

# Ergo Z230

## ASSEMBLY INSTRUCTIONS

---

Also for use in assembly of JR Ergo Quattro when combined with Ergo Quattro Supplement Instructions.



### ERGO Z230 SPECIFICATIONS

---

Overall Length	55.85"	Tail Rotor Diameter	10.34"
Overall Height	18.92"	Gear Ratio	6.77:1:5.18
Main Rotor Diameter	60.45"	Gross Weight	12.4 lbs.

---

**JR PROPO**  
Heli Division



## INTRODUCTION

Congratulations on your purchase of the JR Ergo helicopter kit.

This kit has been both engineered and manufactured by JR with help from some of Japan's top R/C helicopter engineers (now employed by JR).

As you may well know, the name JR has for years been synonymous with state-of-the-art, high quality radio control systems known the world over for their exceptional reliability and engineering.

JR now brings this reputation and knowledge into the helicopter market with the development of the Ergo and the organization of the JR heli division. Years in the making, the Ergo's superior quality and exceptional parts fit and finish create a new standard of quality that was previously unavailable.

Before you begin the assembly of your Ergo, we suggest that you first review the entire instruction manual to become familiar with the assembly sequences and parts layout.

### WARNING

The radio controlled model helicopter contained in this kit is not a toy, but a sophisticated piece of equipment. This product is not recommended for use by children. Radio controlled models such as this are capable of causing both property damage and/or bodily harm to both the operator/assembler and/or spectator if not properly assembled and operated. Horizon Hobby Distributors assumes no liability for damage that could occur from the assembly and/or use/misuse of this product.

### AMA INFORMATION

We strongly encourage all prospective and current R/C aircraft pilots to join the Academy of Model Aeronautics. The AMA is a non-profit organization which provides services to model aircraft pilots. As an AMA member, you will receive a monthly magazine entitled *Model Aviation*, as well as a liability insurance plan to cover against possible accident or injury. All AMA charter aircraft clubs require individuals to hold a current AMA sporting license prior to operation of their models. For further information, you can contact the AMA at:

**Academy of Model Aeronautics**  
5151 East Memorial Drive  
Muncie, IN 47302  
(317) 287-1256



### PRE-ASSEMBLY INFORMATION

Since this manual has been formatted for use in assembly of both the Ergo Z230 and the Ergo Quattro, near each assembly step number you will notice the following symbols:



For use in assembly of Ergo Z230 only



For use in assembly of Ergo Quattro only



For use in assembly of both Ergo Z230 and Ergo Quattro

Please refer to these symbols to guide you in the specific assembly of your particular model.

When first opening your Ergo kit, you will notice that all of the parts are packaged and numbered to coordinate with the assembly step numbers of this instruction manual.

All small hardware (nuts, bolts, washers, etc.) for each step are separated and packaged separately within the main parts bags. When beginning a section, you will need to open only the bag with the corresponding number to the section you are going to start. It is suggested that you place all of the hardware in an open container (e.g., coffee can) during assembly so as not to lose any of the small parts. It may also be helpful to familiarize yourself with the various sizes of screws, bolts, nuts, etc., as illustrated in the appropriate assembly section before you begin assembly. At the end of each assembly, in most cases, there should be no parts remaining.

Great care has been taken in filling the bags with the correct quantity of parts and hardware for each section. However, occasionally mistakes do happen. In the event that you find a parts shortage or are in need of technical assistance, please contact your local JR heli division parts dealer, or contact the Horizon Service Center directly.

**Horizon Service Center**  
4105 Fieldstone Road  
Champaign, IL 61821  
(217) 355-9511 (9am to 5pm CST)

## INDEX

Section	Description	Page	Section	Description	Page
	Building Supplies .....	5	<b>5-4</b>	Tail Blade Holder Assembly .....	29
	Tools/Field Equipment .....	6	<b>5-5</b>	Tail Pitch Control Lever Installation .....	30
	Hardware Identification .....	7	<b>5-6</b>	Tail Boom Carrier Installation .....	30
<b>1-1</b>	Clutch Bell/Start Shaft Assembly .....	8	<b>5-7</b>	Tail Boom Assembly Installation .....	31
<b>1-2</b>	Tail Drive Pinion/Bearing Block Assembly .....	8	<b>5-8</b>	Vertical Fin Attachment .....	31
<b>1-3</b>	Control Ball Installation .....	9	<b>5-9</b>	Tail Boom Brace Assembly .....	32
<b>1-4</b>	Servo Mixing Lever Unit Assembly .....	9	<b>5-10</b>	Tail Boom Brace/Horizontal Fin Installation .....	32
<b>1-5</b>	Elevator Arm Assembly .....	10	<b>6-1</b>	Upper Servo Tray Installation .....	33
<b>1-6</b>	Fuel Tank Assembly .....	11	<b>6-2</b>	Servo/Switch Harness Installation .....	34
<b>2-1</b>	Upper Main Frame Section Assembly .....	12	<b>6-3</b>	Tail Control Rod Assembly .....	35
<b>2-2</b>	Upper Main Frame Control Lever Installation .....	13	<b>6-4</b>	Tail Control Rod Installation .....	35
<b>2-3</b>	Lower Main Frame Assembly .....	14	<b>6-5</b>	Gyro/Receiver/Battery Installation .....	36
<b>2-4</b>	Fuel Tank Installation .....	14		Radio System Preparation .....	37
<b>2-5</b>	Front Radio Bed Installation .....	15	<b>7-1</b>	Aileron Linkages .....	38
<b>2-6</b>	Cooling Fan Shroud Installation .....	15	<b>7-2</b>	Elevator Linkage Installation .....	38
<b>2-7</b>	Upper/Lower Main Frame Assembly Attachment .....	16	<b>7-3</b>	Collective Pitch Linkages .....	39
<b>3-1</b>	Main Drive Gear/Autorotation Assembly .....	17	<b>7-4</b>	Tail Control Rod Servo Connection .....	39
<b>3-2</b>	Main Drive Gear/Autorotation Assembly Installation .....	17	<b>7-5</b>	Throttle Linkage Installation .....	40
<b>3-3</b>	Landing Gear Assembly Installation .....	18	<b>7-6</b>	Control Lever/Linkage Adjustment .....	41
<b>3-4</b>	Engine Preparation/Cooling Fan Installation .....	18	<b>8-1</b>	Body Assembly/Canopy Attachment .....	42
<b>3-5</b>	Clutch Assembly Attachment .....	19	<b>8-2</b>	Body Attachment .....	42
<b>3-6</b>	Engine Installation .....	19		Decal Placement .....	43
<b>3-7</b>	Muffler Installation .....	20	<b>8-3</b>	Main Rotor Blade Assembly .....	44
<b>3-8</b>	Carburator/Aircleaner Assembly Installation .....	20	<b>8-4</b>	Main Rotor Blade Final Balancing .....	45
<b>4-1</b>	Rotor Head Hub Assembly .....	21	<b>8-5</b>	Main Rotor Blade Final Attachment .....	45
<b>4-2</b>	Main Blade Holder Assembly .....	21		Final Servo Adjustment and Radio Set Up .....	46-47
<b>4-3</b>	Main Blade Holder/Seesaw Attachment .....	22		Data Sheets .....	48-51
<b>4-4</b>	Seesaw Mixing Arm Installation .....	22		Final Pre-Flight Check .....	52
<b>4-5</b>	Washout Unit Assembly .....	23		Range Test/Initial Engine Start-Up & Adjustment .....	53-54
<b>4-6</b>	Tail Pitch Slide Ring Assembly .....	23		General Maintenance .....	55
<b>4-7</b>	Swashplate/Washout Assembly Installation .....	24		Rotor Head/Swashplate/Washout Assembly Parts List .....	56-57
<b>4-8</b>	Rotor head Installation .....	25		Cyclic Mixing Arms/Elevator/Aileron Control Arms Parts List .....	58-59
<b>4-9</b>	Flybar Installation .....	26		Start Shaft/Clutch/Engine Assembly Parts List .....	60-61
<b>4-10</b>	Flybar Paddle Attachment .....	26		Upper Main Frame/Radio Tray/Body Set Parts List .....	62-63
<b>4-11</b>	Rotor Head/Swashplate Control Rod Installation .....	27		Lower Main Frame/Landing Gear/Fuel Tank Parts List .....	64-65
<b>5-1</b>	Tail Output Shaft/Pulley Assembly .....	28		Tail Boom/Tail Brace/Tail Boom Carrier Parts List .....	66-67
<b>5-2</b>	Tail Gear Case Assembly .....	28		Tail Case/Tail Blade Holders/Tail Pitch Plate Parts List .....	68-69
<b>5-3</b>	Tail Center Hub Assembly .....	29		Zenoah G23 Engine Service/Information Parts .....	70

## ERGO Z230 FEATURES

### Heavy-Duty Aluminum Quad Frame System

Provides excellent rigidity and vibration absorption.

### Powerful Zenoah G23 Gas Engine w/Recoil Start

Provides reliable, economical gasoline operation. Convenient recoil starter included.

### Wide Spread Tail Output Shaft Bearings

Reduces vibration and improves control response.

### Belt-Driven Tail Rotor Design

Provides easy adjustment and low maintenance. Also eliminates the need for optional/expensive tube drive shafts.

### Precision Ball Bearings at All Critical Locations

Provide low wear, high precision and reduced maintenance.

### Unique Cyclic Mixing Control System

Offers easy adjustment and precise control.

### Self-Aligning One-Piece Steel Clutch System

Offers easy installation and adjustment with exceptional reliability.

### Straight Blade Axle Rotor Head Design

Provides high responsiveness and solid blade tracking.

### Low Drag Flybar Paddles

Provide quick yet smooth cyclic response at all flight speeds.

### Heavy-Duty Main Blade Grips with 4mm Blade Bolts

Provide a solid and secure mounting surface to easily handle the stresses of radical flight.

### Heavy-Duty Tail Boom Carrier

Provides increased structural rigidity and improved tail rotor precision.

### Superior Parts Fit and Finish

Make assembly trouble free and enjoyable.

## ITEMS REQUIRED TO COMPLETE THE JR ERGO (not supplied in kit)

### 1. RADIO SYSTEM REQUIREMENTS (NOT INCLUDED):

6-channel or greater PCM R/C helicopter system with 5 servos, 1000 mAh receiver battery and gyro.

**Note:** Due to the additional RF interference generated by the Zenoah G23 gasoline engine, it is highly recommended that only a PCM (Pulse Code Modulation) system be used with the Ergo Z230.



JRXP783 PCM



JRXP8103 PCM



JRPCM10SX PCM



Flight Pack



Gyro



PCM Receiver

## 2. BUILDING SUPPLIES (NOT INCLUDED):

---

The following items are needed to complete the assembly of the JR Ergo Z230:



Gasoline Fuel Filter  
(DUB341)



Gasoline Fuel Tubing  
(AER1073)



Whip Antenna  
(RVO1010)



Locktite 242 (Blue)  
Locktite (Red)



Double Sided Servo  
Mounting Tape



Dubro Brass Sintered Fuel Filters (2pc)  
(DUB161)



Nylon Wire Ties (to secure  
radio wires, etc)



5 Minute Epoxy or Rotor Blade  
CA Adhesive

**3. TOOLS NEEDED TO ASSEMBLE THE JR ERGO Z230 (NOT INCLUDED):**

---



Phillips Screwdriver



Nut Drivers: 5mm, 7mm



Needle Nose Pliers



Scissors



Drill and Drill Bits



Small Hammer



Hobby Knife



Metric Ruler



Sandpaper (80-100 Grit)



Allen Wrenches: 1.5, 2.0, 2.5, 3.0, 4.0mm



Blade Balancer



Adjustable Pliers

**4. FIELD EQUIPMENT REQUIRED (NOT INCLUDED):**

---



DOT Approved Gasoline Can  
(93 octane unleaded gasoline  
recommended w/2 cycle oil added)



Gasoline Fuel Pump



2 Cycle Oil Additive  
(21 to 25% mix ratios)



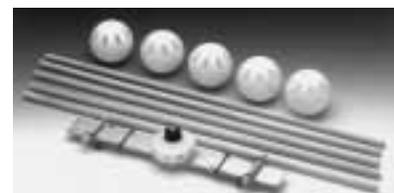
Fire Extinguisher



Pitch Gauge



Ball Link Pliers

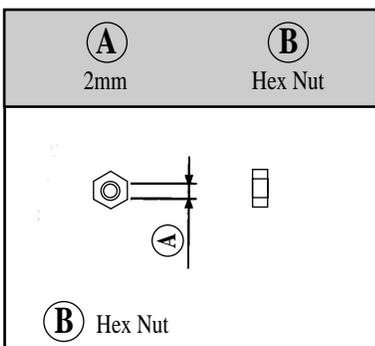
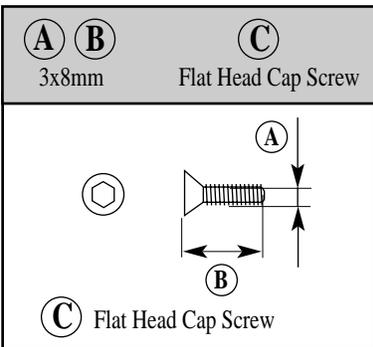
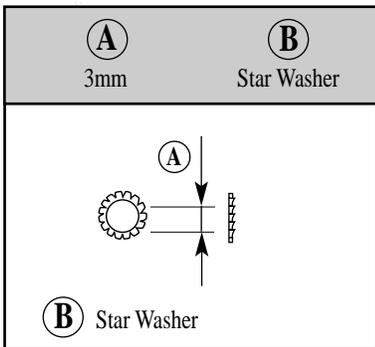
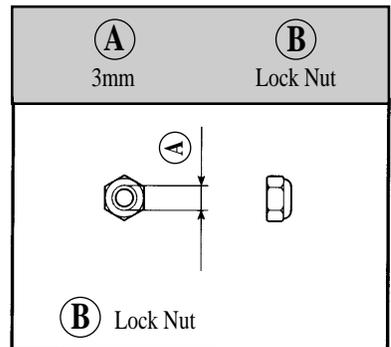
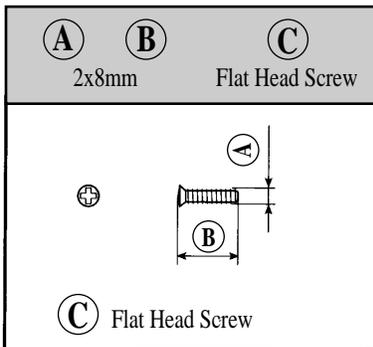
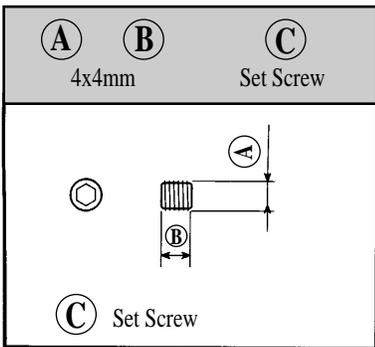
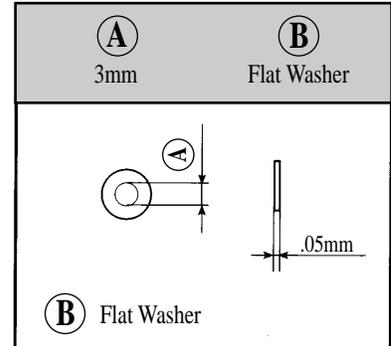
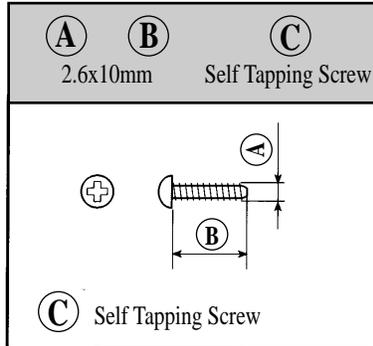
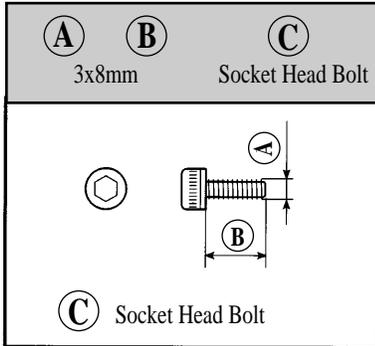


Training Gear (Beginners Only)

## HARDWARE IDENTIFICATION

There are a variety of sizes and shapes of hardware included in this kit. Prior to assembly, please be careful to identify each screw by matching it to the full size screw outlines included in each step.

All of the hardware, screws, nuts, etc., contained in the Ergo kit are described in the following A, B, C manner:

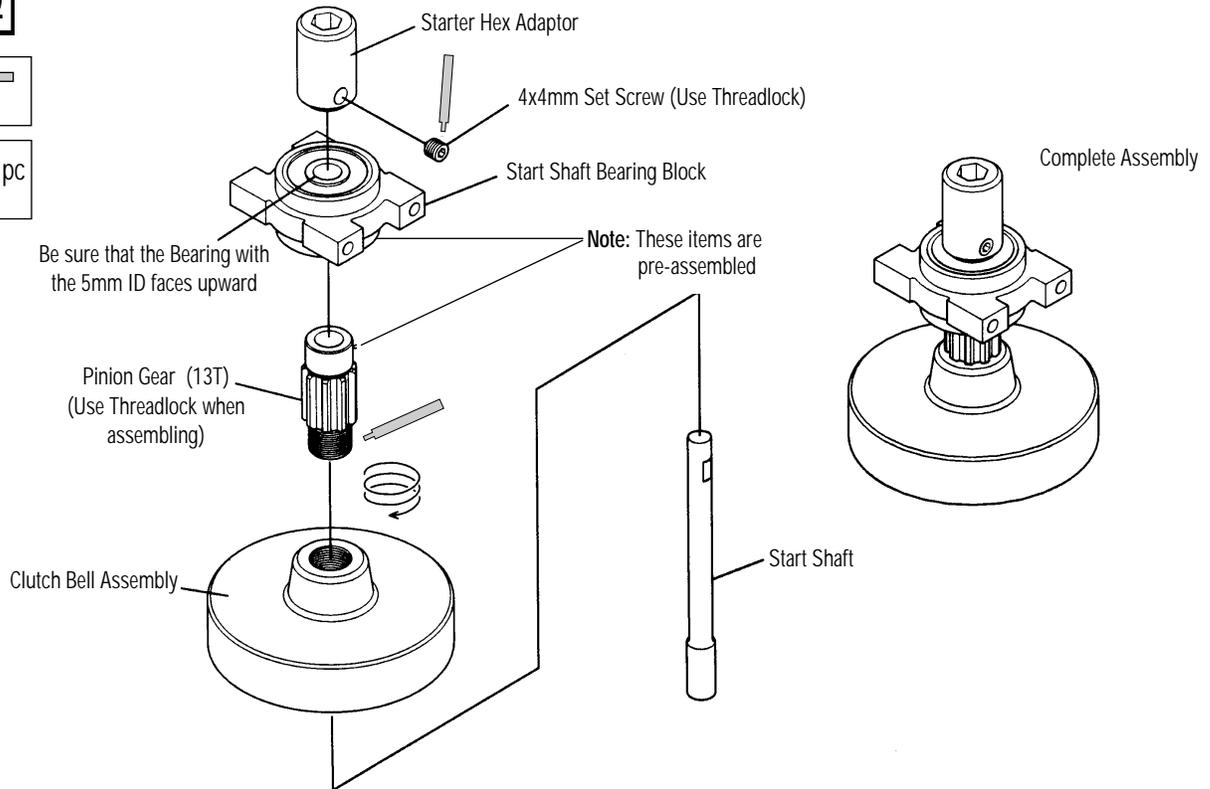


# 1-1

## CLUTCH BELL/START SHAFT ASSEMBLY

Z,Q

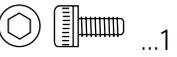
-  Use Threadlock
-  ..... 1 pc  
4x4mm Set Screw



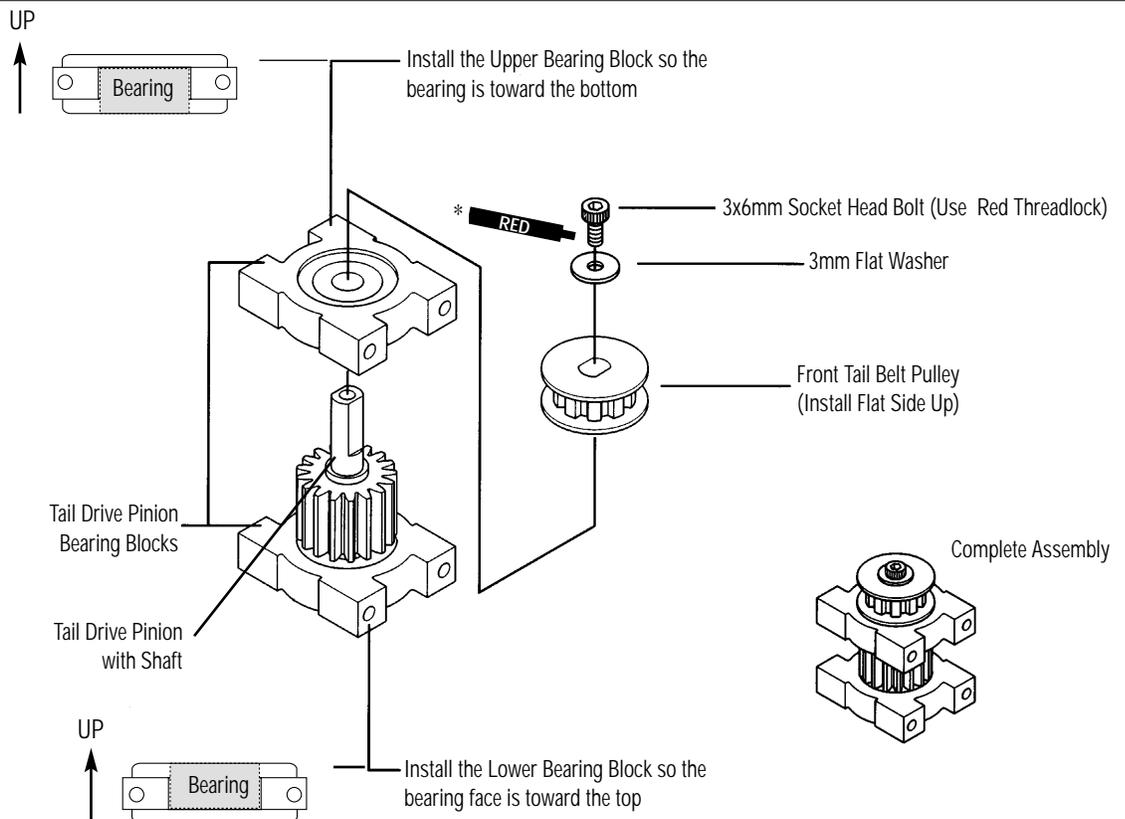
# 1-2

## TAIL DRIVE PINION/BEARING BLOCK ASSEMBLY

Z,Q

- \*  **RED**  
Use Red Threadlock
-  ..... 1 pc  
3x6mm Socket Head Bolt
-  ..... 1 pc  
3mm Flat Washer

**Note:** It will be necessary to press the two Bearings into the Bearing Blocks. Press the Bearings in evenly by hand. Do not use a vise or pliers for this procedure as damage could result.



