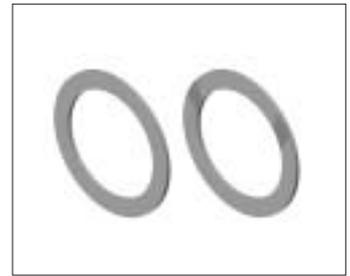
PV0120 MAIN ROTOR GRIP



PV0123 MIXING LEVER



PV0124 FLYBAR CONTROL ROD



PV0125 THRUST WASHER



PV0126 SPINDLE



PV0131 ELEVATOR ARM



PV0132 PITCH CONTROL ARM



PV0133 ELEVATOR LEVER



PV0134 AILERON LEVER



PV0135 TAIL PITCH CONTROL LEVER



PV0137 MAIN SHAFT LOCK RING



PV0139 ONE WAY CLUTCH SHAFT



PV0140 TAIL DRIVE GEAR



PV0141 ENGINE MOUNT



PV0147 TAIL CASE



PV0148 TAIL ROTOR GRIP



PV0149 TAIL BEVEL GEAR



PV0150 TAIL ROTOR SHAFT



PV0151 TAIL ROTOR HUB



PV0154 MAIN SHAFT LOWER BRG CASE



PV0155 PITCH GUIDE COLLAR



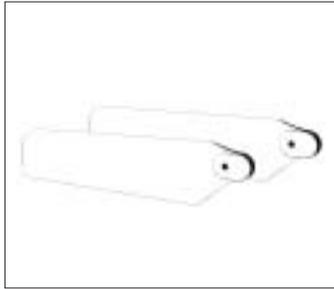
PV0157 REAR FRAME



PV0158 TAIL BOOM BRACKET



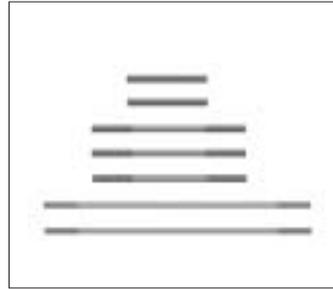
PV0162 FLYBAR PADDLE



PV0163 TAIL ROTOR BLADE



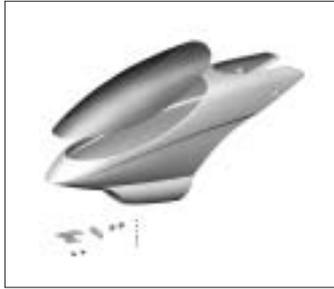
PV0164 TAIL FIN



PV0169 LINKAGE ROD



PV0170 MAIN SHAFT BRG



PV0171 BODY



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 (OPT)



PV0189 MAIN SPUR GEAR 94T(OPT)



PV0190 TAIL DRIVE SPUR GEAR



PV0191 PINION GEAR 10T (OPT)



PV0192 PINION GEAR 11T (STD)



PV0193 PINION GEAR 12T (STD)



PV0195 TAIL DRIVE SHAFT BRG



PV0197 TAIL DRIVE SHAFT BEVEL GEAR BRG



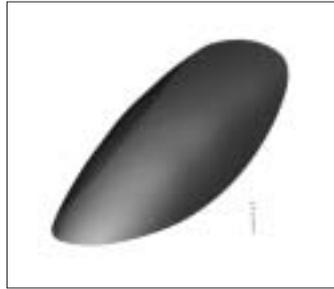
PV0198 COOLING FAN ASSY



PV0200 TAIL ROTOR BRG



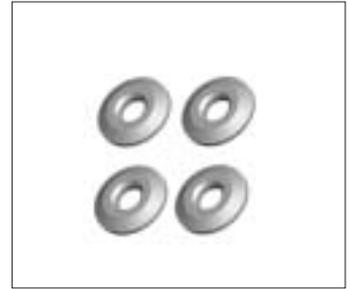
PV0203 STARTER SHAFT BRG



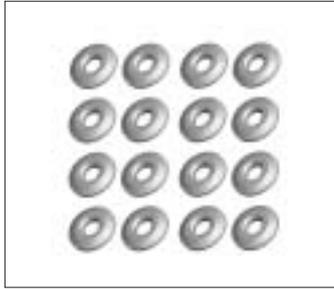
PV0206 CANOPY



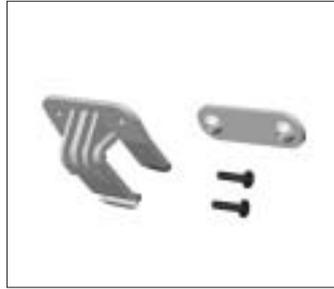
PV0208 FUEL TANK RUBBER GROMMET



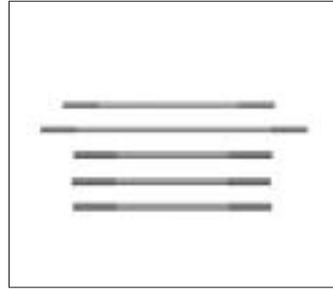
PV0209 WASHER, d4xD11x1.7



PV0210 WASHER, d3xD8x1.4



PV0239 BODY CLIP



PV0240 SERVO LINK ROD



PV0241 ROD GUIDE COLLAR



PV0242 MAIN SHAFT UPPER BRG CASE



PV0243 CLUTCH BRG CASE



PV0244 PINION BRG



PV0245 WASH OUT LINK



PV0246 TAIL DRIVE GEAR SHAFT



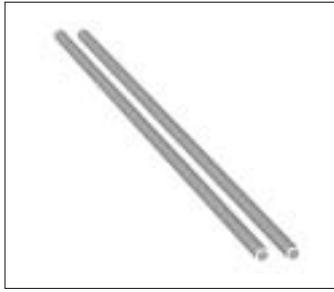
PV0247 ELEVATOR ARM LINK



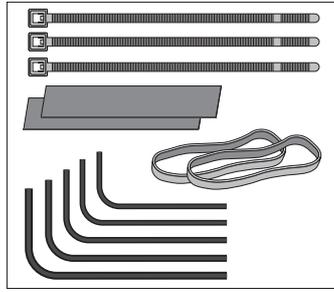
PV0248 PITCH ARM CROSS MEMBER



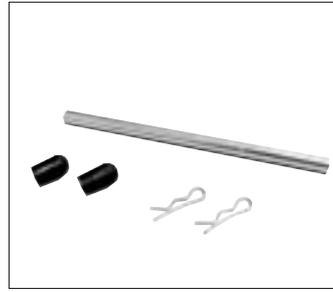
PV0251 FUEL PLUG



PV0253 ANTENNA PIPE



PV0254 INSTALLATION TOOLS



PV0262 BODY SUPPORT



PV0267 LOCTITE #242



PV0268 LOCTITE #262



PV0269 GREASE
(FOR PLASTIC GEAR)



PV0270 GREASE
(FOR BEARING)



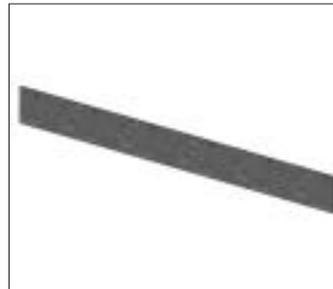
PV0284 METAL SWASH PLATE



PV0310 FUEL TANK, 550c.c.