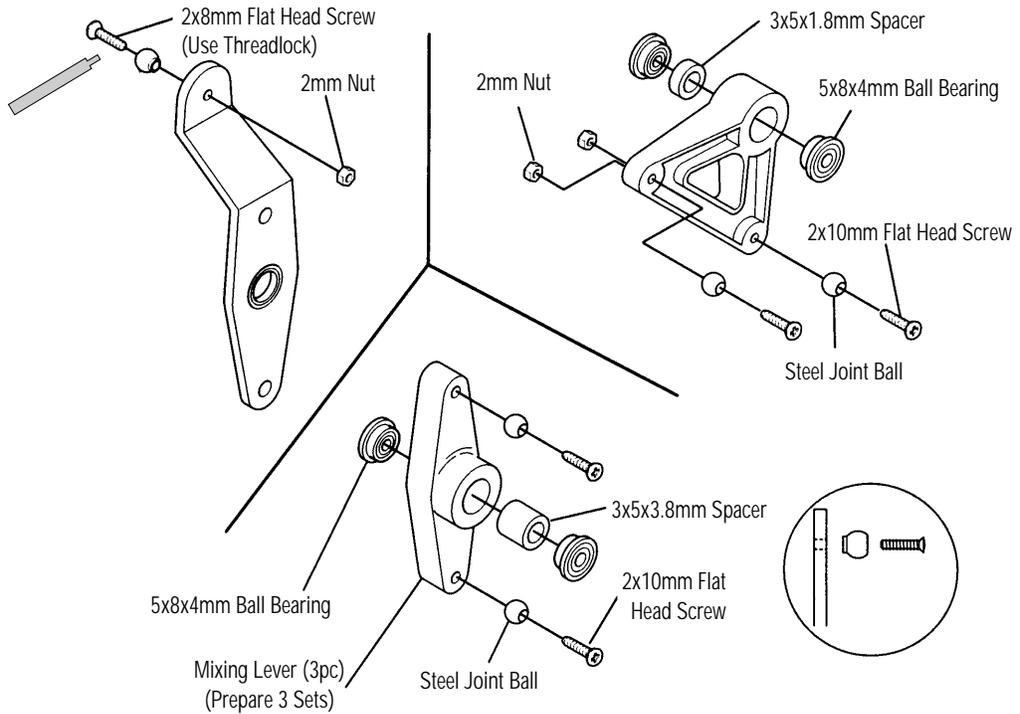
# 1-3

## CONTROL BALL INSTALLATION

Use Threadlock

Z,Q

-  ..... 1 pc  
2x8mm Flat Head Screw
-  ..... 8 pc  
2x10mm Flat Head Screw
-  ..... 9 pc  
Steel Joint Ball
-  ..... 3 pc  
2mm Nut
-  ..... 8 pc  
5x8x4mm Ball Bearing
-  ..... 3 pc  
3x5x3.8mm Spacer
-  ..... 1 pc  
3x5x1.8mm Spacer



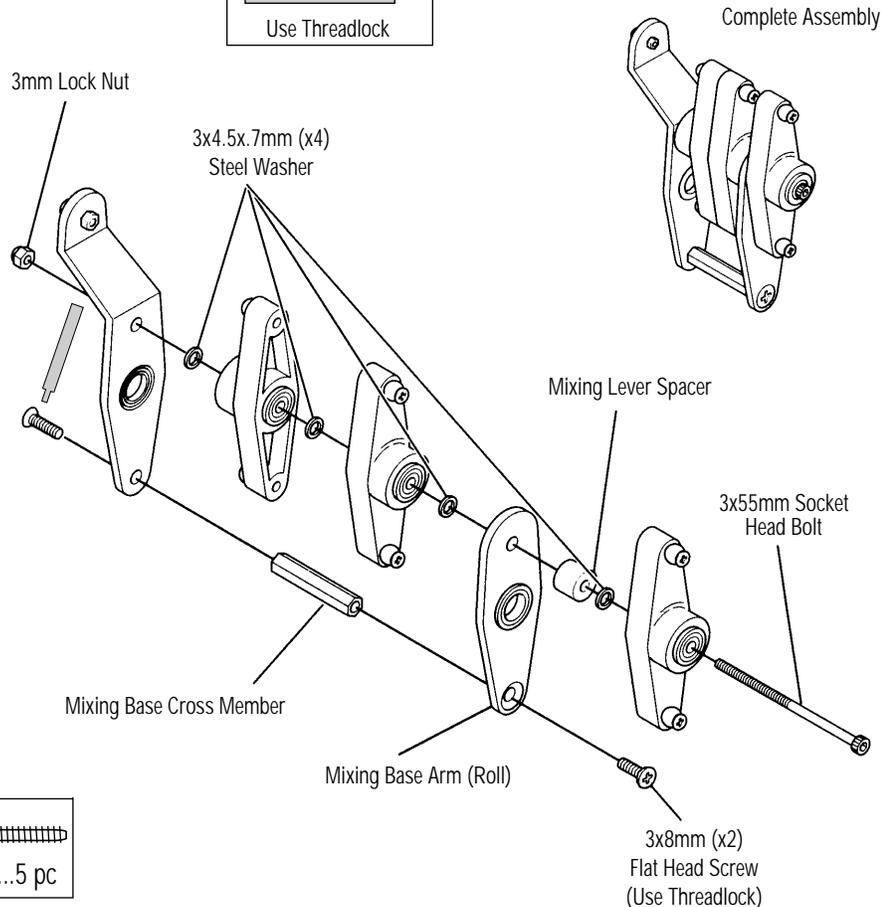
# 1-4

## SERVO MIXING LEVER UNIT ASSEMBLY

Z,Q

Use Threadlock

-  ..... 2 pc  
3x8mm Flat Head Screw
-  ..... 1 pc  
3mm Lock Nut
-  ..... 4 pc  
3x4.5x.7mm Steel Washer
-  ..... 1 pc  
Mixing Lever Spacer
-  ..... 1 pc  
Mixing Base Cross Member
-  ..... 5 pc  
3x55mm Socket Head Bolt

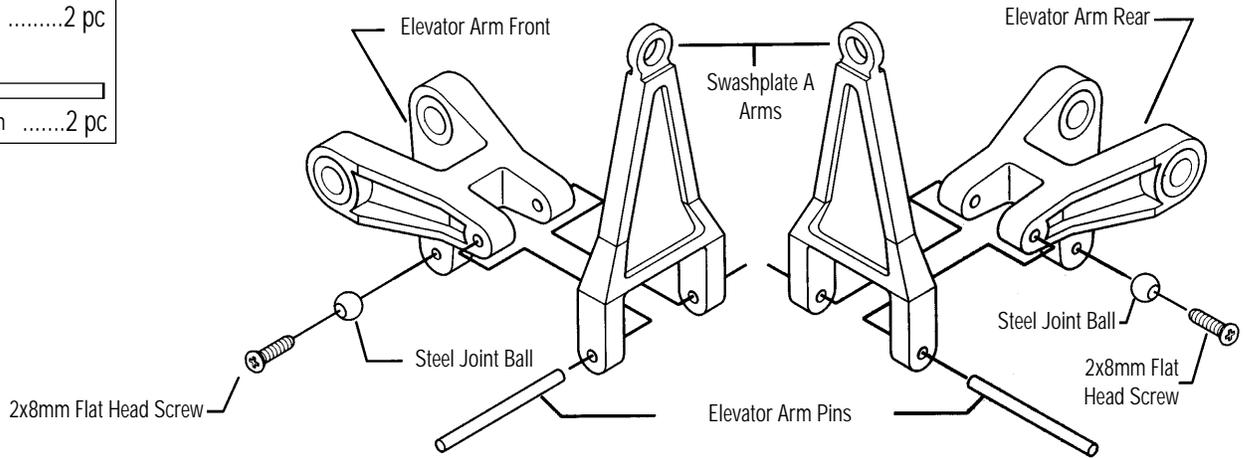


# 1-5

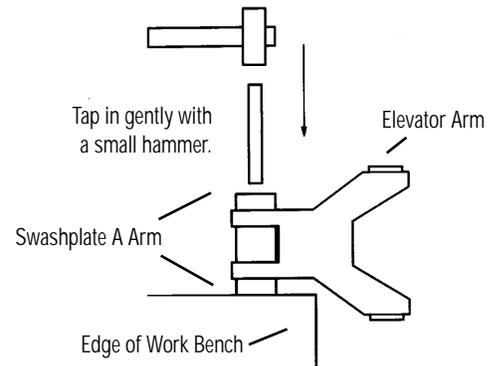
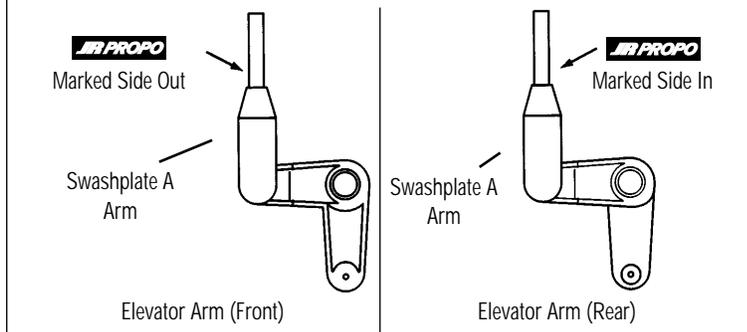
## ELEVATOR ARM ASSEMBLY

Z,Q

-  .....2 pc  
2x8mm Flat Head Screw
-  .....2 pc  
Steel Joint Ball
-  .....2 pc  
Elevator Arm Pin



**Caution:** Be sure to note the correct installation direction of the Swashplate A Arm.



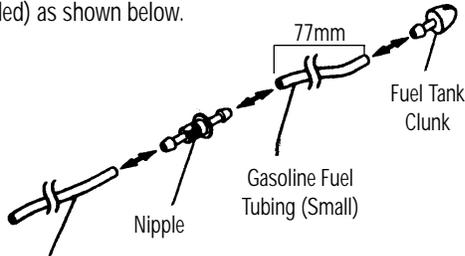
# 1-6

## Z,Q

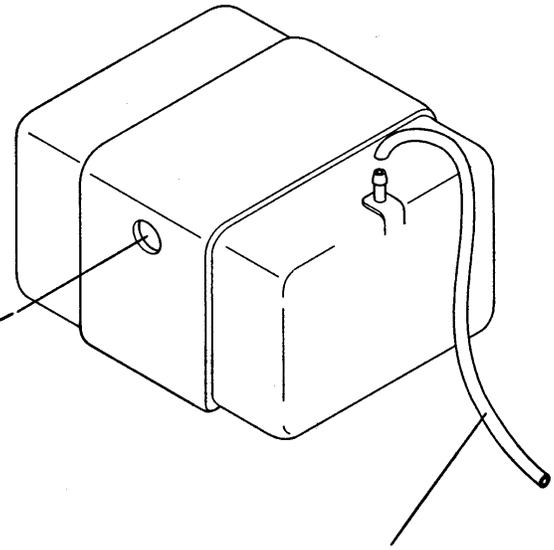
### FUEL TANK ASSEMBLY

**Note:** The Fuel Tank Fittings included in the Z230 kit are made specifically for gasoline use.

1. Cut the small Gasoline Tubing (included) to a length of 77mm. Next, connect the Fuel Tank Clunk, Nipple, and medium Gasoline Fuel Tubing (not included) as shown below.

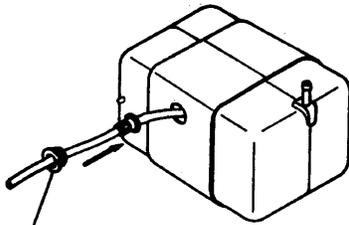


Medium Gasoline Fuel Tubing (not included)  
Connects to Engine Carburetor



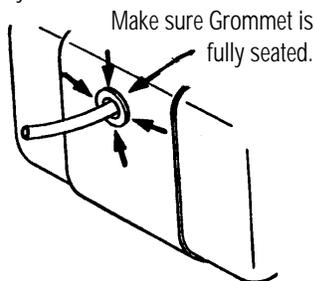
Gasoline Fuel Tubing (not included)  
Connects to Muffler Pressure Tap

2. Insert the assembly above (Fuel Tank Clunk first) into the Fuel Tank opening so that the Nipple is inside the tank. Next, slide the Fuel tank Grommet over the medium Fuel Tubing.

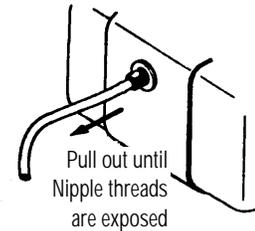


Fuel Tank Grommet

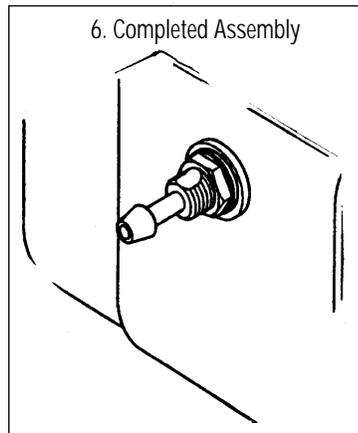
3. Insert the Fuel Tank Grommet into the Fuel Tank opening, making sure that it is fully seated.



4. Pull the medium Gasoline Fuel Tubing out of the Fuel Tank until the threads of the Fuel Tank Nipple are exposed.

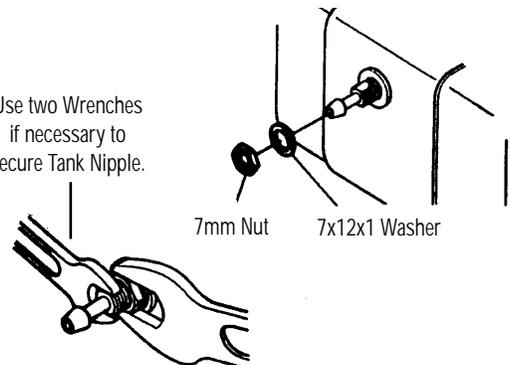


5. Remove the medium Gasoline Fuel Tubing from the Nipple and secure the Nipple to the Fuel Tank using the 7x12x1mm Washer and 7mm Nut supplied. Be sure to secure this assembly firmly to avoid leakage.



6. Completed Assembly

Use two Wrenches if necessary to secure Tank Nipple.



# 2-1

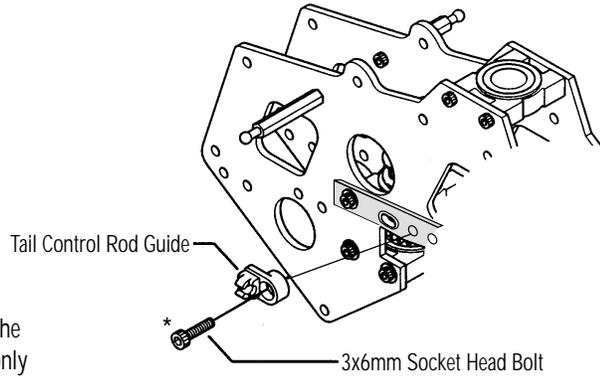
# Z,Q

## UPPER MAIN FRAME SECTION ASSEMBLY

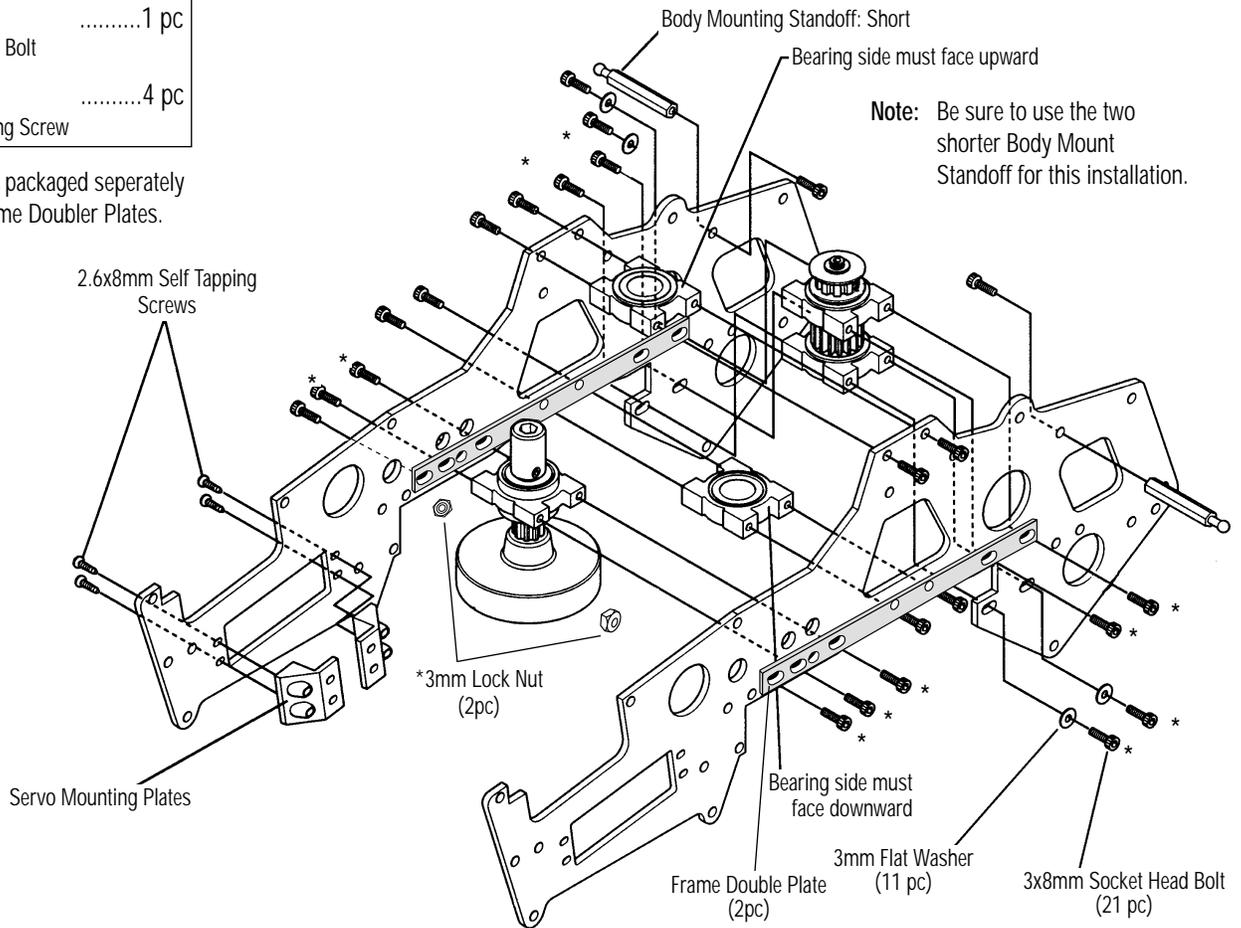
	.....22 pc
	.....2 pc
	.....11 pc
	.....2 pc
	.....1 pc
	.....4 pc



**Note:** Due to the addition of the Frame Double Plates, only four 3mm Flat Washers are required for this step.

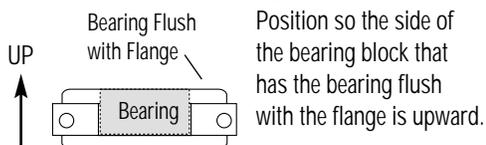


\* This hardware is packaged separately with the two Frame Doubler Plates.

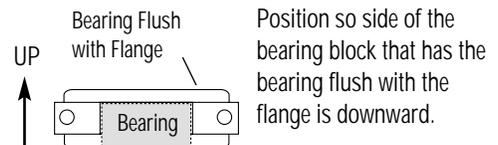


When installing the Main Rotor Shaft Bearing Blocks, it is important to note the correct direction in which they need to be installed. Please refer to the diagram below for clarification.

### Upper Main Shaft Bearing Block



### Lower Main Shaft Bearing Block



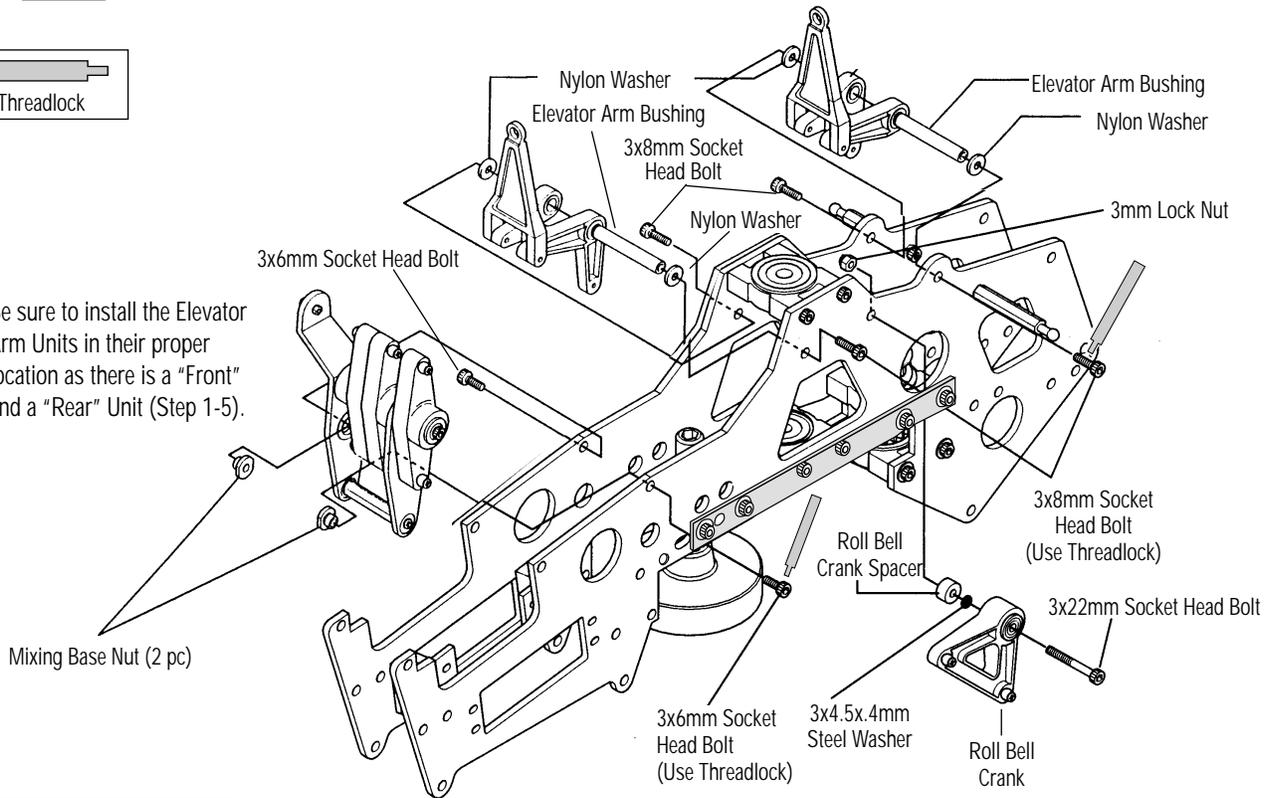
# 2-2

# Z,Q

## UPPER MAIN FRAME CONTROL LEVER INSTALLATION



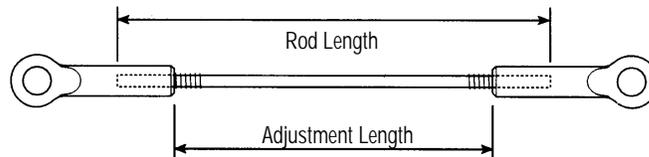
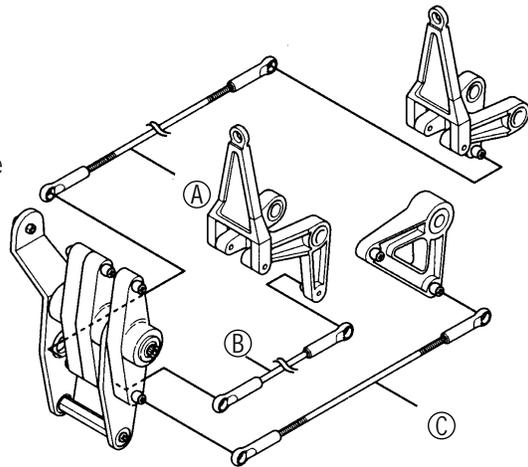
**Note:** Be sure to install the Elevator Arm Units in their proper location as there is a "Front" and a "Rear" Unit (Step 1-5).