PV0322 HEAVY DUTY CLUTCH



PV0324 HEAVY DUTY CLUTCH
LINER



PV0350 HARDENED MAIN SHAFT



PV0351 ONE WAY CLUTCH
REINFORCED RING



PV0360 STARTER SHAFT



PV0361 STARTER COUPLING



PV0395 SUS FLYBAR ROD



PV0402 FLYBAR CONTROL
ARM



PV0403 MAIN ROTOR HUB



PV0404 70° FLAP DAMPER



PV0405 80° FLAP DAMPER



PV0406 FLYBAR CONTROL
LEVER SET



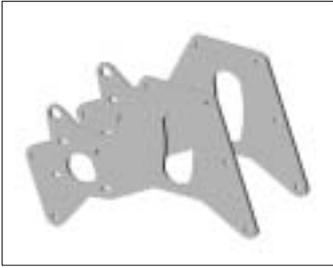
PV0407 TAIL PITCH SLIDER



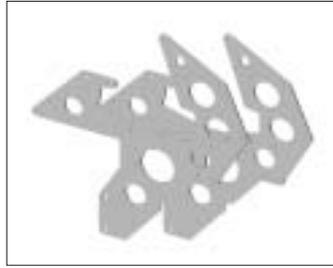
PV0408 HEAVY DUTY
CLUTCH BELL



PV0409 ONE WAY CLUTCH



PV0410 UPPER METAL FRAME



PV0411 LOWER METAL FRAME



PV0412 FAN CASING



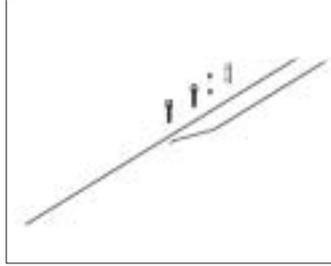
PV0413 SERVO FRAME



PV0414 LANDING SKID



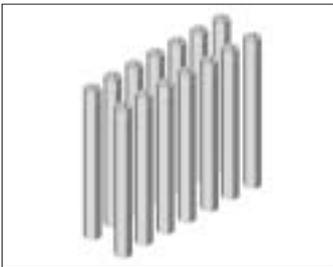
PV0415 TAIL SUPPORT



PV0416 TAIL CONTROL ROD



PV0417 DECAL



PV0418 FRAME SPACER (L)



PV0419 FRAME SPACER (M)



PV0420 FRAME SPACER (S)



PV0421 TAIL DRIVE SHAFT



PV0422 TAIL BOOM



PV0423 TAIL ROD GUIDE



PV0425 TAIL PITCH CONTROL SLIDE BUSHING



PV0455 SKID PIPE END CAP BUSHING



PV0466 METAL FORK

SCREWS

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

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

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0041	BALL LINK	BK0086	Ball Link 4.8x20	12	
PV0046	ELEVATOR ARM ,BRG	HMV1280	d8xD12x3 BRG	2	1-5-4
PV0048	BRG:PITCH FRAME & ROTOR HUB SEESAW 4830 / LEVER & PITCH ARM 4870	HMV840ZZ	d4xD8x3 BRG	2	
PV0050	BRG:FEATHERING 4830/TAIL SHAFT	HMV1350	d5xD13x4 BRG	2	3-1-1
PV0052	TAIL SLIDER BRG	HMV1060	d6xD10x3 BRG	2	3-1-2
PV0054	SERVO MOUNTING PLATE	BK0104	Sever Mounting Plate	10	5-1, 5-2
PV0058	LINK BALL	BK0075	Link Ball 4.5	12	
PV0062	BODY MOUNT RUBBER GROMMENTS	BK0102	d3xD6x11 RUBBER Grommet	5	5-4-1
PV0120	MAIN ROTOR GRIP	BK0075	Link Ball 4.8	2	2-1-2
		BK0319	Main Rotor Pitch Housing	2	2-1-2
		HMJ2-10N	M2X10 Self-Tapping Screw	2	2-1-2
PV0123	MIXING LEVER	BK0324	Mixing Lever	2	2-1-1
		BK0075	Link Ball 4.8	4	2-1-1
		BK0410	Collar d3xD4x13	2	2-1-1
		HMC3-18B	M3x18 Socket Screw	2	2-1-1
		BK0088	d3xD5x0.5 Washer	2	2-1-1
		HMJ2-10N	HMJ2-10N	4	2-1-1
PV0124	FLYBAR CONTROL ROD	BK0344	Flybar Control Rod	2	2-1-1
PV0125	THRUST WASHER	BK0325	Thrust Collar	2	2-1-2
PV0126	SPINDLE	BK0326	Spindle	1	2-1-2
		BK0477	Washer	2	2-1-2
		HMC4-10B	M4x10 Socket Screw	2	2-1-2
PV0131	ELEVATOR ARM	BK0020	Elevator Arm Shaft	1	1-5
		BK0075	Link Ball 4.8	1	1-5-2
		BK0335	Elevator Arm Link	2	1-5-5
		BK0337	Elevator Arm Parallel Lever	1	1-5-2
		BK0339	Elevator Control Arm	1	1-5-5
		BK0413	Pin 2x29	2	1-5-5
		HMJ2-8N	M2x8 Self-Tapping Screw	1	1-5-2
		HMJ3-20N	M3x20 Self-Tapping Screw	2	1-5
PV0132	PITCH CONTROL ARM	BK0075	Link Ball 4.8	2	1-5-4
		BK0336	Pitch Frame	1	1-5-4
		BK0407	Collar d3xD4x13	1	1-5
		HMC3-10B	Elevator Control Lever	1	1-5
		HMC3-25B	M2x14 Self-Tapping Screw	1	1-5
		HMJ2-10N	M2x10 Self-Tapping Screw	1	1-5-2
PV0133	ELEVATOR LEVER	BK0075	Link Ball 4.8	2	1-5-3
		BK0088	d3xD5x0.5 Washer	1	1-5
		BK0410	Collar d3xD4x13	1	1-5
		BK0338	Elevator Control Lever	1	1-5-3
		HMJ2-14N	M2x14 Self-Tapping Screw	1	1-5-3
PV0134	AILERON LEVER	BK0075	Link Ball 4.8	4	1-5-1
		BK0340	Aileron Control Arm	2	1-5-1
		BK0410	Collar d3xD4x13	2	1-5-1
		HMJ2-10N	M2x10 Self-Tapping Screw	4	1-5-1
		HMJ3-20N	M3x20 Self-Tapping Screw	2	1-5
PV0135	TAIL PITCH CONTROL LEVER	BK0075	Link Ball 4.8	1	3-1-1
		BK0076	Collar d3xD4x10	1	3-1-1
		BK0088	d3xD5x0.5 Washer	1	3-1-1
		BK0346	Tail Pitch Control Lever	1	3-1-1
		HMJ2-8N	M2x8 Self-Tapping Screw	1	3-1-1
		HMJ3-20N	M3x20 Self-Tapping Screw	1	3-1-1
PV0137	MAIN SHAFT LOCK RING	BK0234	Lock Ring	1	1-6
		HMC3-6B	M3x6 Socket Screw	2	1-6
PV0139	ONE WAY CLUTCH SHAFT	BK0359	One Way Clutch Shaft	1	1-6-3
		HMC4-25B	M4x25 Socket Screw	1	1-6-3
		HMM4B	M4 Locknut	1	1-6-3
		HMQ16	Retaining Ring	1	1-6-3
PV0140	TAIL DRIVE GEAR SET	BK0362	Tail Drive Bevel Gear A	1	1-2-2
		BK0363	Tail Drive Bevel Gear B	1	1-2-2
		BK0364	Tail Drive Pinion	1	1-2-2
		BK0414	Pin 2x12	2	1-2-2
		HME3-4B	M3x4 Set Screw	2	1-2-2

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
PV0141	ENGINE MOUNT	BK0349	Engine Mount	1	1-2
		BK0435	d4xD11x1.7 Washer	4	1-2
		HMC4-12B	M4x12 Socket Screw	4	1-2
		HMC4-18B	M4x18 Socket Screw	4	4-2
PV0147	TAIL CASE	BK0370	Tail Case L	1	3-1-1
		BK0371	Tail Case R	1	3-1-1
		HMC3-10B	M3x10 Socket Screw	3	3-1-1
		HMM3B	M3 Locket	3	3-1-1
PV0148	TAIL ROTOR GRIP	BK0302-1	Tail Pitch Housing A	2	3-1-2
		BK0303-1	Tail pitch Housing B	2	3-1-2
		HMC26-10B	M2.6x10 Socket Screw	4	3-1-2
		HMC3-14B	M3x14 Socket Screw	2	3-1-2
		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
PV0154	MAIN SHAFT LOWER BRG CASE	BK0387	Lower BRG Case	2	1-2-1
PV0155	PITCH GUIDE COLLAR SET	BK0384	Pitch Guide Collar L	1	1-2-1
		BK0385	Pitch Guide Collar R	1	1-2-1
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	1-2-2
		BK0383	Tail Boom Bracket R	1	1-2-2
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
PV0164	TAIL FIN	BK0399	Vertical Fin	1	3-1
		BK0400	Stabilizer Fin	1	3-1
		BK0401	Stabilizer Fin Bracket	1	3-1
		HMC3-30B	M3x30 Socket Screw	2	3-1
		HMM3B	M3 Locknut	2	3-1
		HSE3-12B	M3x12 Self-Tapping Screw	2	3-1
PV0169	LINKAGE ROD	BK0093	2x46 Link Rod	3	1-5
		BK0292	2.3x24 Link Rod	2	2-1
		BK0318	2.3x95 Link Rod	2	4-1
PV0170	MAIN SHAFT BRG	HMV6901ZZ	d12xD24x6 BRG	2	1-1-1, 1-2-1
PV0171	BODY	BK0098	Body Clip A	1	5-4-1
		BK0099	Body Clip B	1	5-4-1
		BK0102	d3xD6x11 RUBBER Grommet	2	5-4-1
		BK0428	Canopy	1	5-4-1
		BK0429	Body	1	5-4-1
		HMJ2-6B	M2x6 Self-Tapping Screw	8	5-4-1
		HSE3-12B	M3x12 Self-Tapping Screw	2	5-4-1
PV0172	THRUST BRG	HMX0816	d8xD16x5 Thrust Bearing	2	2-1-2
PV0174	FLY BAR SEESAW BRG	HMV694ZZ	d4xD11x4 BRG	2	2-1-1
PV0175	FEATHERING BRG	HMV1680	d8xD16x5 BRG	2	2-1-2
PV0176	TAIL PITCH CONTROL LEVER BRG	HMV740ZZ	d4xD7x2.5 BRG	2	3-1-1
PV0177	ROTOR BOLT	BK0446	Rotor Bolt	2	5-5
		HMM5Z	M5 Locknut	2	5-5
PV0182	CLUTCH BELL BRG	HMV1360Z	d6xD13x5 BRG	2	1-1-2
PV0183	BODY RETAINING SET	BK0103	Body Fitting Pin	2	5-4-1
		HSA3-22	M3x22 Button Head Socket Screw	2	5-4-1
PV0184	FLYBAR SEESAW	BK0322	Flybar Seesaw Hub	1	2-1-1