- .....2 pc  
3x6mm Socket Head Bolt
- .....4 pc  
3x8mm Socket Head Bolt
- .....1 pc  
3x22mm Socket Head Bolt
- .....1 pc  
3mm Lock Nut
- .....4 pc  
Nylon Washers
- .....1 pc  
3mm Flat Washer
- .....1 pc  
Roll Bell Crank Spacer
- .....2 pc  
Elevator Arm Bushing
- .....2 pc  
Mixing Base Nut

Assemble and attach the Control Rods to the Mixing Levers/Control Arms as shown:

**Note:** When adjusting final control rod lengths, make sure that "JR Propo" moulded into the Ball Link faces outwards before attaching to the Steel Joint Balls.



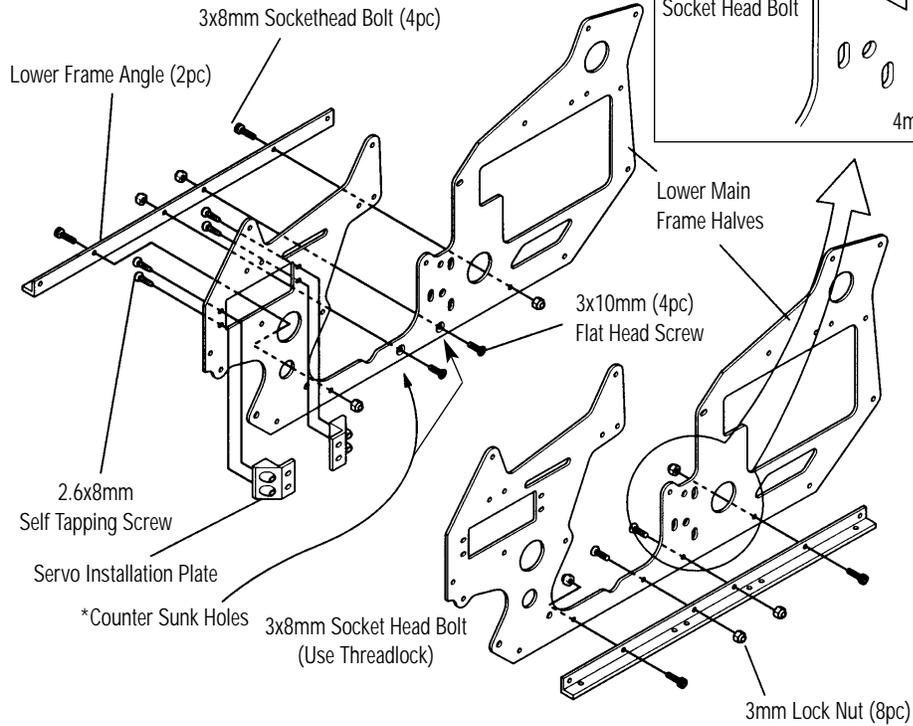
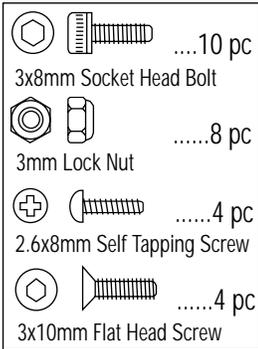
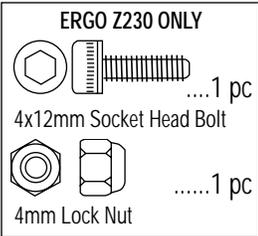
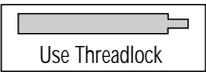
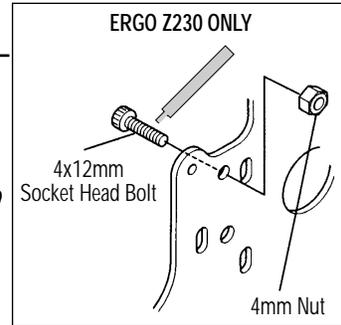
	Rod Length	Adjust Length To
(A)	120mm	104mm
(B)	55mm	36mm
(C)	90mm	72mm

# 2-3

## Z

### LOWER MAIN FRAME ASSEMBLY

**\* Note:** Make sure that the frames are positioned so that the counter sunk screw holes face towards the inside of the Main Frame Assembly as shown.



# 2-4

## Z,Q

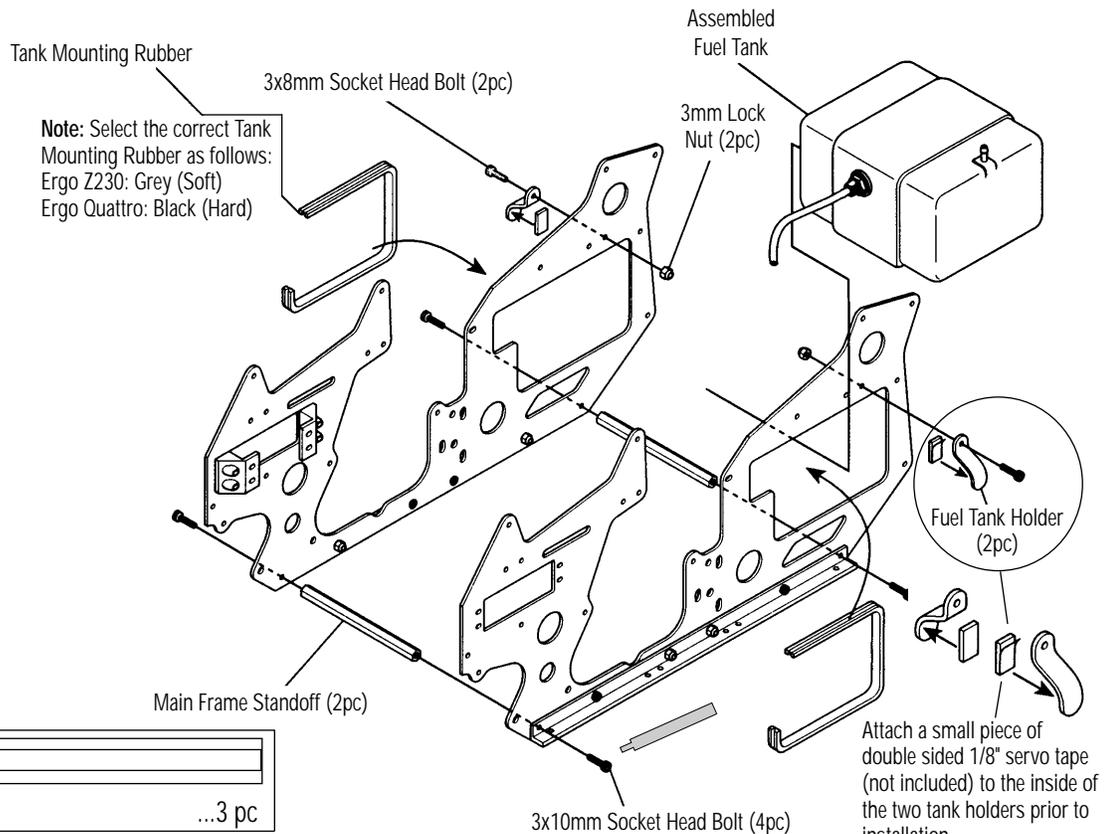
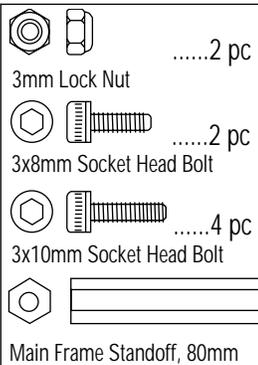
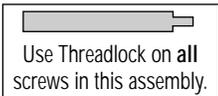
### FUEL TANK INSTALLATION

**Note:** Install the Fuel Tank and Tank Mounting Rubber into the lower frame halves before attaching the Main Frame Standoffs.

When securing Standoffs to Frame, position the bottom of the frame on a level surface to prevent twisting during tightening.

Also be sure to use the correct length bolt in the correct location when assembling.

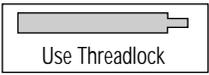
**Note:** Select the correct Tank Mounting Rubber as follows:  
Ergo Z230: Grey (Soft)  
Ergo Quattro: Black (Hard)



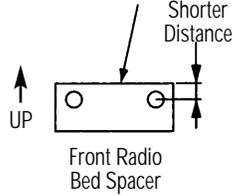
# 2-5

Z,Q

## FRONT RADIO BED/INSTALLATION

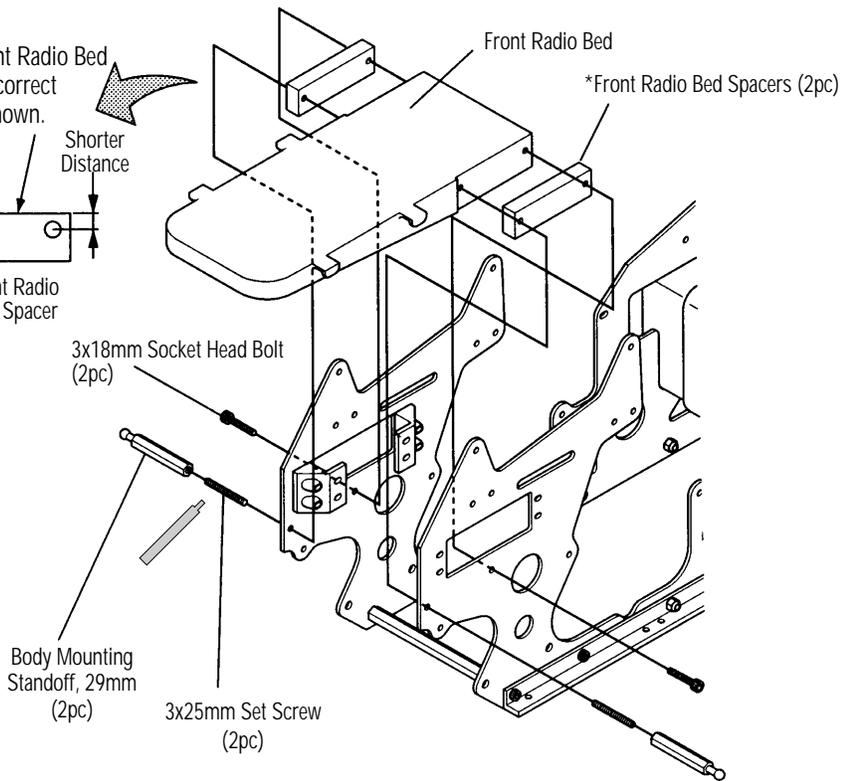


\* Install the Front Radio Bed Spacer in the correct direction as shown.



Install the 3x25mm Set Screw into the Body Mounting Standoffs to the correct distance as shown and secure with Threadlock.

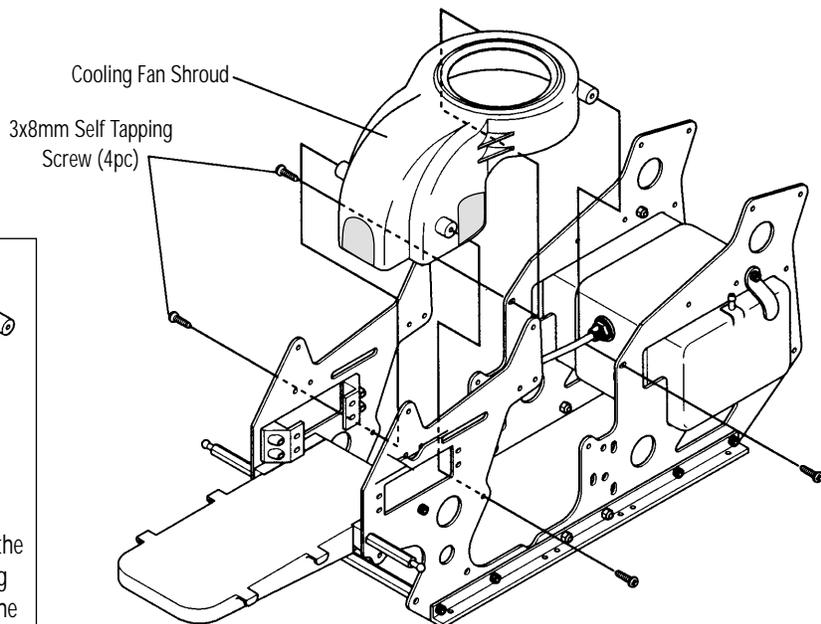
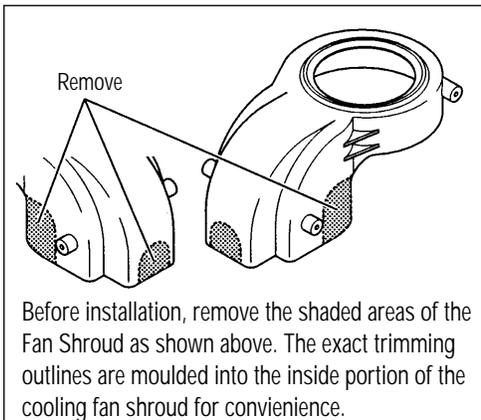
	3x18mm Socket Head Bolt	.....2 pc
	3x25mm Set Screw	.....2 pc
	Body Mounting Standoff, 29mm	.....2 pc



# 2-6

Z,Q

## COOLING FAN SHROUD INSTALLATION

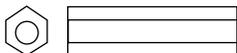


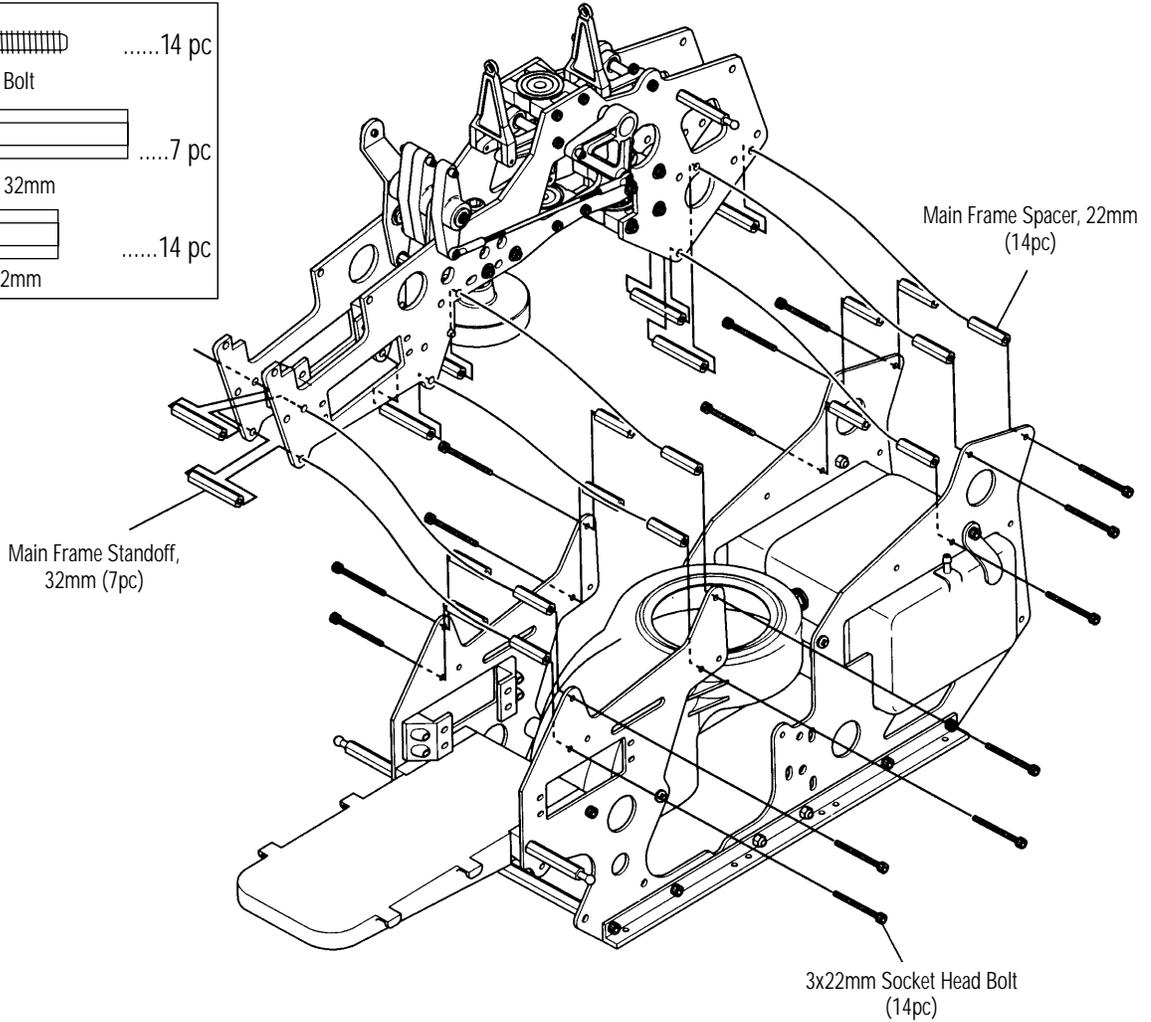
# 2-7

Z,Q

## UPPER/LOWER MAIN FRAME ASSEMBLY ATTACHMENT

  
Use Threadlock on **all**  
screws in this assembly.

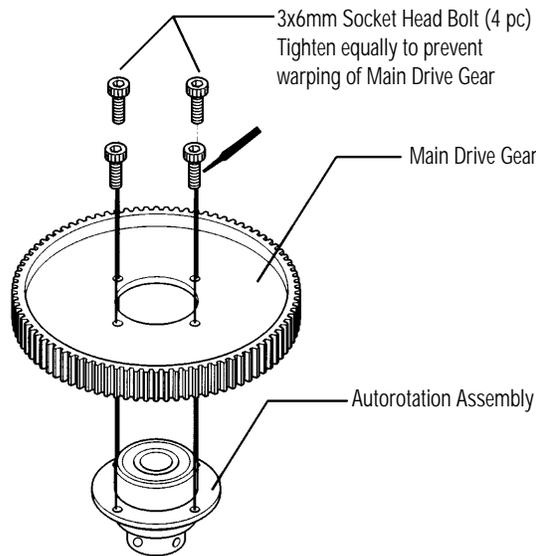
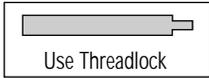
	.....14 pc
3x22mm Socket Head Bolt	
	.....7 pc
Main Frame Standoff, 32mm	
	.....14 pc
Main Frame Spacer, 22mm	



# 3-1

Z,Q

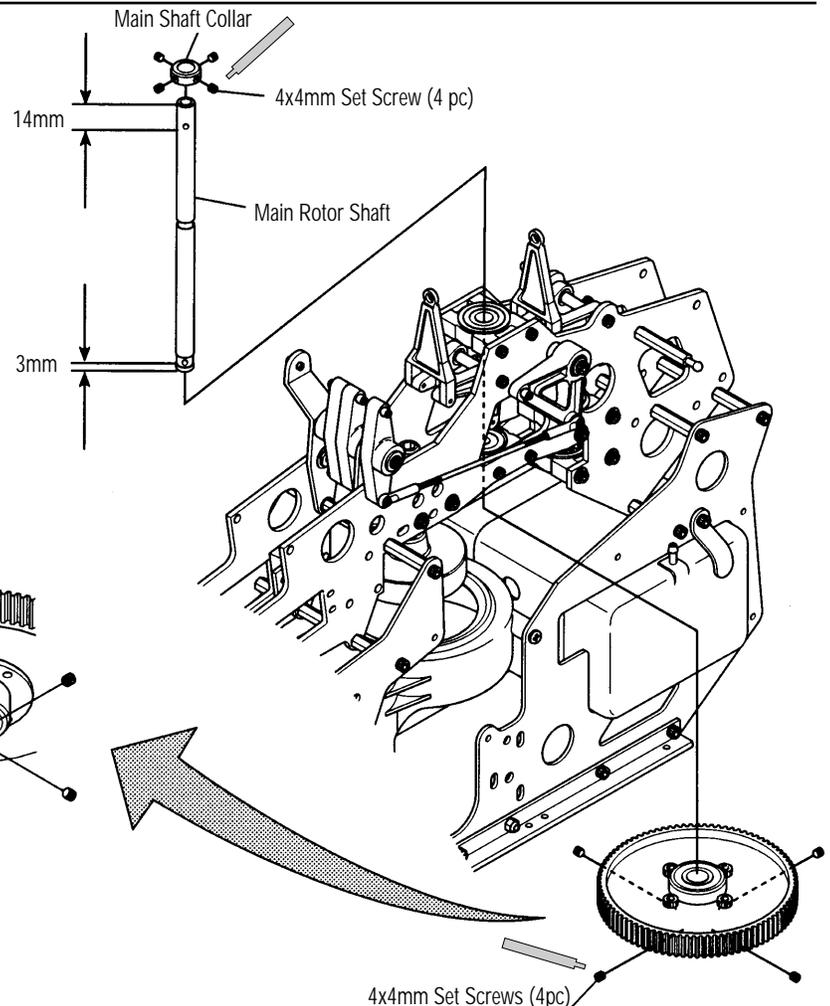
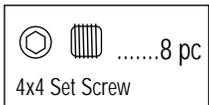
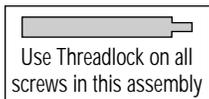
## MAIN DRIVE GEAR/AUTOROTATION ASSEMBLY



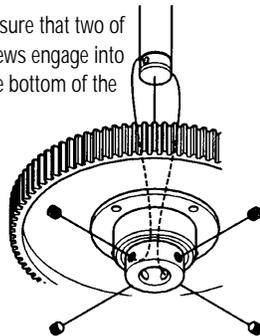
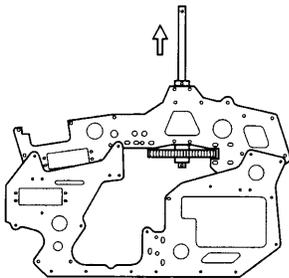
# 3-2

Z,Q

## MAIN DRIVE GEAR/AUTOROTATION ASSEMBLY INSTALLATION



When assembling, be sure that two of the four 4mm Set Screws engage into the through hole in the bottom of the Main Rotor Shaft.