No.	NAME	Parts No.	Parts Name	quantity	Reference Assembly Step
		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(OPT)	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
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
PV0198	COOLING FAN ASSY	BV0380	Cooling Fan Assy	1	4-2-1
PV0200	TAIL ROTOR BRG	HMV1050	d5xD10x4 BRG	4	3-1-2
PV0203	STARTER SHAFT BRG	HMV696Z	d6xD15x5 BRG	2	1-1-2
PV0204	CLUTCH LINER	BK0354	Clutch Liner	1	1-1-2
PV0206	CANOPY	BK0428	Canopy	1	5-4-1
		HMJ2-6B	M2x6 Self-Tapping Screw	8	5-4-1
PV0208	FUEL TANK RUBBER GROMMET	BK0274	Tank Rubber Grommet	4	1-2
PV0209	WASHER,d4xD11xt1.7	BK0435	d4xD11x1.7 Washer	4	
PV0210	WASHER,d3xD8xt1.4	BK0087	d3xD8x1.4 Washer	16	
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	PHILIP 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
PV0242	MAIN SHAFT UPPER BRG CASE	BK0386	Upper BRG Case	2	1-1-1
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

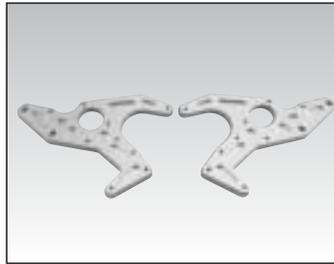
No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
PV0246	TAIL DRIVE GEAR SHAFT	BK0365	Tail Drive Gear Shaft	1	1-2-2
		BK0414	Pin 2X12	2	1-2-2
		HME3-4B	M3x4 Set Screw	2	1-2-2
PV0247	ELEVATOR ARM LINK	BK0335	Elevator Arm Link	2	1-5-5
PV0248	PITCH ARM CROSS MEMBER	BK0393	Pitch Frame Cross Member	1	1-1
		BK0394	Pitch Frame Cross Member Nut	2	1-1
PV0251	FUEL PLUG	BK0445	Fuel Plug	3	1-2-4
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
		HNLR6	R Pin	2	5-4-1
PV0267	LOCTITE #242			1	
PV0268	LOCTITE #262			1	
PV0269	PLASTIC GEAR GREASE			1	
PV0270	THRUST BEARING GREASE			1	
PV0284	METAL SWASH PLATE	BV0504	Metal Swash Plate	1	1-6-2
PV0298	91T MAIN SPUR GEAR	BK0356	Main Gear 91T	1	1-6-3
PV0310	FUEL TANK 550C.C	BV0503	Fuel Tank	1	1-2-4
PV0322	HEAVY DUTY CLUTCH	BV0521	Heavy Duty Clutch	1	1-1-2
PV0324	HEAVY DUTY CLUTCH LINER	BK0523	H.D Clutch Linear	1	1-1-2
PV0350	MAIN SHAFT	BK0547	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
PV0395	SUS FLYBAR ROD	BK0640	SUS FlyBar Rod	1	2-1
PV0402	FLYBAR CONTROL ARM	BK0655	Flybar Control Arm	2	2-1-1
		BK0075	Link Ball 4.5	2	2-1-1
		HMJ2-10N	M2x10 Sefl-Tapping Screw	2	2-1-1
		BK0323	Flybar Arm Bushing	2	2-1-1
		HME4-6B	M4x6 Set Screw	2	2-1-1
PV0403	MAIN ROTOR HUB	BV0321	Main Rotor Hub	1	2-1-2
		BK0330	Main Rotor Hub Pin	1	2-1-2
		BK0617	Socket Screw	1	2-1-2
		HMM4B	M4 Locknut	1	2-1-2
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 Sefl-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