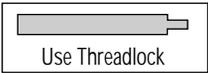
1. Secure the Autorotation Hub to the Main Rotor Shaft using four 4x4mm Set Screws. Next, slide the Main Shaft Collar onto the Main Rotor Shaft. While pulling upward on the Main Rotor Shaft, secure the Main Shaft Collar to the Main Rotor Shaft using the remaining four 4x4mm Set Screws.

2. Once the Main Shaft Assembly is in place, adjust the gear mesh of the Clutch Bell and Tail Belt Pinion Gears, and secure the bolts left loose from Step 2-1.

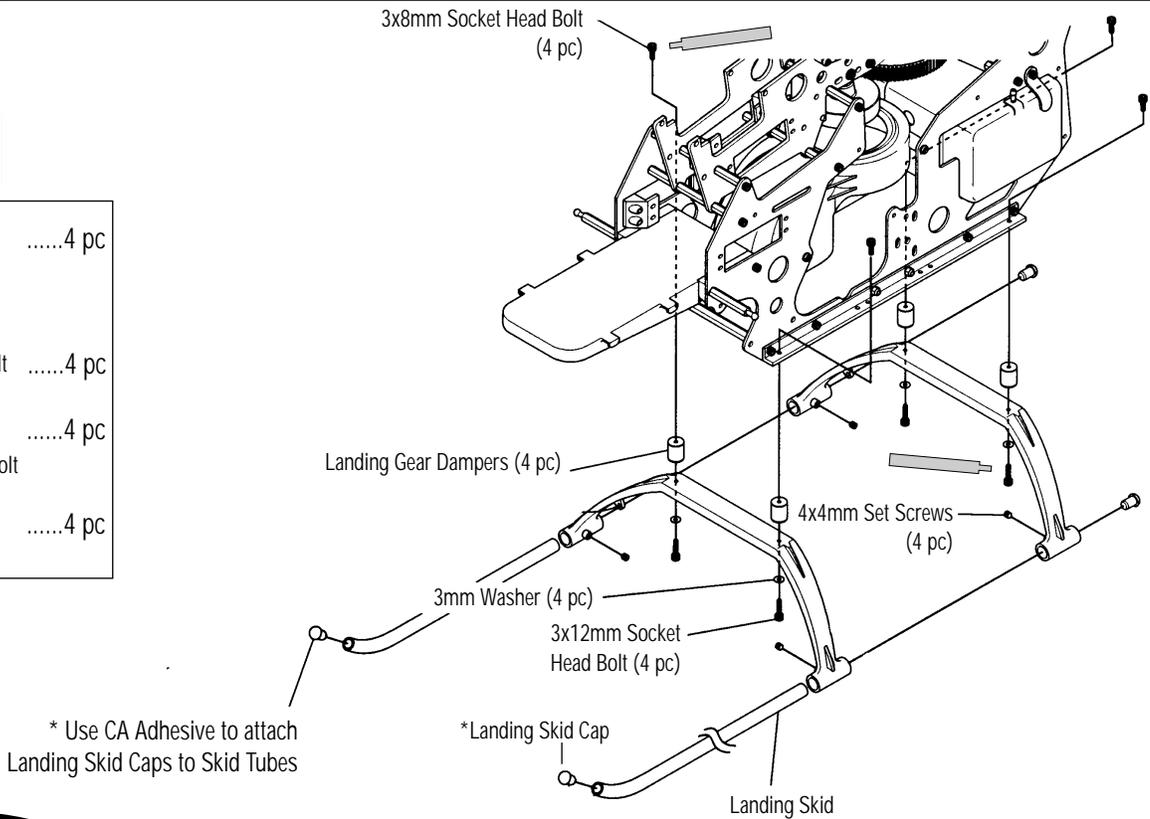
# 3-3

## Z,Q

### LANDING GEAR ASSEMBLY INSTALLATION



- ..... 4 pc
- ..... 4 pc
- ..... 4 pc
- ..... 4 pc

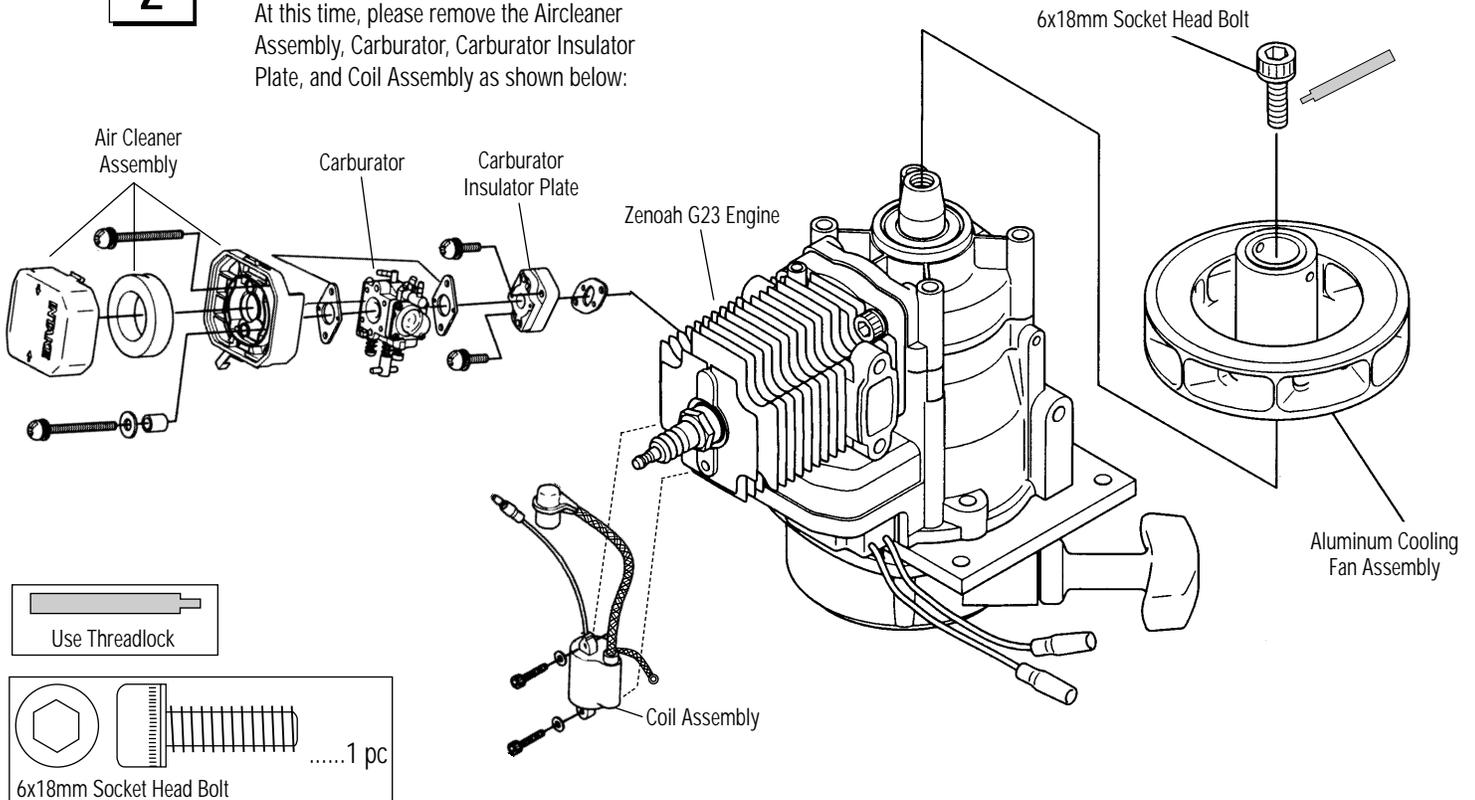


# 3-4

## Z

### ENGINE PREPARATION/COOLING FAN INSTALLATION

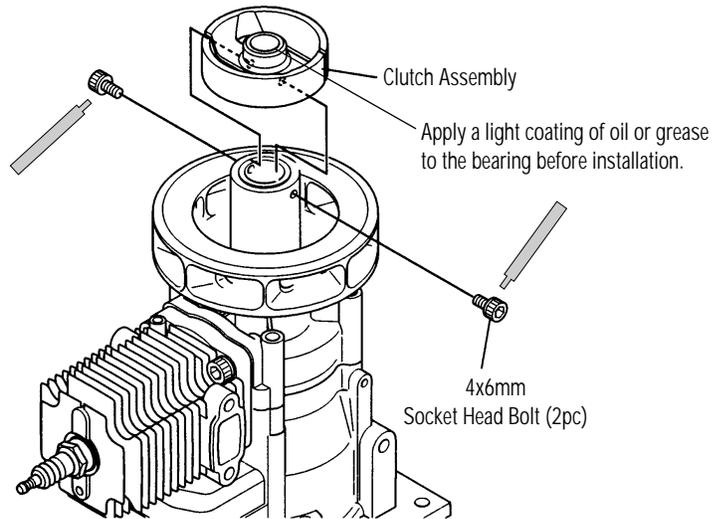
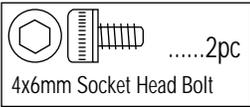
At this time, please remove the Aircleaner Assembly, Carburetor, Carburetor Insulator Plate, and Coil Assembly as shown below:



# 3-5

## CLUTCH ASSEMBLY ATTACHMENT

Z

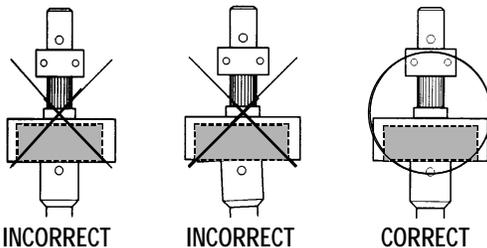
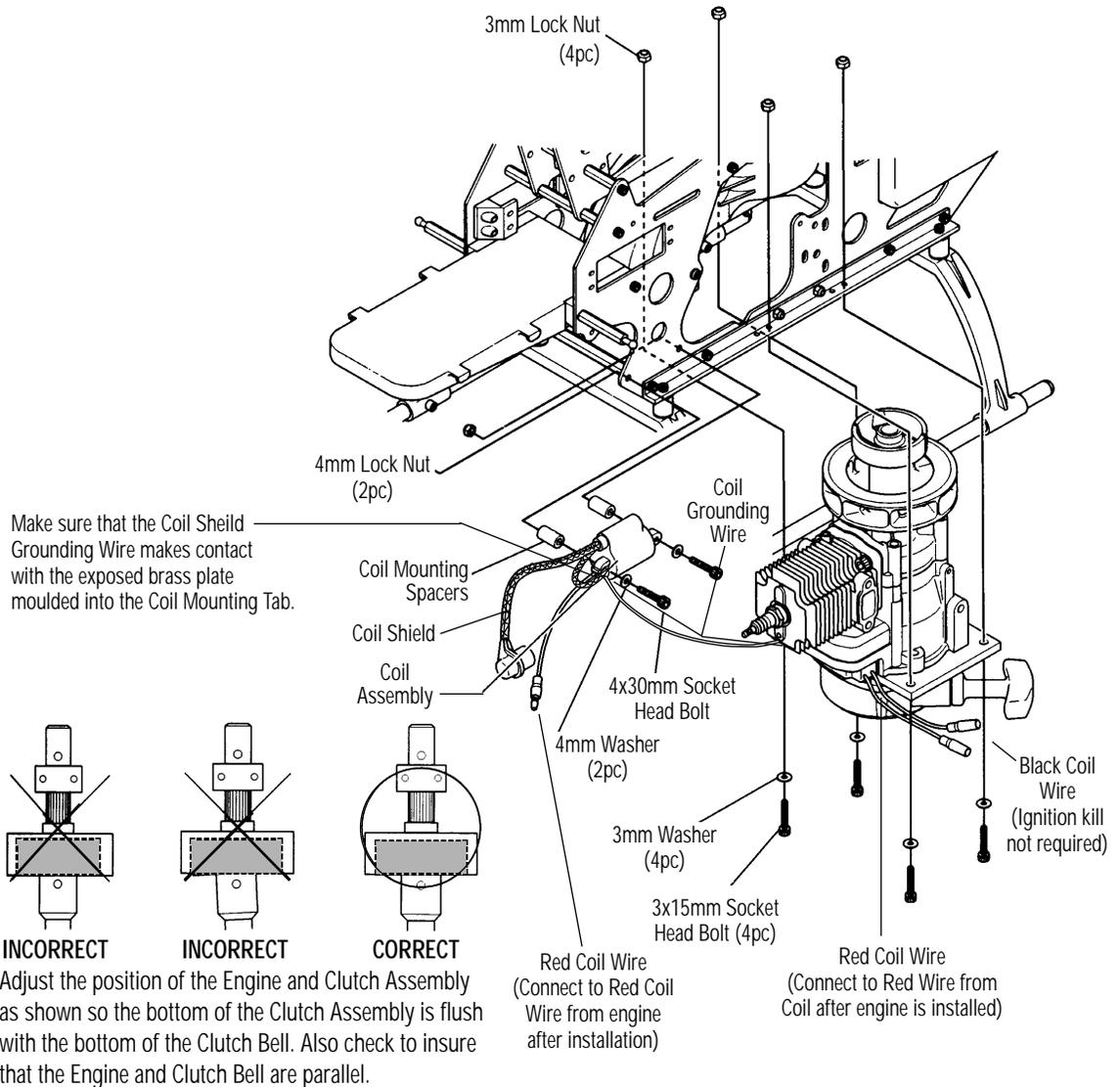


# 3-6

## ENGINE INSTALLATION

Z

- .....4pc  
3x15mm Socket Head Bolt
- .....4pc  
3mm Lock Nut
- .....2pc  
4x30mm Socket Head Bolt
- .....2pc  
4mm Lock Nut
- .....4pc  
3mm Washer
- .....2pc  
4mm Washer
- .....2pc  
4x8x14mm Coil Mounting Spacers
- .....2pc  
Coil Grounding Wire
- .....1pc  
3x8mm Socket Head Bolt



Adjust the position of the Engine and Clutch Assembly as shown so the bottom of the Clutch Assembly is flush with the bottom of the Clutch Bell. Also check to insure that the Engine and Clutch Bell are parallel.

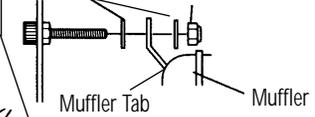
# 3-7

## MUFFLER INSTALLATION

Z

Secure the Muffler Tab to the 4x12mm Socket Head Bolt as shown below.

4mm Washer (2pc) 4mm Lock Nut



4mm Washer (2pc)

4x12mm Socket Head Bolt

Muffler

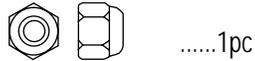
5x60mm Socket Head Bolt (2pc)

4x12mm Socket Head Bolt (Installed in Step 2-3)

Muffler Gasket (2pc)

Muffler Spacer

Use Threadlock



4mm Lock Nut

.....1pc



4mm Washer

.....4 pc



4x12mm Socket Head Bolt

.....2 pc



5x60mm Socket Head Bolt

.....2pc

# 3-8

## CARBURATOR/AIR CLEANER ASSEMBLY INSTALLATION

Z

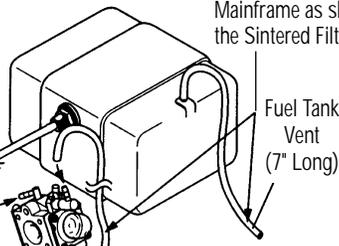
Attach the Carburetor Overflow Vent Line and the Fuel Tank Vent Line to each side of the Mainframe as shown at right. Make sure that the Sintered Filters are below the frame.

\* Carburetor Overflow Vent:

Duplicate on other side of Heli for Fuel Tank Vent

Use Threadlock

Fuel Line (6" Long) Connect to Fuel Inlet Nipple as shown.



Carburetor Overflow Vent (9" Long)

Fuel Tank Vent (7" Long)

5x20mm Carburetor Insulator Plate Bolt (2pc)

Insulator Plate Gasket

Carburetor Insulator Plate

\* Carburetor Overflow Vent:

Duplicate on other side of Heli for Fuel Tank Vent

Nylon Wire Tie (2pc) (not included)

Dubro Sintered Bronze Filter (2pc) (not included)

Carburetor Gasket

Carburetor Assembly

2x8mm Flat Head Screw

Steel Joint Ball

3x3mm Set Screw

**Note:** It is suggested that an In Line Fuel Filler be installed into the Main Fuel Line (not included).

.....1pc

2x8mm Flat Head Screw

.....1pc

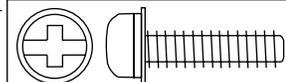
Steel Joint Ball

.....1pc

2mm Nut

.....1pc

3x3mm Set Screw



5x20mm Carburetor Insulator Plate Bolt

.....2pc



5x55mm Air Cleaner Mounting Bolts

.....2pc

Air Filter

Air Cleaner Cover

5x55mm Air Cleaner Mounting Bolts (2pc)

Air Cleaner Body

\* Install the Throttle Arm so that when the Carburetor is at 1/2 throttle, the Throttle Arm is exactly 90° to the Carburetor Flange as shown above use Threadlock

2mm Nut

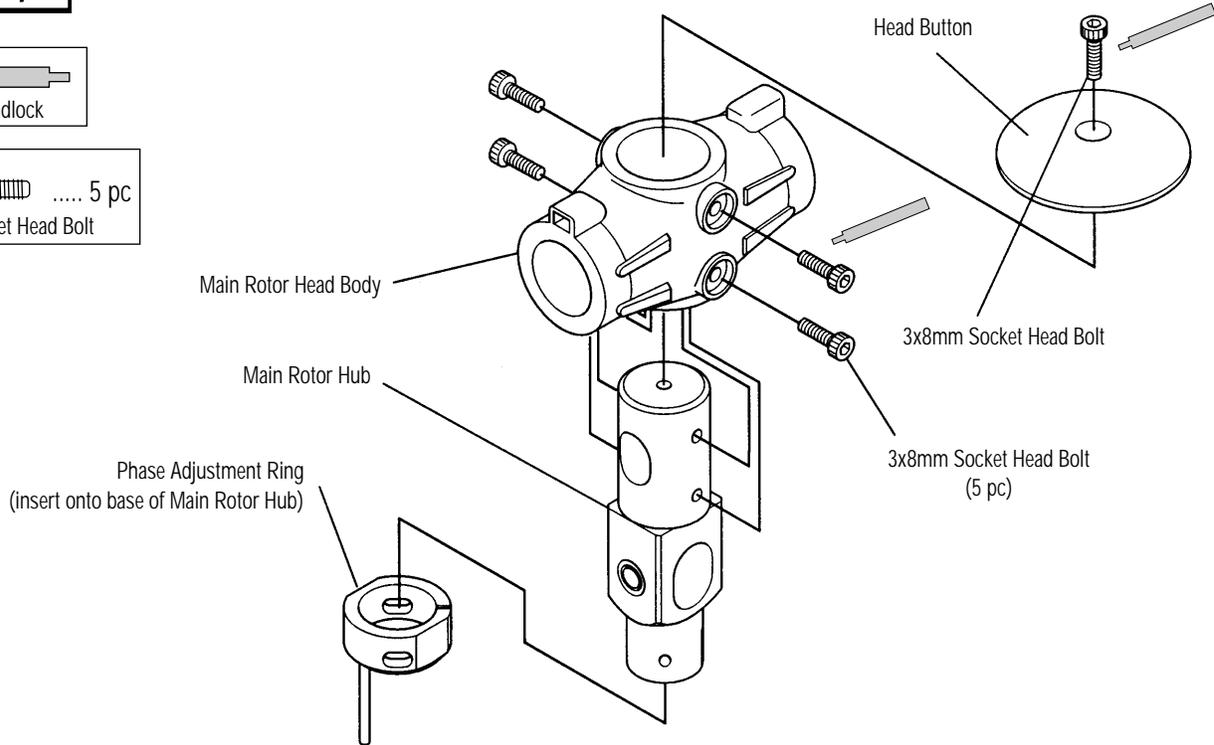
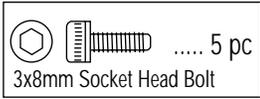
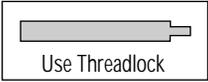
\* Throttle Arm

Included with Engine

# 4-1

## ROTOR HEAD HUB ASSEMBLY

Z,Q

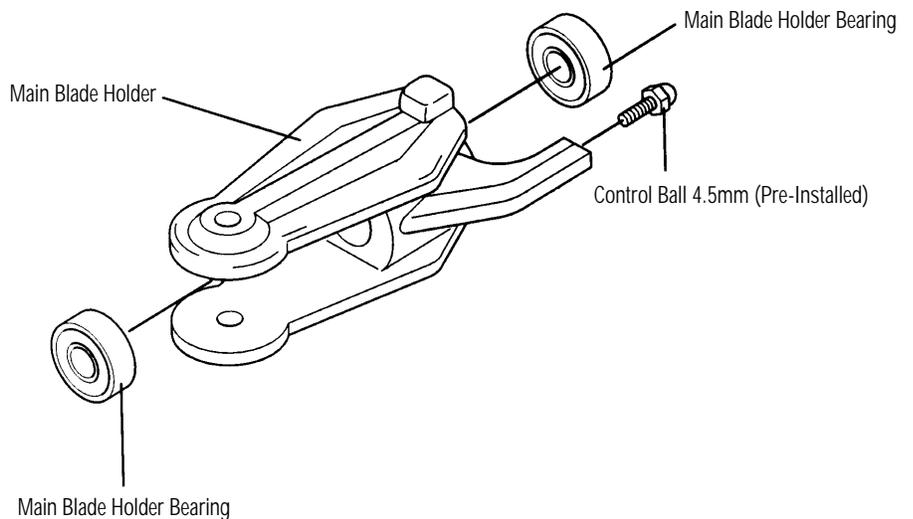
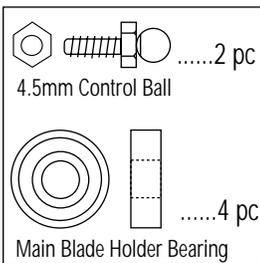


# 4-2

## MAIN BLADE HOLDER ASSEMBLY

Z,Q

TWO SETS REQUIRED

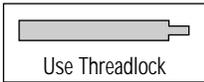
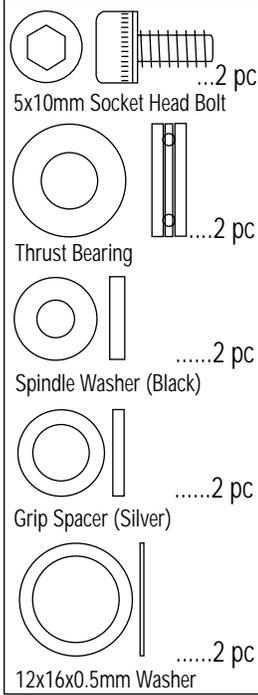


**Note:** Use caution when inserting the Main Blade Holder Bearings so as not to distort/damage the Main Blade Holders.

# 4-3

## MAIN BLADE HOLDER/SEESAW ATTACHMENT

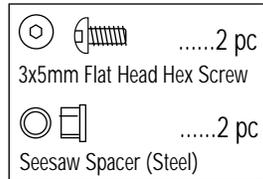
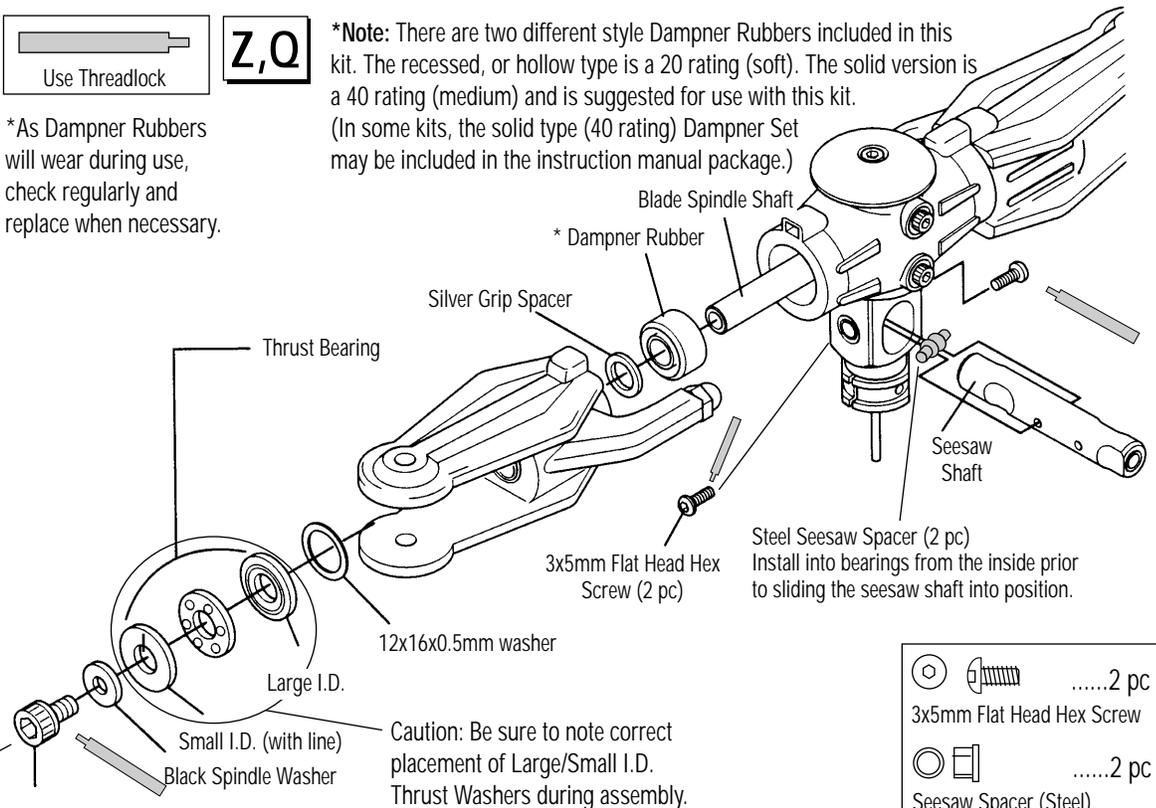
TWO SETS REQUIRED



\*As Dampner Rubbers will wear during use, check regularly and replace when necessary.

**Z,Q**

\*Note: There are two different style Dampner Rubbers included in this kit. The recessed, or hollow type is a 20 rating (soft). The solid version is a 40 rating (medium) and is suggested for use with this kit. (In some kits, the solid type (40 rating) Dampner Set may be included in the instruction manual package.)



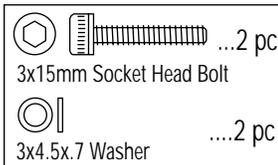
Tighten securely using two 4mm "L" Allen Wrenches.

5x10mm Socket Head Bolt (Use Threadlock)

# 4-4

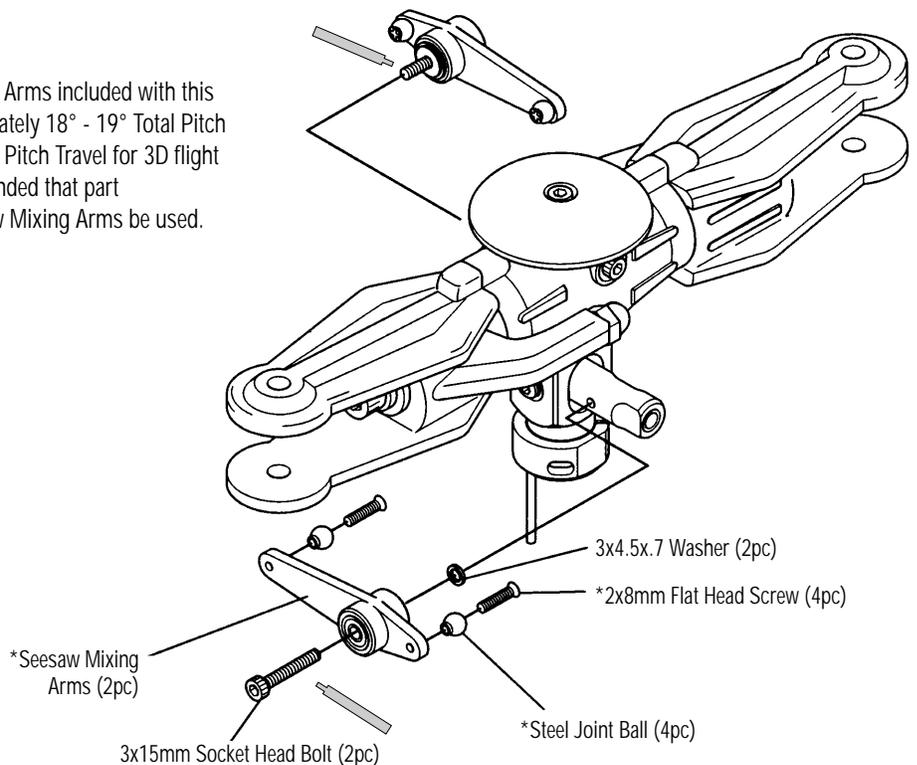
## SEESAW MIXING ARM INSTALLATION

**Z,Q**



\*The Seesaw Mixing Arms included with this kit provide approximately 18° - 19° Total Pitch Travel. For increased Pitch Travel for 3D flight (23°), it is recommended that part #JRP960178 Seesaw Mixing Arms be used.

**Note:** The four 2x8mm Flat Head Screws and Steel Joint Balls are pre-installed onto the Seesaw Mixing Arms.



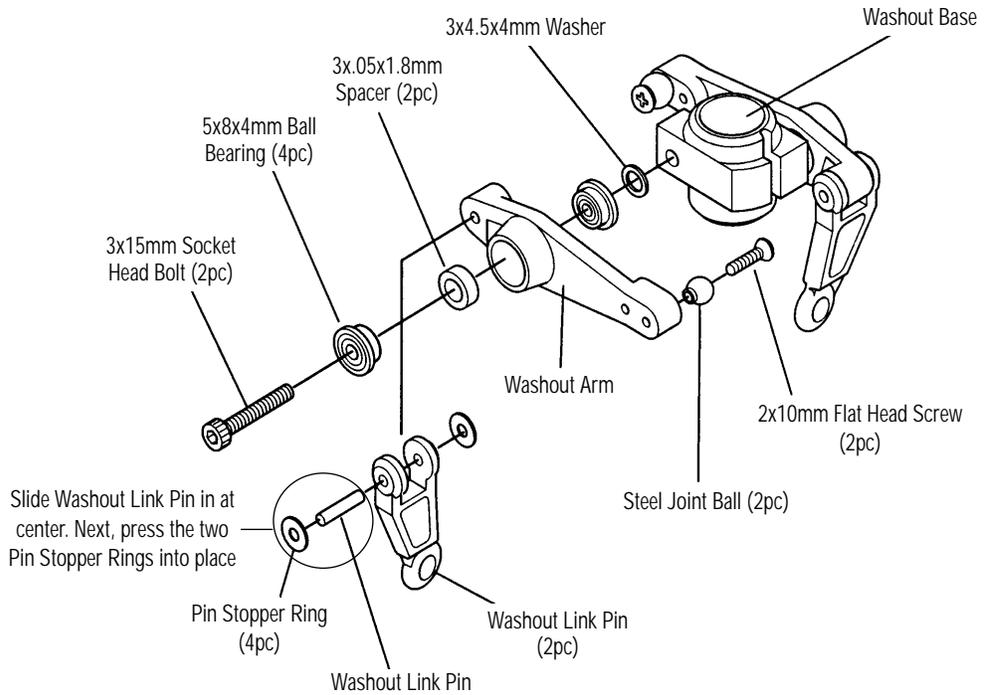
# 4-5

Z,Q

## WASHOUT UNIT ASSEMBLY

### TWO SETS REQUIRED

	....2 pc
	....2 pc
	....4 pc
	....2 pc
	....4 pc
	....4 pc
	....2 pc
	....2 pc



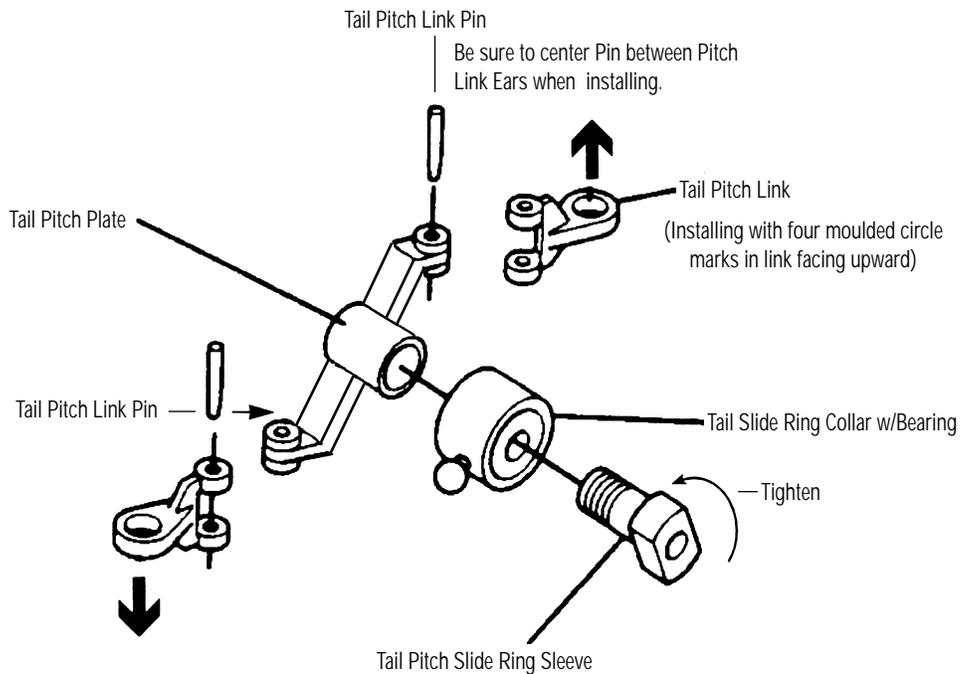
# 4-6

Z,Q

## TAIL PITCH SLIDE RING ASSEMBLY

	....2 pc
Tail Pitch Link Pin	

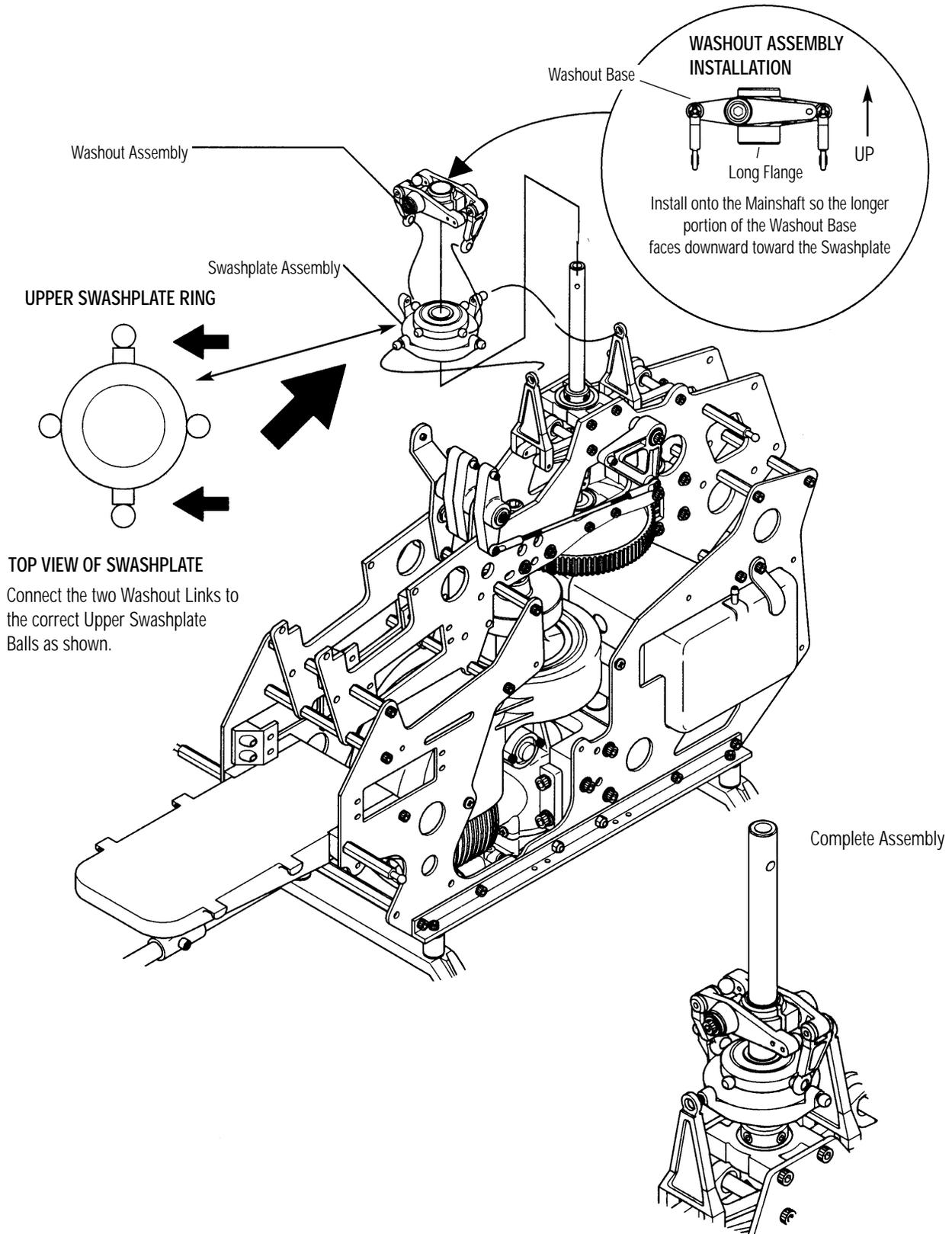
**Note:** Tail Pitch Slide Ring Sleeve is reverse (left hand) thread. Use caution when installing.



# 4-7

## SWASHPLATE/WASHOUT ASSEMBLY INSTALLATION

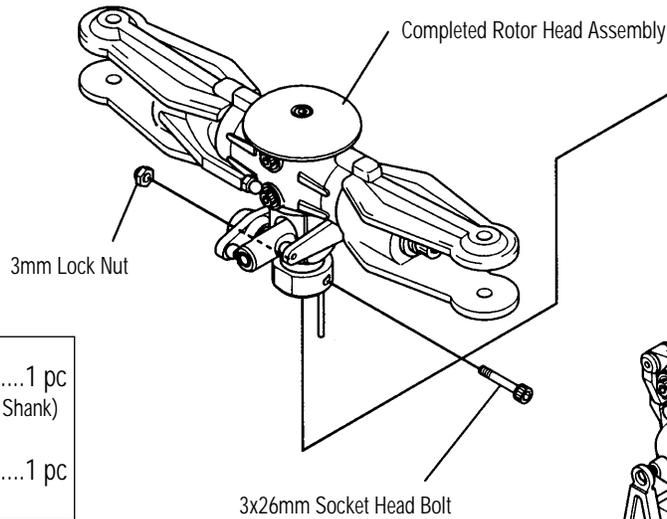
Z,Q



# 4-8

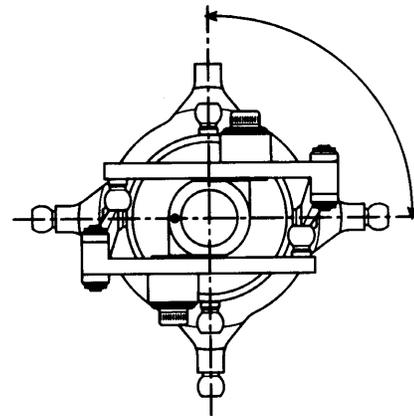
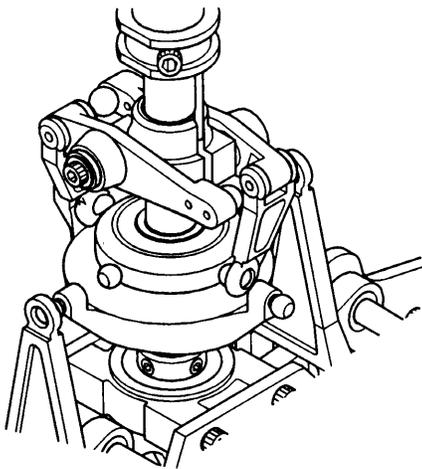
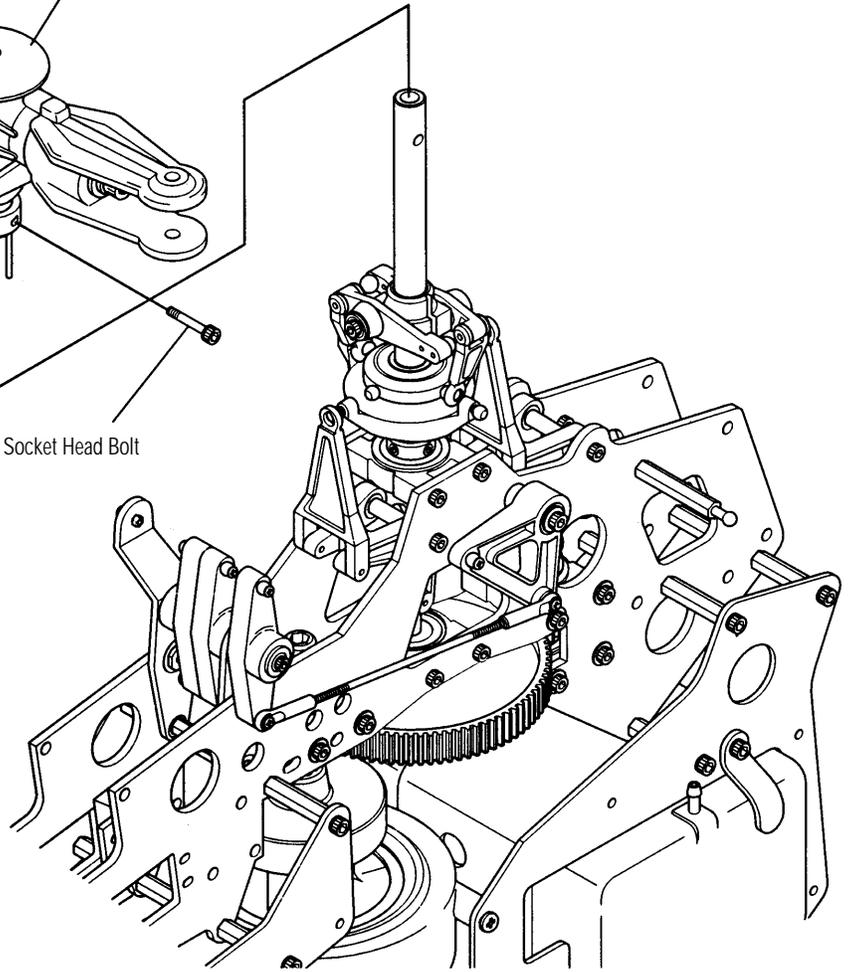
## ROTOR HEAD INSTALLATION

Z,Q



- \*  ..... 1 pc  
3x26mm Socket Head Bolt (Long Shank)
-  ..... 1 pc  
3mm Nut

**\*Note:** Be sure to use the special 3x22mm Long Shank Bolt (included in the separate screw bag)



Be sure to engage the Phase Adjusting Ring Pin into the Washout Base Groove before securing the Rotor Head Assembly in place.

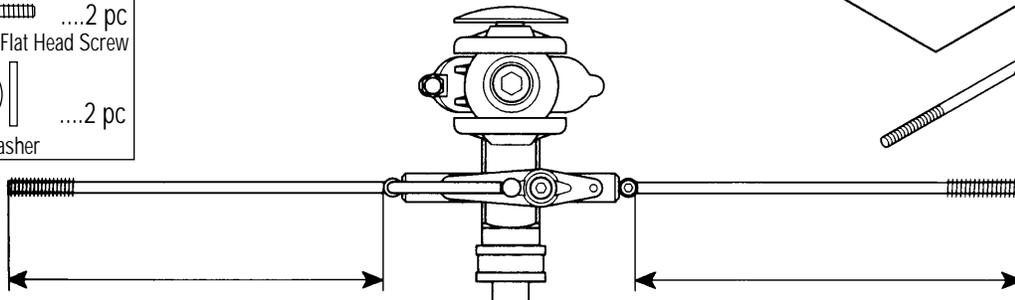
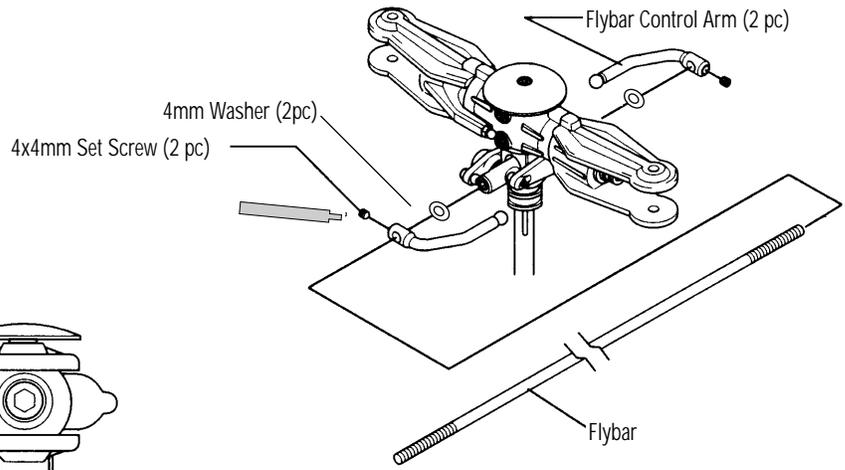
When the Main Rotor Head is secured in place, make sure the Swashplate and Washout Assembly are aligned 90° to the helicopter. This procedure is important to insure correct control inputs. Adjust the Phase Adjusting Ring if necessary.