No.	NAME	Parts No.	Parts Name	Quantity	Reference Assembly Step
PV0410	UPPER METAL FRAME	BK0375T	Upper Metal Frame	2	1-1
PV0411	LOWER METAL FRAME	BK0376T	Lower Metal Frame	2	1-2
PV0412	FAN CASING SET	BK0665	Fan Casing L	1	1-2-3
		BK0666	Fan Casing R	1	1-2-3
		BK0662	Fan Caseing Plate	1	1-2-3
		HME3-6B	M3x6 Set Screw	2	1-2-3
PV0413	SERVO FRAME	BK0667	Servo Frame	1	1-4
		HSE3-12B	M3x12 Self-Tapping Screw	6	1-4
PV0414	LANDING SKID SET	BK0668	Skid Pipe	2	4-3-1
		BK0397	Skid Brace	2	4-3-1
		BK0398	Skid Pipe End Cap	4	4-3-1
		HME4-5B	M4x5 Set Screw	4	4-3-1
		HMC3-25B	M3x25 Socket Screw	4	4-3-1
		HMM3B	M3 Locknut	4	4-3-1
PV0415	TAIL SUPPORT	BK0669	Tail Support Rod	2	4-4-1
		BK0447	Tail Support Rod End	4	4-4-1
		HMJ2-8N	M2x8 Self-Tapping Screw	4	4-4-1
PV0416	TAIL CONTROL ROD	BK0086	Ball Link 4.8x20	2	3-1
		BK0105	Rod Joint	1	3-1
		BK0347	Tail Control Rod A	1	3-1
		BK0653	Tail Control Rod B	1	3-1
		HME4-5B	M4x5 Set Screw	2	3-1
PV0417	DECAL	JV0131	Decal	1	3-1
PV0418	FRAME SPACER (L)	BK0660	Frame Spacer L	14	
PV0419	FRAME SPACER(M)	BK0659	Frame Spacer M	8	
PV0420	FRAME SPACER(S)	BK0658	Frame Spacer S	13	
PV0421	TAIL DRIVE SHAFT SET	BV0651	Tail Drive Shaft Set	1	3-1-3
PV0422	TAIL BOOM	BK0650	Tail Boom	1	3-1
PV0423	TAIL ROD GUIDE	BK0403	Rod Guide	4	3-1
PV0425	TAIL PITCH CONTROL SLIDE BUSHING	BK0345	Tail Pitch Control Slide Bushing	1	3-1-2
PV0455	SKID PIPE END CAP	BK0398	Skid Pipe End Cap	8	4-3-1
PV0466	METAL FORK	BK0545	Metal Fork	1	3-1-2
		BK0546	Pin 2mm	2	3-1-2
		HMS15	E Ring	6	3-1-2