# 4-9

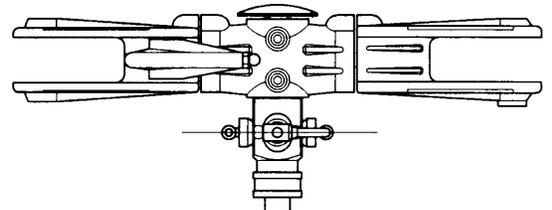
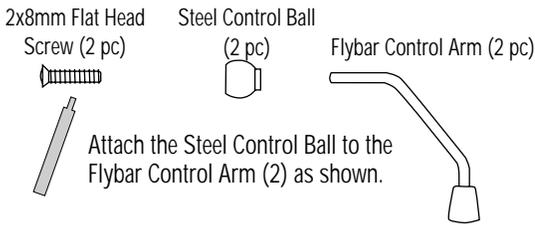
## FLYBAR INSTALLATION

Z,Q

-  ..... 2 pc  
4x4mm Set Screw
-  ..... 2 pc  
Steel Joint Ball
-  ..... 2 pc  
2x8mm Flat Head Screw
-  ..... 2 pc  
4mm Washer



**Note:** Center the Flybar in the Seesaw Shaft before securing the two Flybar Control Arms



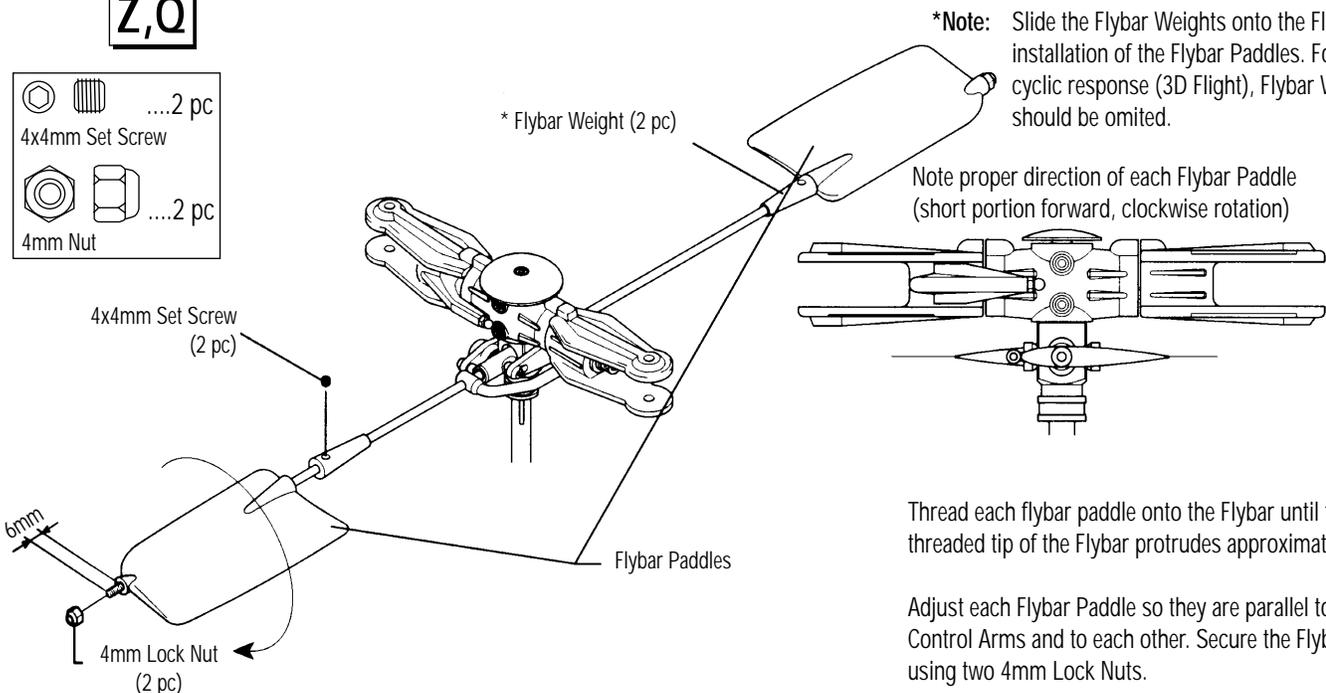
Check to insure that the two Flybar Control Arms are parallel to the center line of the Flybar

# 4-10

## FLYBAR PADDLE ATTACHMENT

Z,Q

-  ..... 2 pc  
4x4mm Set Screw
-  ..... 2 pc  
4mm Nut



**\*Note:** Slide the Flybar Weights onto the Flybar before installation of the Flybar Paddles. For increased cyclic response (3D Flight), Flybar Weights should be omitted.

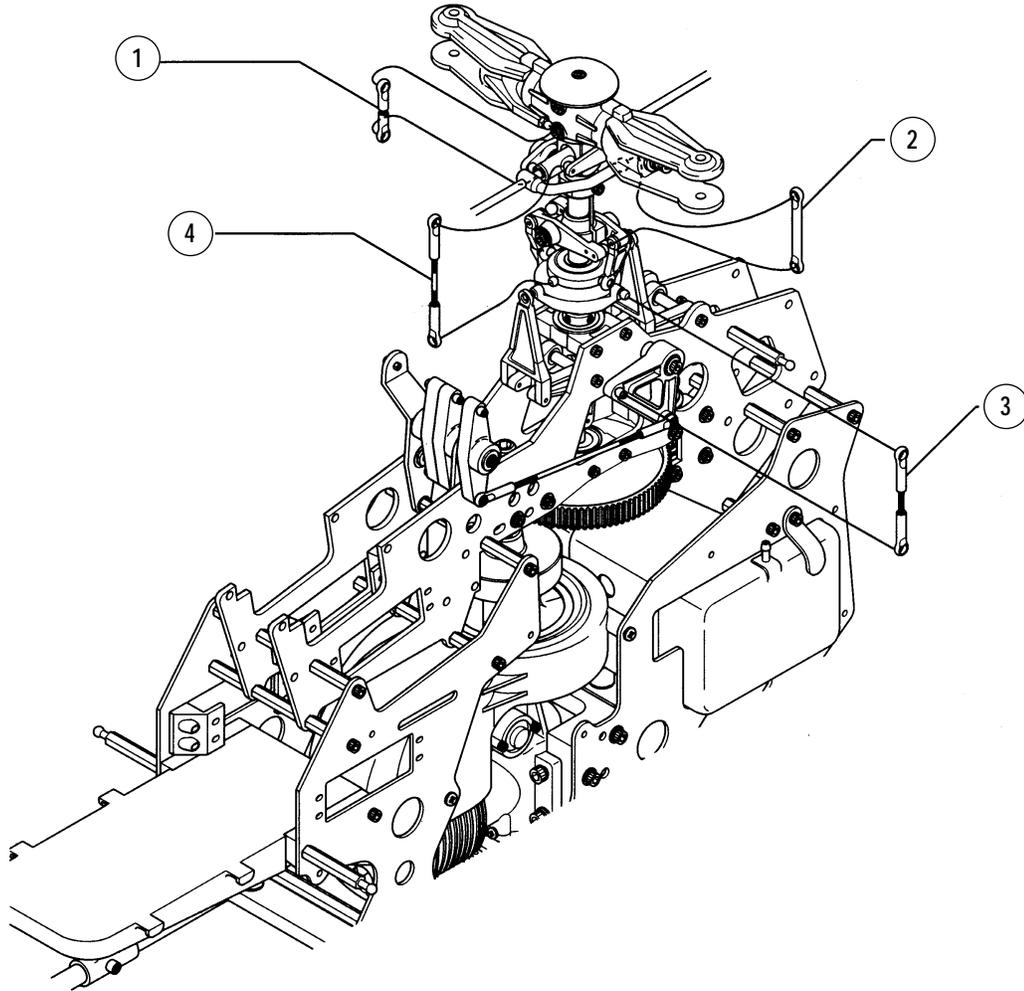
Thread each flybar paddle onto the Flybar until the threaded tip of the Flybar protrudes approximately 6mm.

Adjust each Flybar Paddle so they are parallel to the Flybar Control Arms and to each other. Secure the Flybar Paddles using two 4mm Lock Nuts.

# 4-11

Z,Q

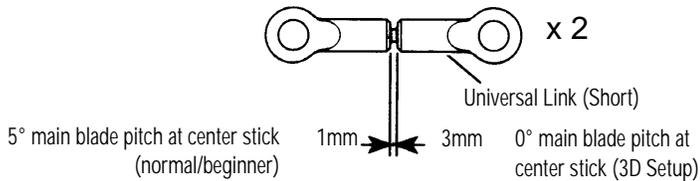
## ROTOR HEAD/SWASHPLATE CONTROL ROD INSTALLATION



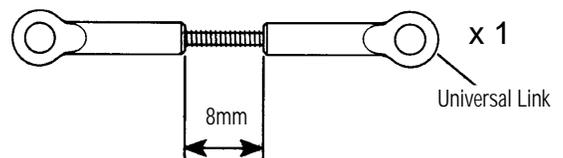
### CONTROL ROD ASSEMBLY

Thread the Universal Links onto the threaded Control Rods to the lengths shown below. Please note that all links should be adjusted so that when attached to the Control Ball, the words "JR Propo" are to the outside.

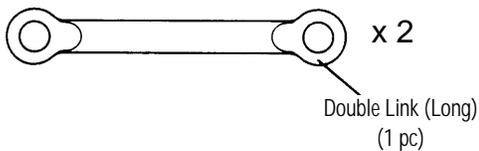
- ① SEESAW ARM TO MAIN BLADE HOLDER  
(2.3x15mm Threaded Rod)



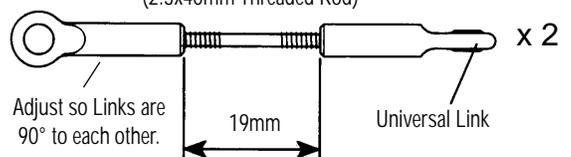
- ③ SWASHPLATE TO ROLL BELLCRANK  
(2.3x30mm Threaded Rod)



- ② WASHOUT ARM TO FLYBAR CONTROL ARM



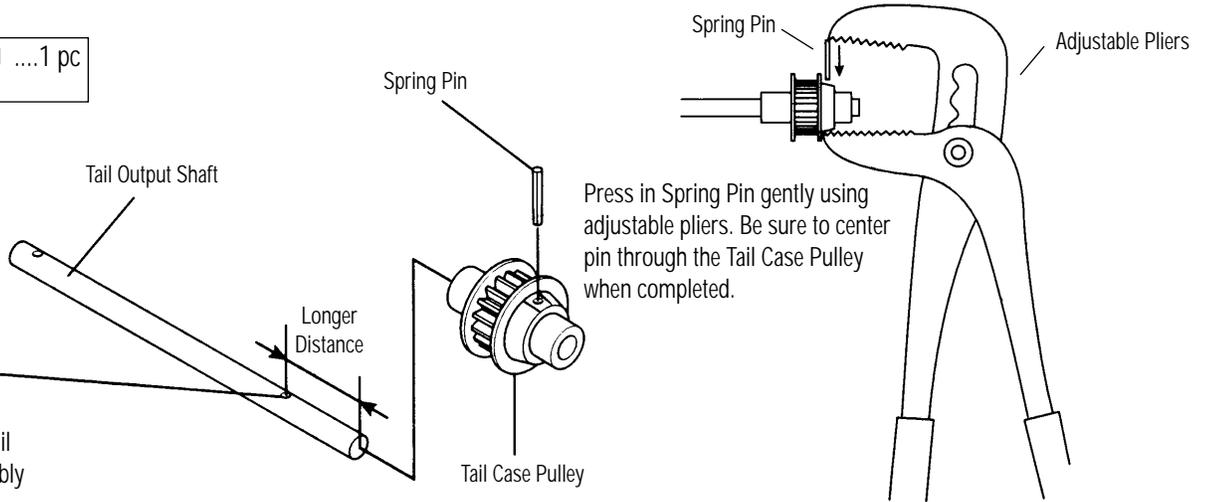
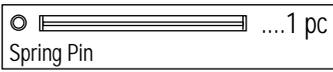
- ④ SWASHPLATE TO SEESAW ARM  
(2.3x40mm Threaded Rod)



# 5-1

## TAIL OUTPUT SHAFT/PULLEY ASSEMBLY

Z,Q

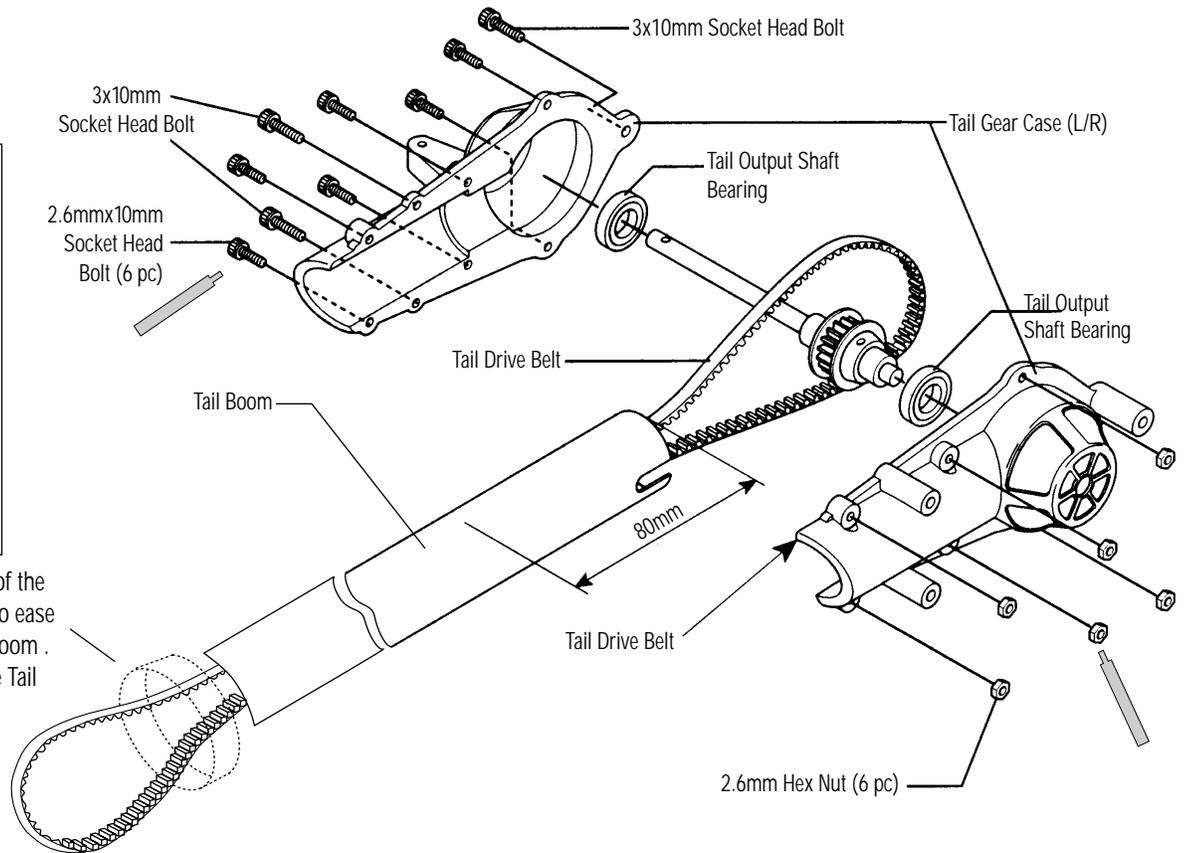
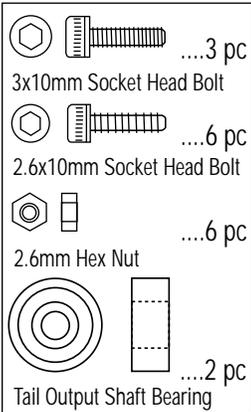


Note correct direction of Tail Output Shaft during assembly

# 5-2

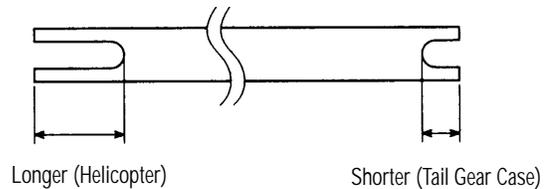
## TAIL GEAR CASE ASSEMBLY

Z,Q



Wrap tape around the end of the Tail Drive Belt temporarily to ease insertion through the Tail Boom . Be careful not to "kink" the Tail Drive Belt.

Note: Be sure to position the Tail Gear Case onto the shorter slotted side of the Tail Boom.



# 5-3

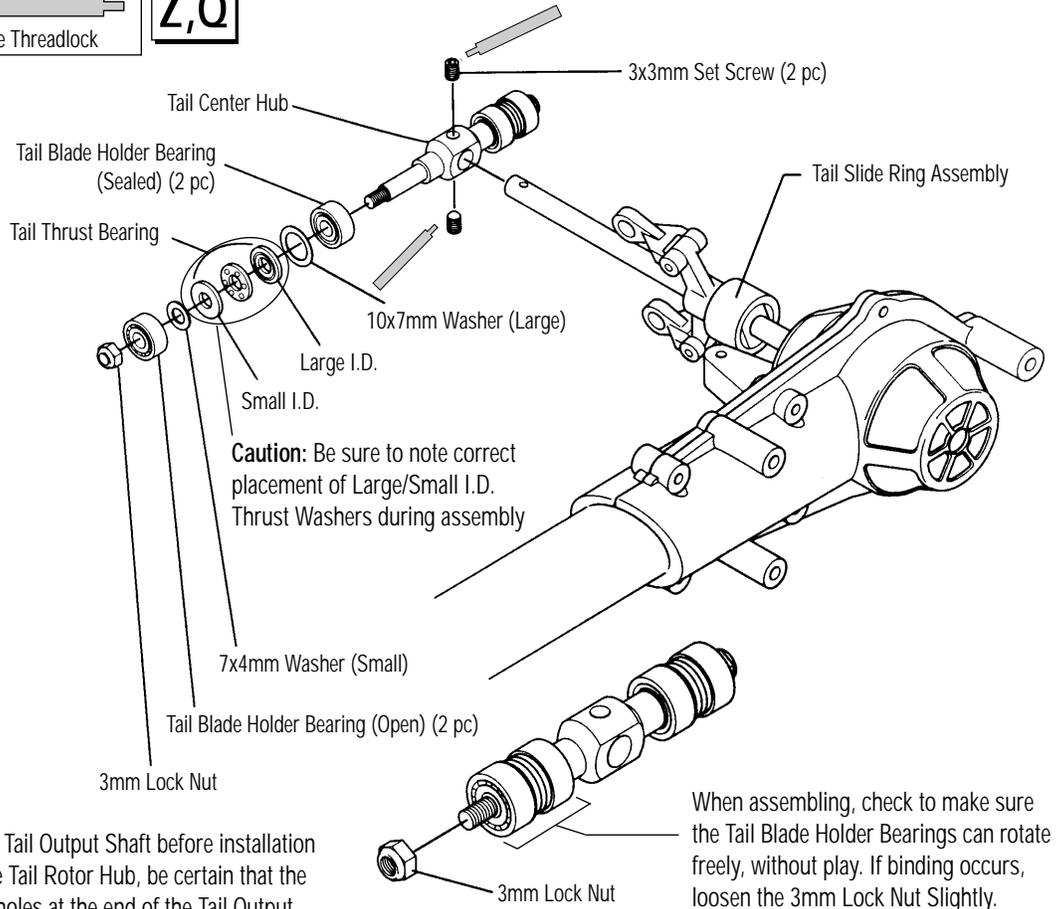
## TAIL CENTER HUB ASSEMBLY

- .....2 pc  
3x3mm Set Screw

Use Threadlock **Z,Q**

**TWO SETS REQUIRED**

- .....2 pc  
3mm Lock Nut
- .....2 pc  
Tail Blade Holder Bearing (Sealed)
- .....2 pc  
Tail Blade Holder Bearing (Open)
- .....2 pc  
Washer, 10x7mm (Large)
- .....2 pc  
Washer, 7x4mm (Small)
- .....2 pc  
Tail Thrust Bearing



Slide the Tail Slide Ring Assembly on the Tail Output Shaft before installation of the Tail Rotor Hub. When attaching the Tail Rotor Hub, be certain that the two 3x3mm Set Screws engage into the holes at the end of the Tail Output.

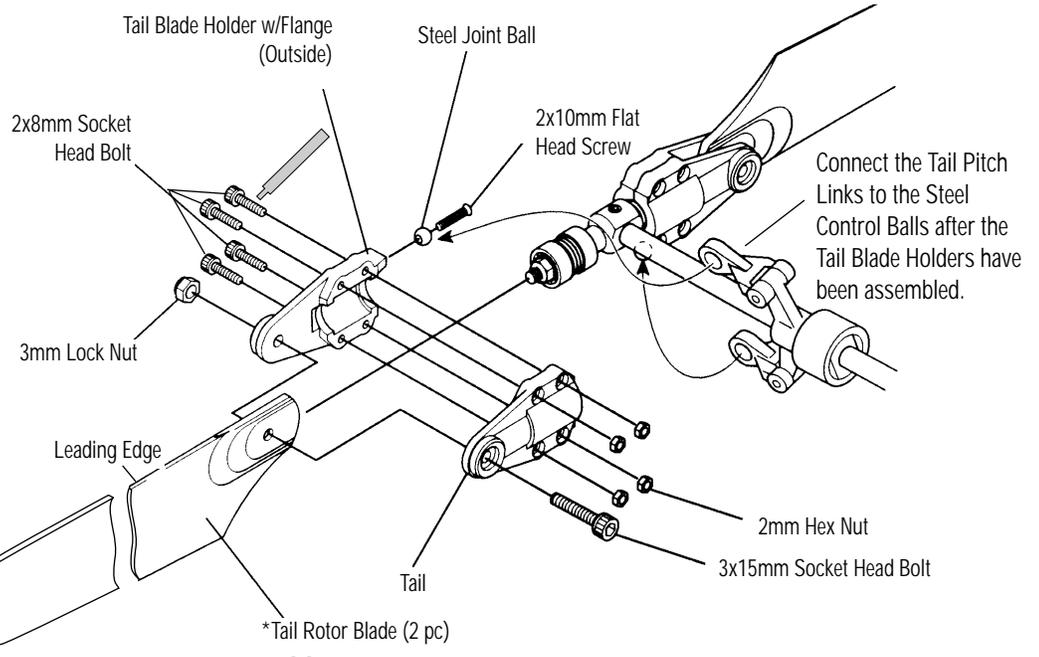
# 5-4

## TAIL BLADE HOLDER ASSEMBLY

**TWO SETS REQUIRED**

- .....2 pc  
2x10mm Flat Head Screw
- .....8 pc  
2x8mm Socket Head Bolt
- .....2 pc  
3x15mm Socket Head Bolt
- .....8 pc  
2mm Hex Nut
- .....2 pc  
3mm Lock Nut
- .....2 pc  
Steel Joint Ball

**Z,Q**

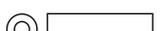


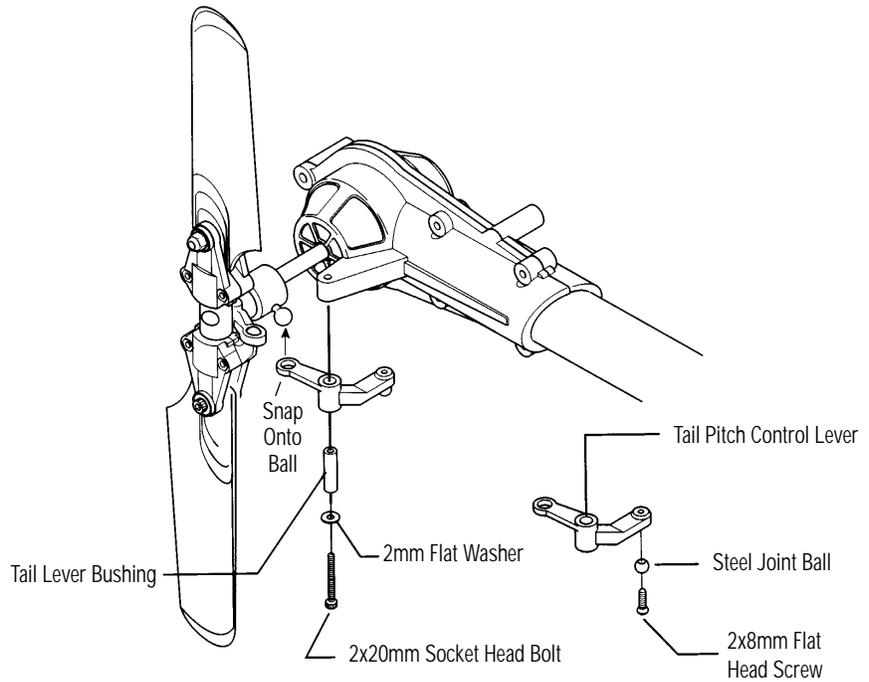
\*Be sure to note the correct direction of the Tail Rotor Blades during assembly.