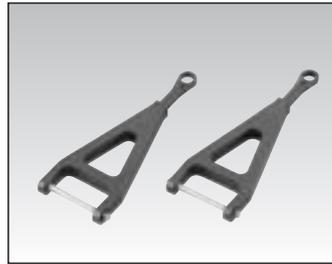
RAPTOR 90 OPTIONAL PARTS



3821 710mm CARBON GRAPHITE MAIN ROTOR BLADES



PV0283 METAL SIDEFRAME STIFFENER



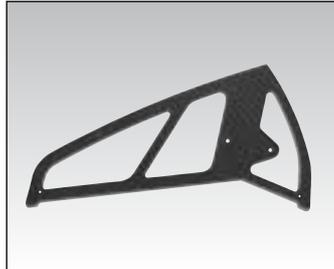
PV0286 MACHINED ELEVATOR ARM LINK



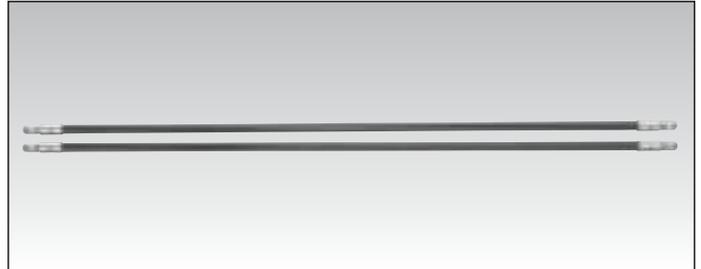
PV0298 MAIN SPUR GEAR 91T



PV0299 CARBON GRAPHITE HORIZONTAL FIN



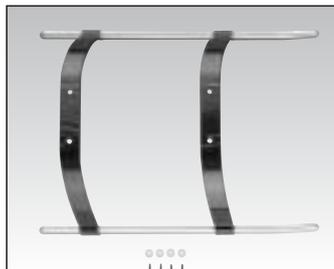
PV0300 CARBON GRAPHITE VERTICAL FIN



PV0306 CARBON TAIL BOOM SUPPORT



PV0308 CARBON GRAPHITE HILLER PADDLE



PV0309 CARBON GRAPHITE LANDING SKID



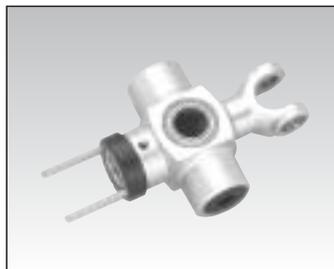
PV0315 CARBON GRAPHITE UPPER SIDE FRAMES



PV0316 CARBON GRAPHITE LOWER SIDE FRAMES



PV0321 REAR MOUNTED TAIL SERVO TRAY



PV0334 METAL MAIN ROTOR HUB



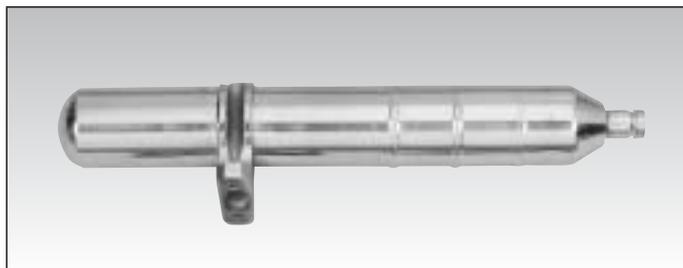
PV0335 METAL MAIN ROTOR GRIP



PV0384 WIRE CLAP



PV0388 HELI THROTTLE LEVER



PV0391 MUFFLER, .90 (YS)



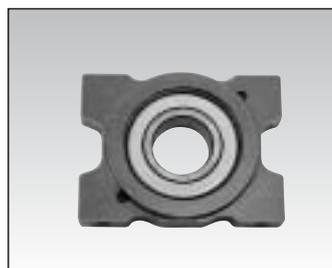
PV0396 METAL FLYBAR CONTROL ARM SET
PV0396-L METAL FLYBAR CONTROL ARM SET(BL)



PV0397 SIM-CARBON CANOPY



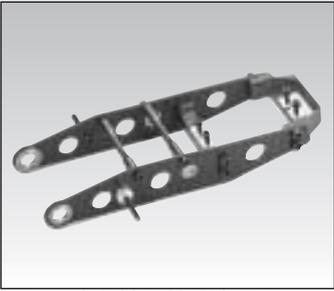
PV0429 ELEVATOR LEVER SET
PV0429-L ELEVATOR LEVER SET(BL)



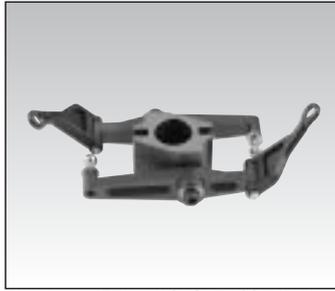
PV0430 METAL UPPER BEARING BLOCK
PV0430-L METAL UPPER BEARING BLOCK(BL)



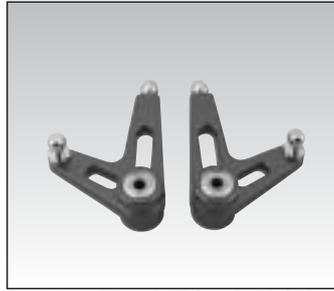
PV0431 METAL LOWER BEARING BLOCK
PV0431-L METAL LOWER BEARING BLOCK(BL)



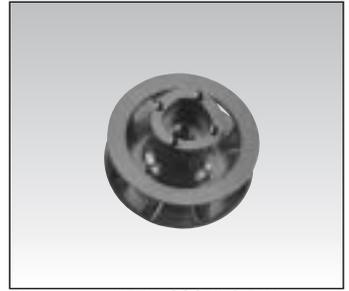
PV0432 C. G. COLL. CONTROL ARM
PV0432-L C. G. COLL. CONTROL ARM (BL)



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



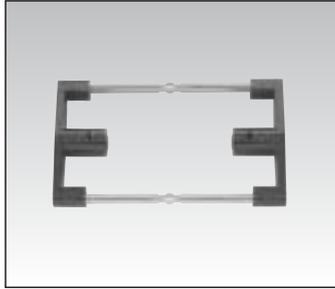
PV0434 METAL AILERON LEVER SET
PV0434-L METAL AILERON LEVER SET(BL)



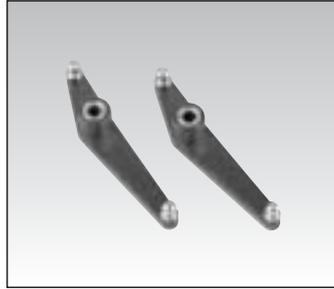
PV0435-L METAL COOLING FAN
PV0435YS-L METAL COOLING FAN, YS (BL)



PV0435 METAL COOLING FAN
PV0435YS METAL COOLING FAN, YS



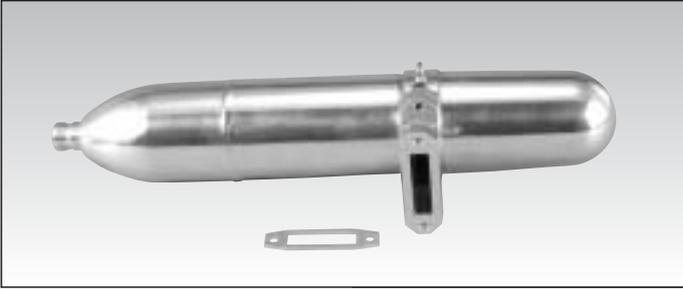
PV0436 METAL FLYBAR CONTROL ARM
PV0436-L METAL FLYBAR CONTROL ARM(BL)



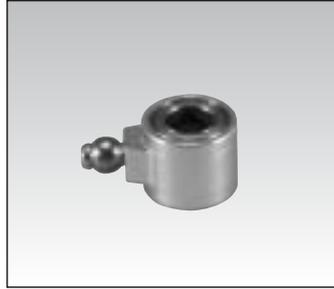
PV0437 METAL B-H. MIXING ARM SET
PV0437-L METAL B-H. MIXING ARM SET(BL)



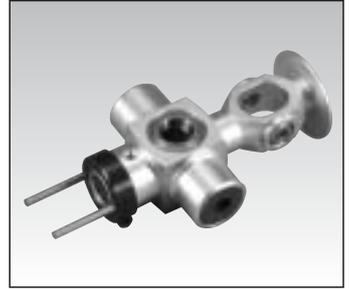
PV0438 METAL HORIZ. FIN BRACKET
PV0438-L METAL HORIZ. FIN BRACKET(BL)



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



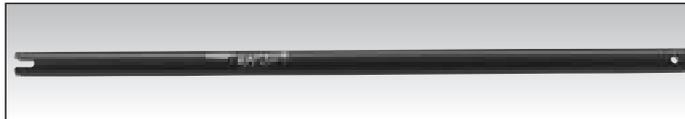
PV0457 METAL TAIL PITCH CONTROL
SLIDER



PV0458 METAL MAIN ROTOR HUB
(BUTTON HEAD)



PV0459 METAL CLUTCH BEARING
CASE



PV0461 CARBON TAIL BOOM PIPE (R90 STD/SE)



PV0462 CARBON TAIL DRIVE SHAFT (R90 STD/SE)



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



PV0466-L METAL TAIL PITCH FORK
(BL)



9609 PRO-90H(R) ENGINE



RAPTOR 3

Specification:

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

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

Total Height: 18 1/4" (465mm)

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

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

Gear Ratio: 8.45: 1: 4.65

Full Equipped Weight: 4800g /10.5 lbs



THUNDER TIGER CORPORATION

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