# 5-5

## TAIL PITCH CONTROL LEVER INSTALLATION

Z,Q

	.....1 pc
2x8 Flat Head Screw	
	.....1 pc
2x20mm Socket Head Bolt	
	.....1 pc
2mm Flat Washer	
	.....1 pc
Steel Joint Ball	
	.....1 pc
Tail Lever Bushing	

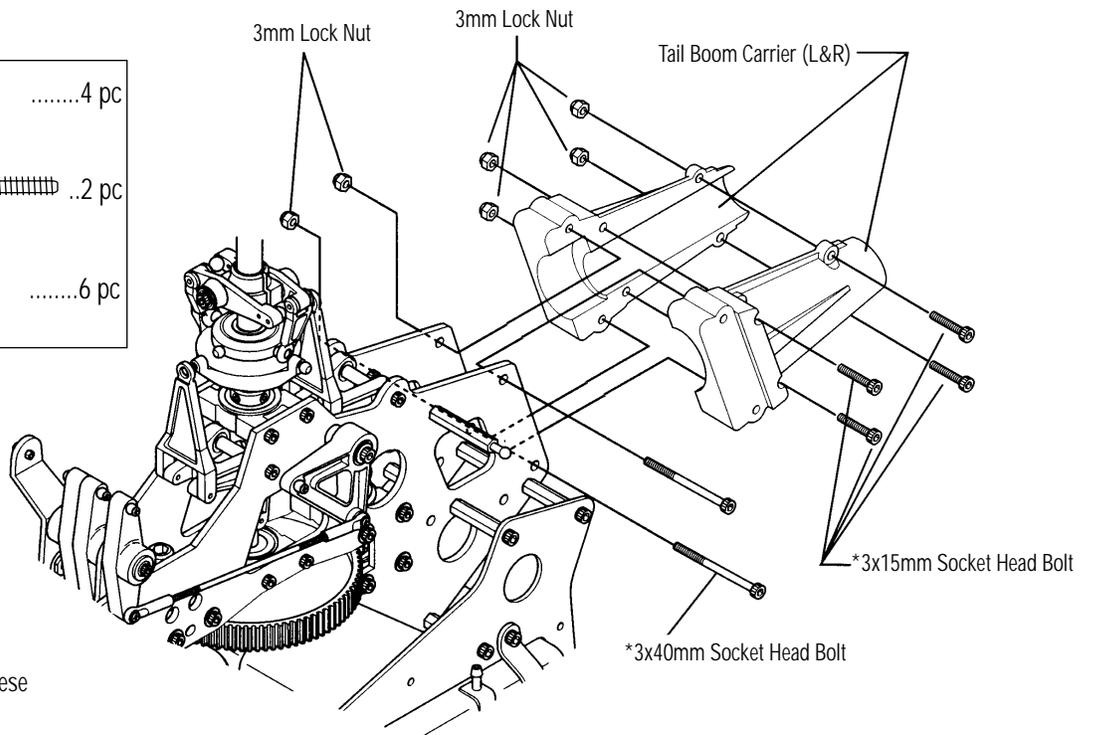


# 5-6

## TAIL BOOM CARRIER INSTALLATION

Z,Q

	.....4 pc
3x15mm Socket Head Bolt	
	.....2 pc
3x40mm Socket Head Bolt	
	.....6 pc
3mm Lock Nut	



\* Do not fully tighten at this time. These bolts will be secured in Step 5-7.

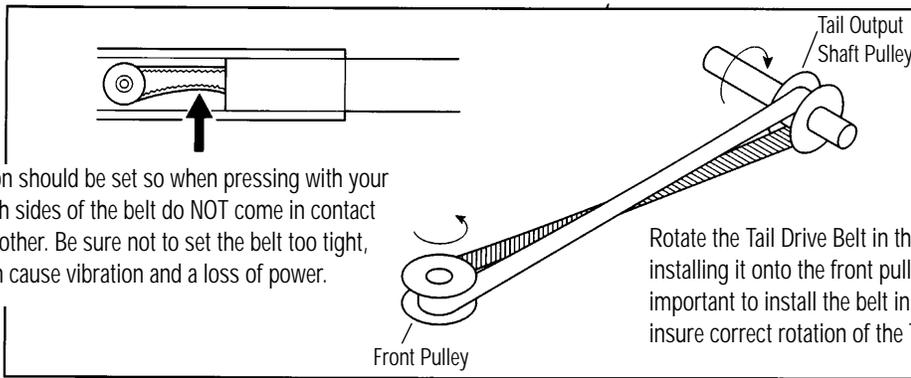
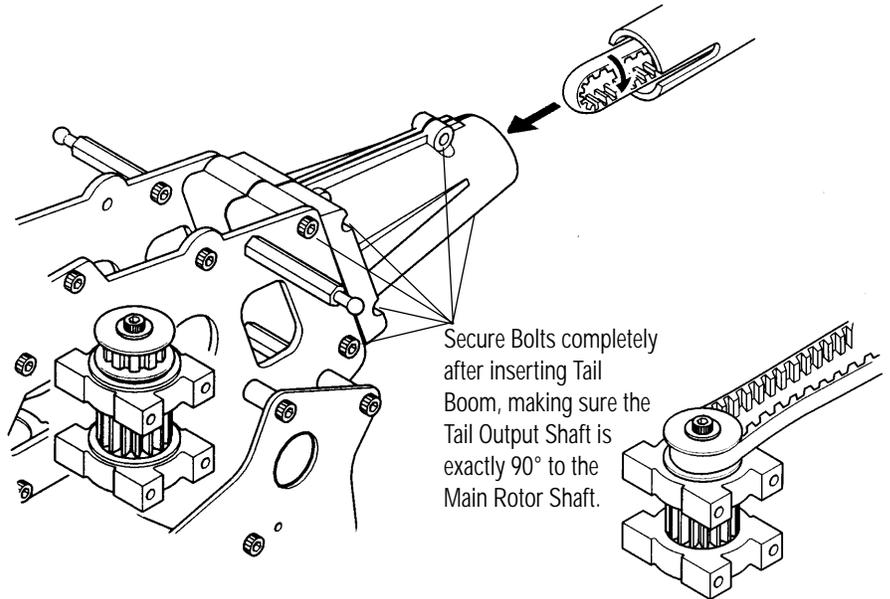
# 5-7

## TAIL BOOM ASSEMBLY INSTALLATION

Z,Q

Slide the Tail Boom through the Tail Boom Carrier and engage the Tail Drive Belt over the Front Pulley. Be certain to note the correct rotation (direction shown below). Set the belt tension per the directions below.

**Note:** It may be necessary to add one thickness of electrical tape around the end of the Tail Boom to insure positive attachment to the Tail Boom Carrier.

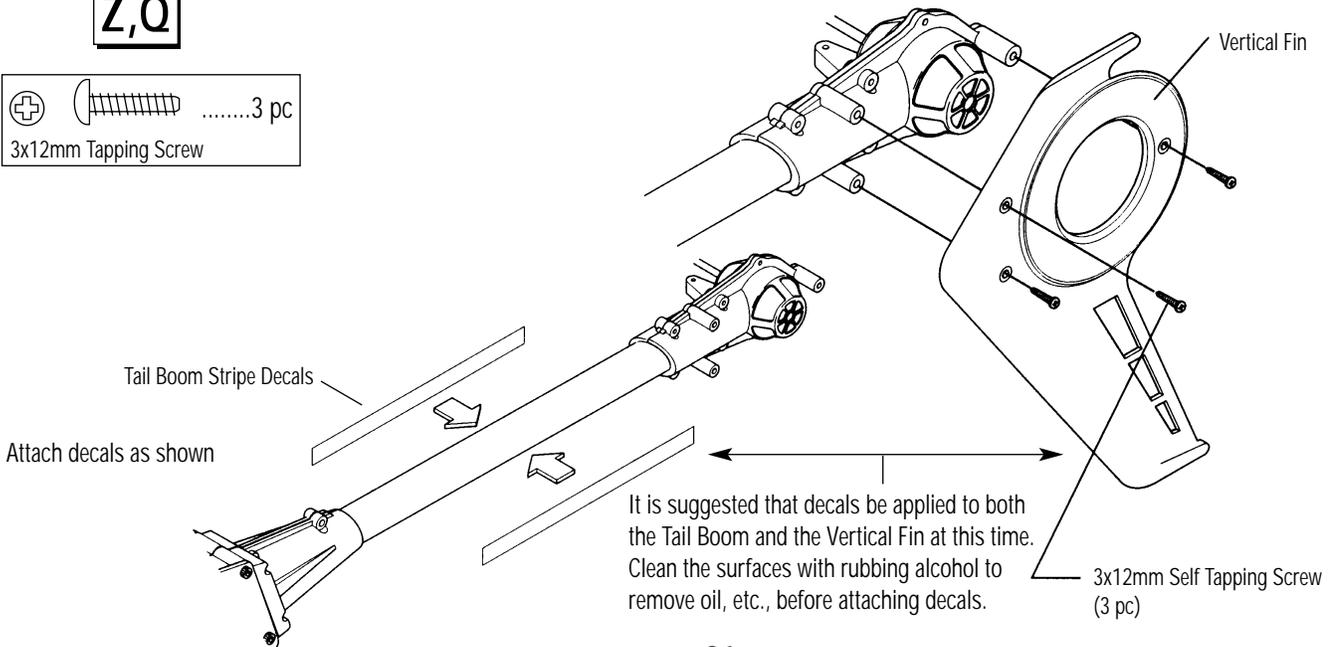


# 5-8

## VERTICAL FIN ATTACHMENT

Z,Q

 .....3 pc  
3x12mm Tapping Screw



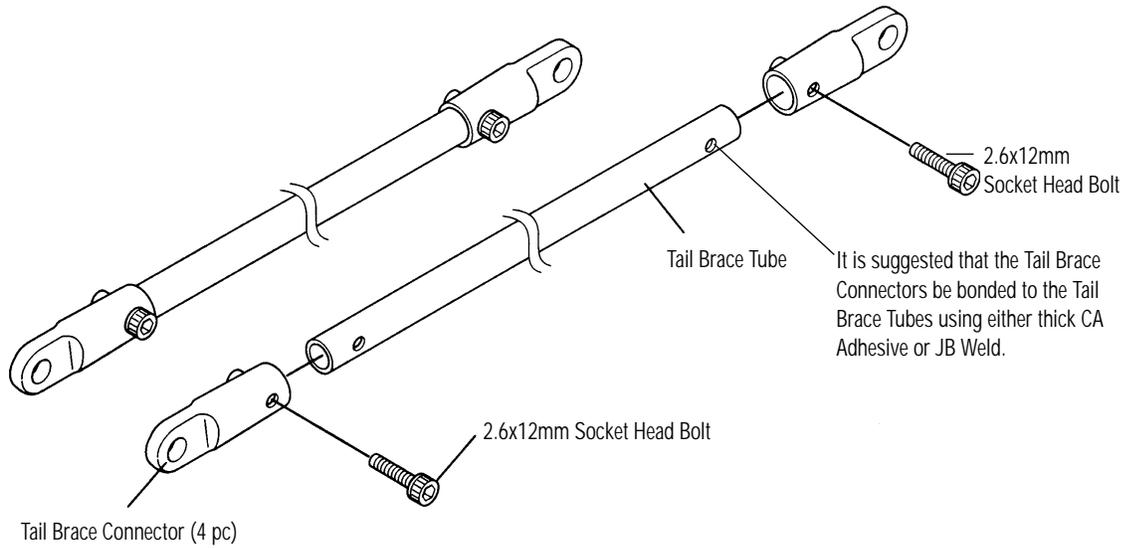
# 5-9

## TAIL BOOM BRACE ASSEMBLY

Z,Q

TWO SETS REQUIRED

-  ..... 4 pc  
2.6x12mm Socket Head Bolt



# 5-10

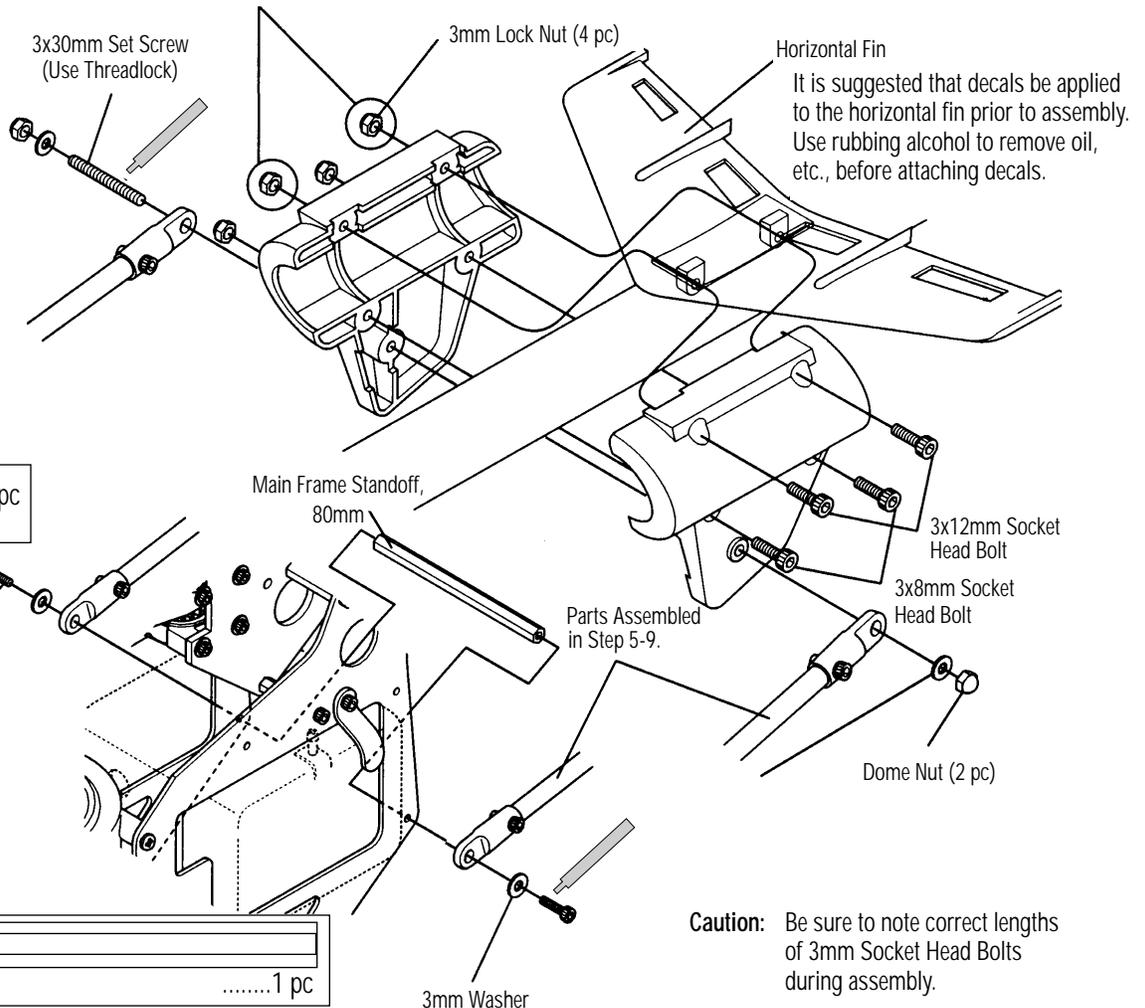
## TAIL BOOM BRACE/HORIZONTAL FIN INSTALLATION

Z,Q

For easy installation, insert these two nuts into the Horizontal Fin/Brace Clamp first.

-  Use Threadlock

-  ..... 2 pc  
3x8mm Socket Head Bolt
-  ..... 2 pc  
3x10mm Socket Head Bolt
-  ..... 2 pc  
3x12mm Socket Head Bolt
-  ..... 4 pc  
3mm Washer
-  ..... 1 pc  
3x30mm Set Screw



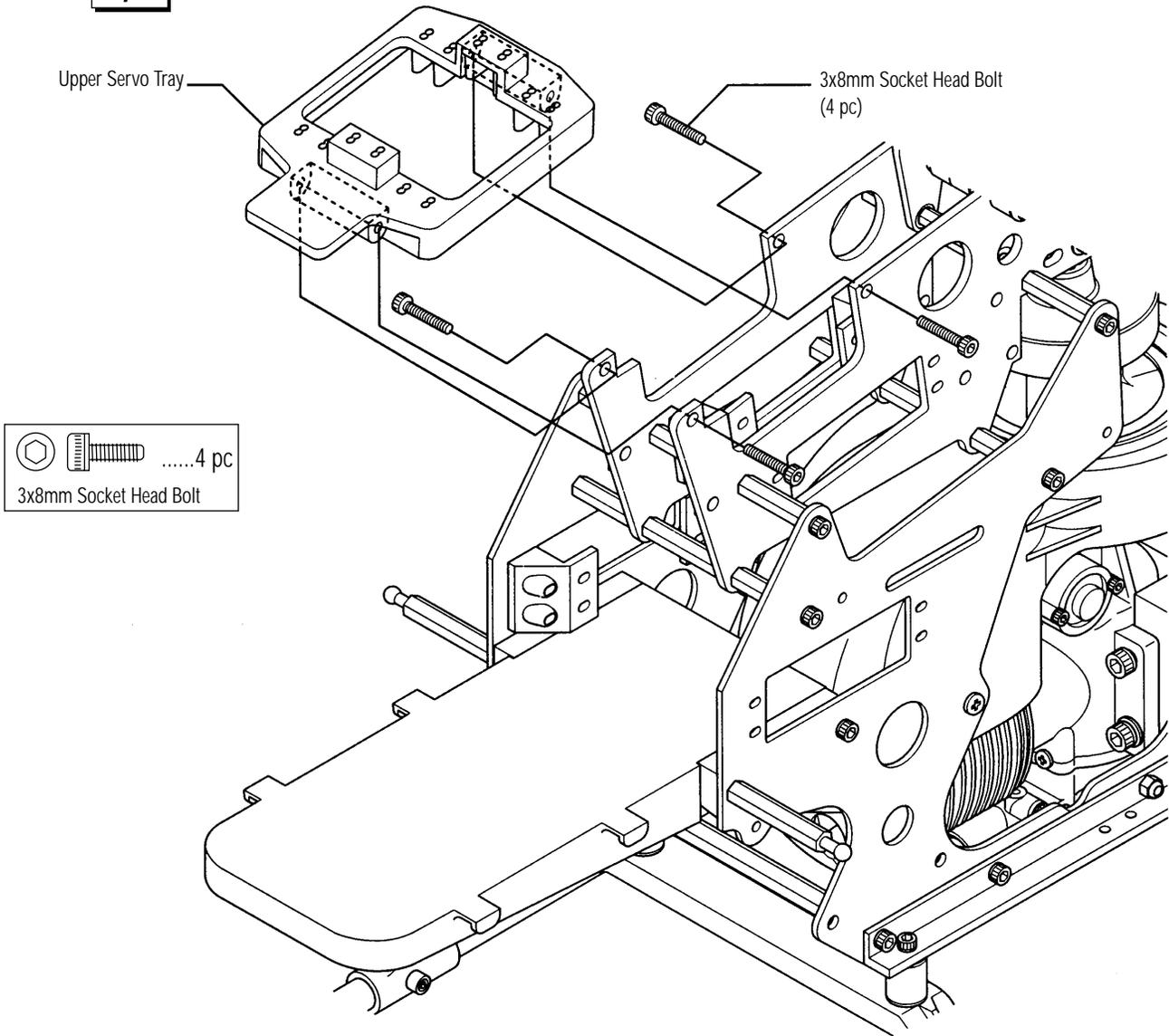
-  ..... 4 pc  
3mm Lock Nut
-  ..... 2 pc  
Dome Nut
-  ..... 1 pc  
Main Frame Standoff, 80mm

**Caution:** Be sure to note correct lengths of 3mm Socket Head Bolts during assembly.

# 6-1

## UPPER SERVO TRAY INSTALLATION

Z,Q



### RADIO INSTALLATION SUGGESTIONS

Be sure to install four rubber servo grommets and eyelets to each servo prior to installation. When securing the servos to the helicopter, be sure not to over-tighten the mounting screws.

When adjusting control rods, be sure to adjust each universal link the same amount so as not to unthread one link too far.

It is suggested that both the receiver and gyro amplifier be isolated from vibration by wrapping them in foam, then securing them to the model using double-sided servo tape.

Be sure to keep all servo lead wires, etc., away from all servo arms, rods, and sharp edges of the helicopter's mechanics. Group these wires together after final installation using small nylon wire ties (not included).

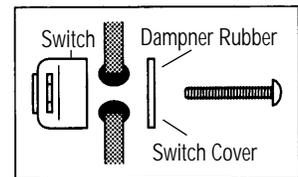
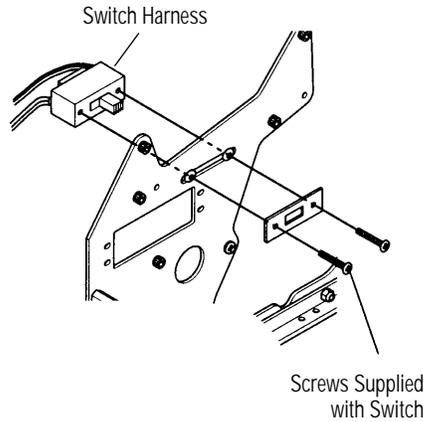
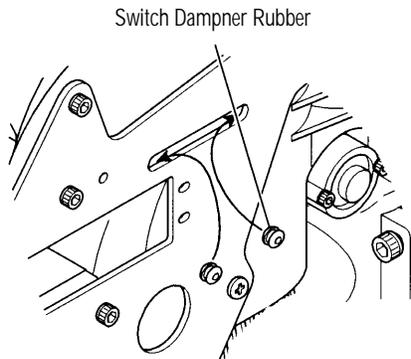
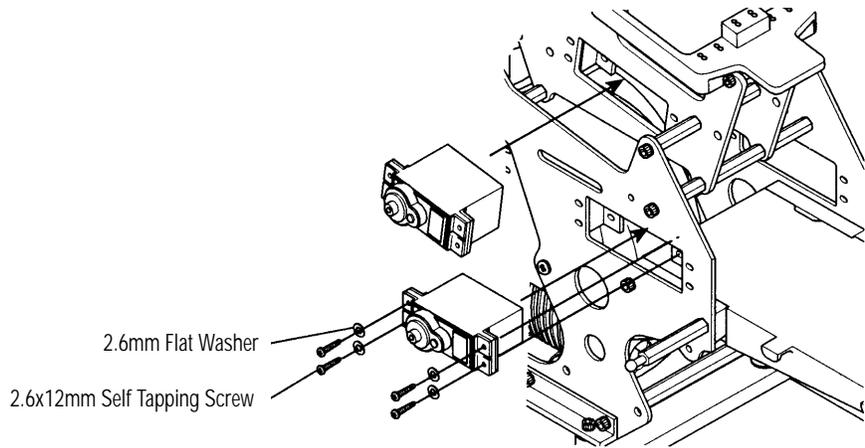
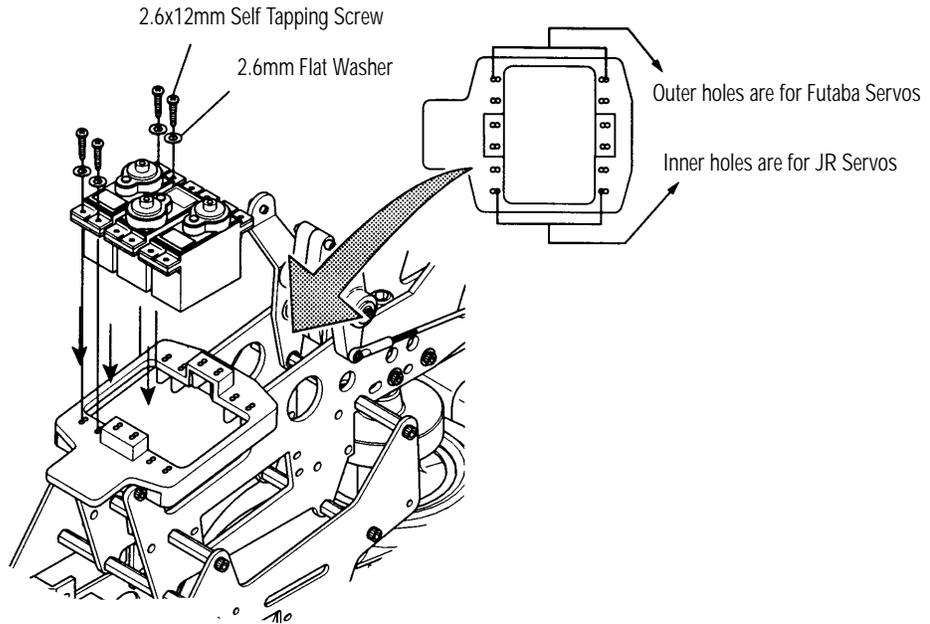
# 6-2

## Z

### SERVO/SWITCH HARNESS INSTALLATION

-  .....20 pc  
2.6x12mm Self Tapping Screw
-  .....20 pc  
2.6mm Flat Washer (4 Per Servo)

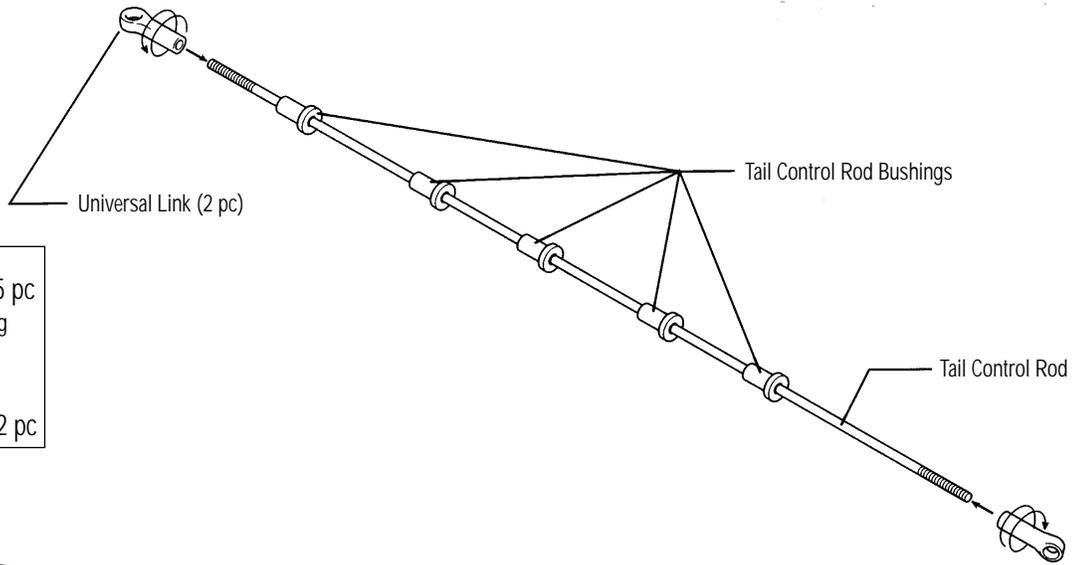
\* Note correct Servo Output Shaft orientation during installation.

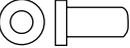


# 6-3

## TAIL CONTROL ROD ASSEMBLY

Z,Q

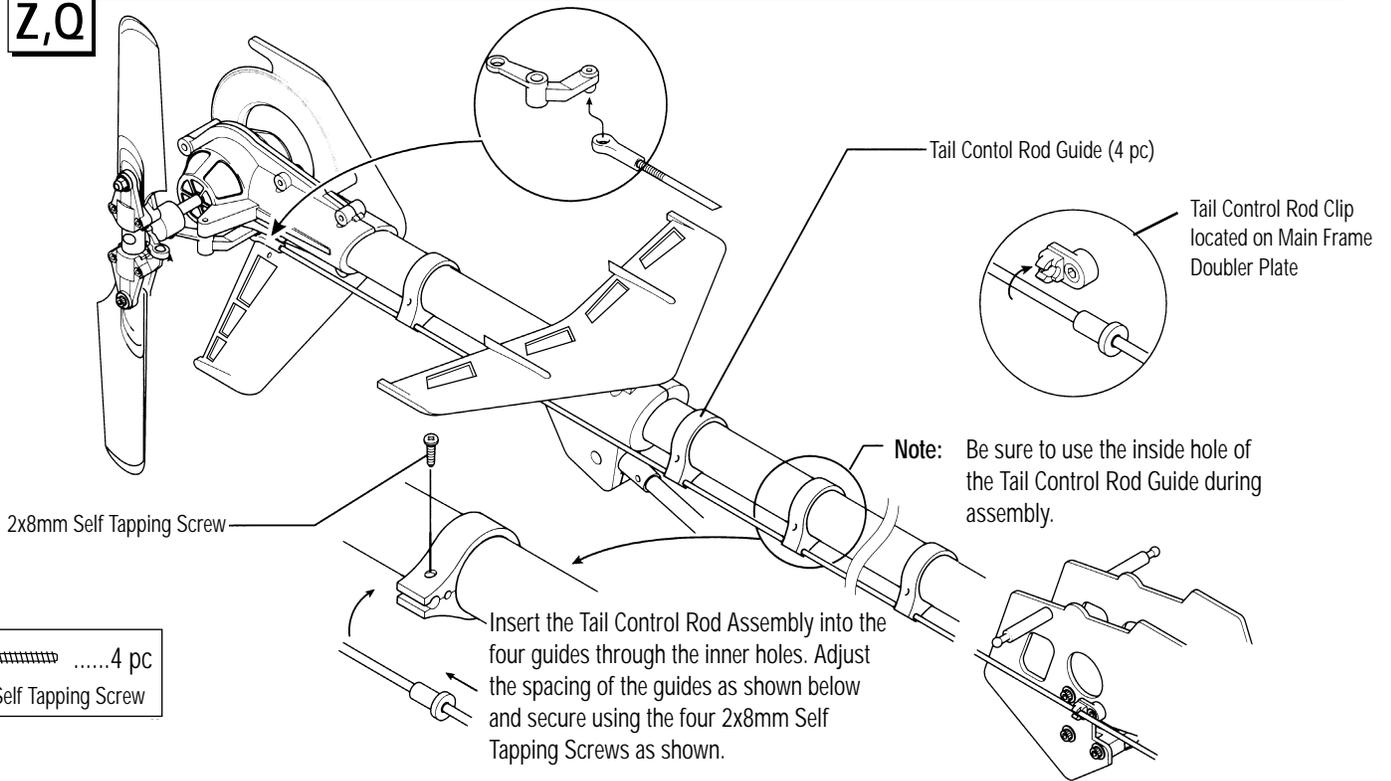


-  .....5 pc  
Tail Control Rod Bushing
-  .....2 pc  
Universal Link

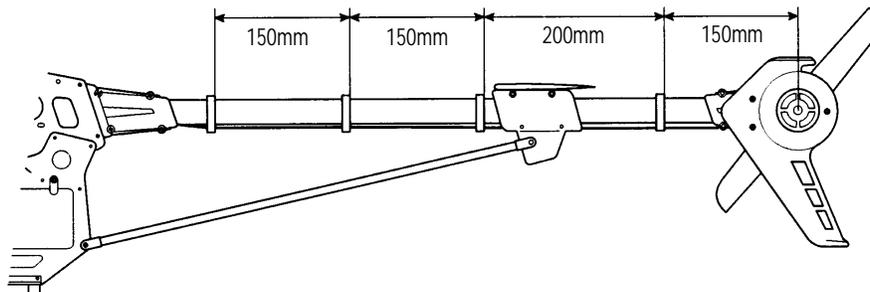
# 6-4

## TAIL CONTROL ROD INSTALLATION

Z,Q



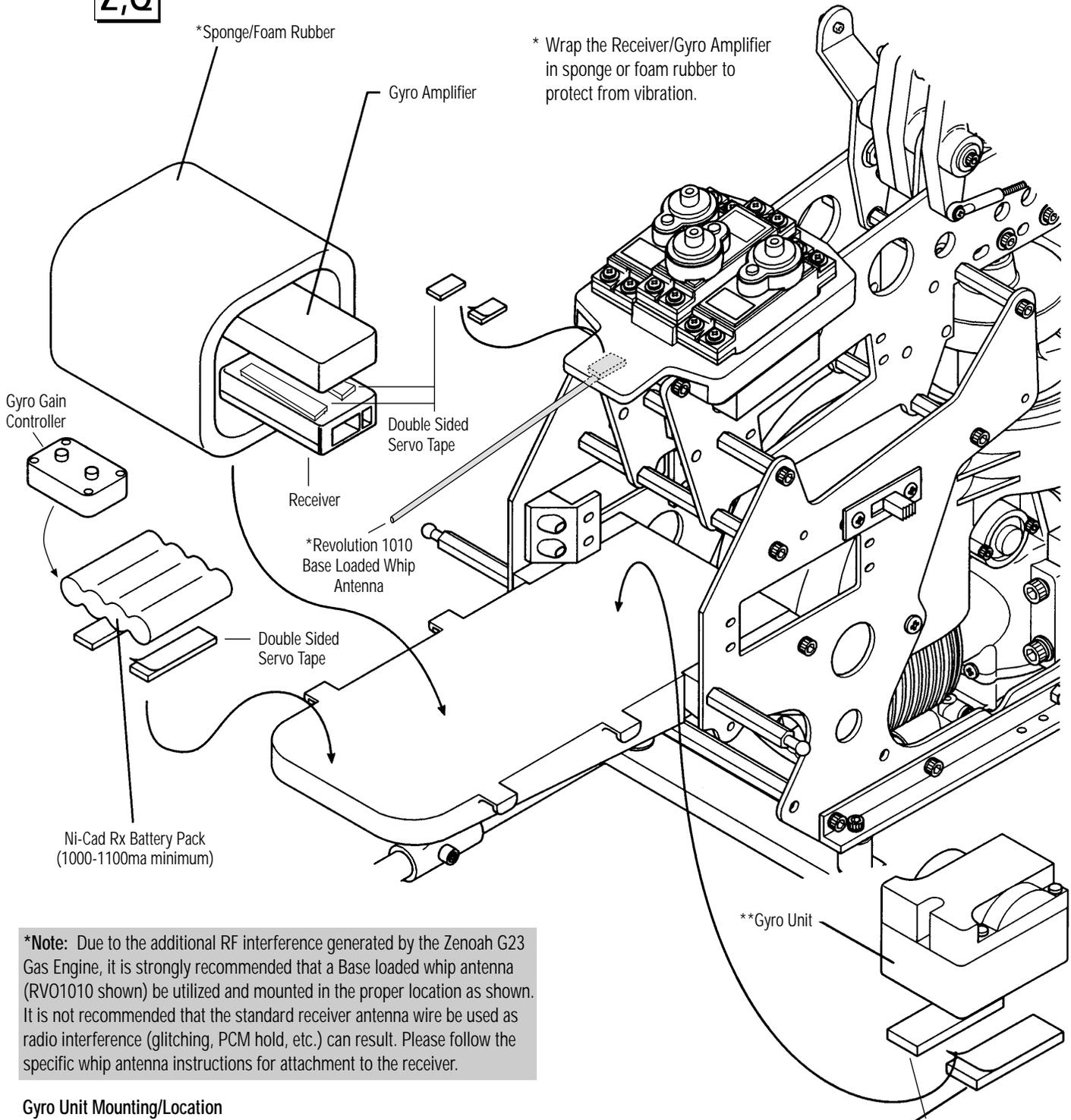
-  .....4 pc  
2x8mm Self Tapping Screw



# 6-5

## Z,Q

### GYRO/RECEIVER/BATTERY INSTALLATION



**\*Note:** Due to the additional RF interference generated by the Zenoah G23 Gas Engine, it is strongly recommended that a Base loaded whip antenna (RVO1010 shown) be utilized and mounted in the proper location as shown. It is not recommended that the standard receiver antenna wire be used as radio interference (glitching, PCM hold, etc.) can result. Please follow the specific whip antenna instructions for attachment to the receiver.

#### Gyro Unit Mounting/Location

\*\* Be certain when installing the Gyro Unit to the Front Radio Tray that it does not come in contact with the frame of the helicopter, etc. If a piezo type gyro is to be used, it is suggested that the gyro unit be repositioned to the forward portion of the radio tray as to position the unit away from the cylinder head of the engine (heat source).

Also make sure that the Front Radio Tray is free from oil, etc. Clean with rubbing alcohol if necessary to insure proper adhesion.

**Note:** Double Sided Servo Tape and Sponge/Foam Rubber are not included in this kit.

Double Sided Servo Tape

The following preparations are suggested for use with JR radio systems. However, these procedures are applicable to most other brand radio systems. These suggested adjustments are necessary to insure correct installation and attachment of the control linkages and servo horns.

## TRANSMITTER PREPARATION

---

1. Set all trim levers, trim knobs and switches to the neutral or zero positions.
2. Turn the transmitter power switch to the “on” position.
3. If you are using a computer radio system that had been previously adjusted to another model, reset all functions and input values to the factory preset position.
4. Move the throttle/collective control stick to the center or half stick position. Next slide the throttle trim lever to the full low position.

## RECEIVER FLIGHT PACK PREPARATION

---

1. With the transmitter still on, slide the receiver switch to its “on” position. All servos should move to the neutral, or center, position.
2. Check to insure that all servos operate with the appropriate control stick.
3. Rest the throttle stick to the center position, making sure the throttle trim is still at low.
4. Turn off the receiver switch first, followed by the transmitter.

## SERVO HORN INSTALLATION SUGGESTIONS

---

For proper operation, it is important that the servo horns are positioned on the servos in the “exact” neutral position. Although most computer radio systems offer a sub-trim feature, it is suggested that the servo horns be manipulated on the servos to achieve the “exact” neutral settings.

Since the servo output spline on a JR system has an odd number of teeth (21), it is possible to reposition the servo arm on the servo at 90° intervals to achieve the proper neutral attachment of the servo horn.

Once the correct arm of the servo horn has been established, it is suggested that the remaining unused arms be removed from the servo horn as shown in the installation diagrams in the following section.

It will also be necessary to enlarge the appropriate hole in the servo horn slightly to allow correct installation of the steel control balls to the servo horn.

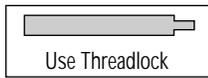
# 7-1

## AILERON LINKAGES

Z,Q

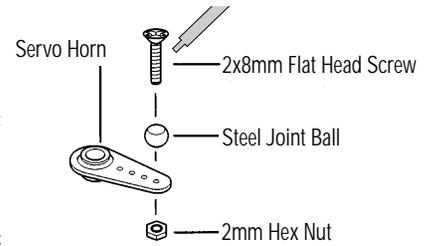
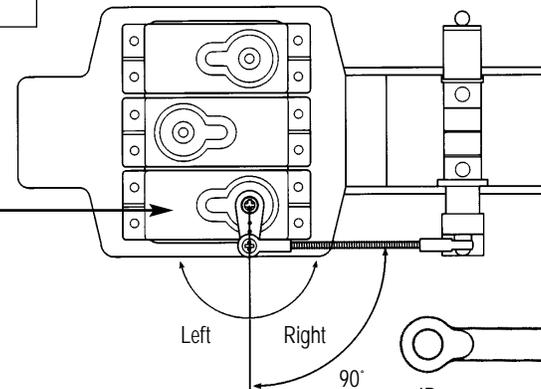
Note: Attach the Steel Joint Ball to the correct hole as shown below:

- ⊕ ..... 1 pc  
2x8mm Flat Head Screw
- ⊙ ..... 1 pc  
Steel Joint Ball
- ⊕ ..... 1 pc  
2mm Hex Nut

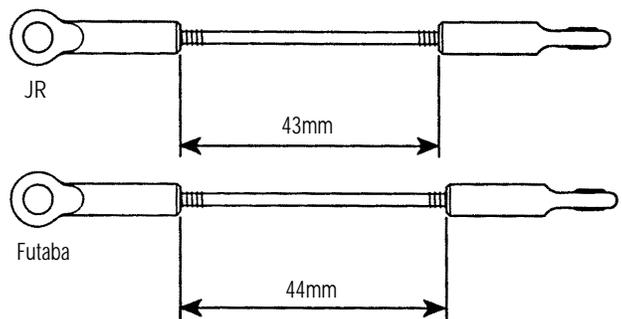


Make sure the Aileron Trim is in the center position before attaching the Servo Arm to the Servo.

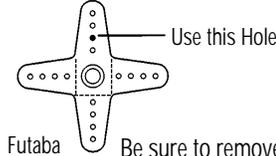
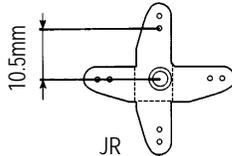
Servo Reversing Directions	
JR	Normal
Futaba	Normal



(2.3x60mm Threaded Rod)



### Servo Horn Hole Selection



Be sure to remove the excess Servo Horn Arms as shown. Secure the Servo Horn using the Servo Horn Screw.

# 7-2

## ELEVATOR LINKAGE INSTALLATION

Z,Q

- ⊕ ..... 2 pc  
2x8mm Flat Head Screw
- ⊙ ..... 2 pc  
Steel Joint Ball
- ⊕ ..... 2 pc  
2mm Hex Nut

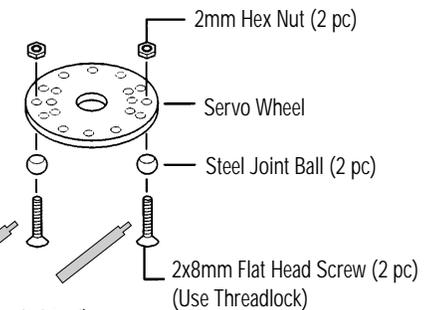
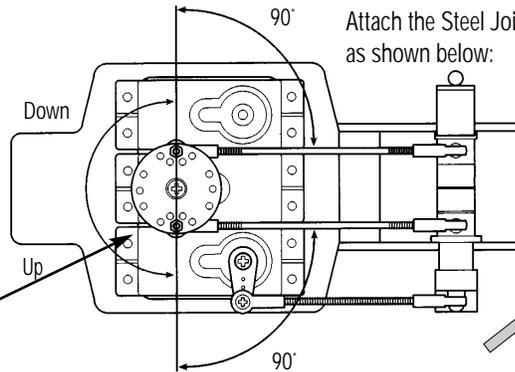


Make sure the Elevator Trim is in the center position before attaching the Servo Arm to the Servo.

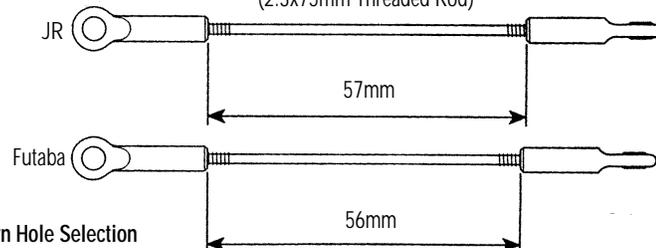
Servo Reversing Directions	
JR	Normal
Futaba	Normal

At this time, check to insure that the Swashplate is at a 90° angle to the Main Rotor Shaft in both fore/aft and right/left directions.

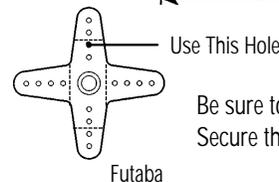
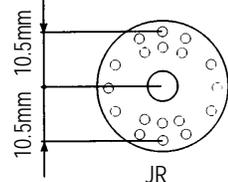
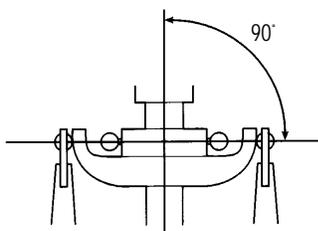
Attach the Steel Joint Ball to the bottom side of the Servo Horn, as shown below:



(2.3x75mm Threaded Rod)



### Servo Horn Hole Selection



Be sure to remove the excess Servo Horn Arms as shown. Secure the Servo Horn using the Servo Horn Screw.

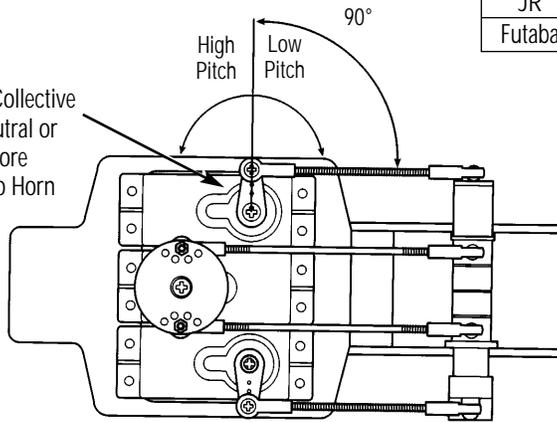
# 7-3

## COLLECTIVE PITCH LINKAGES

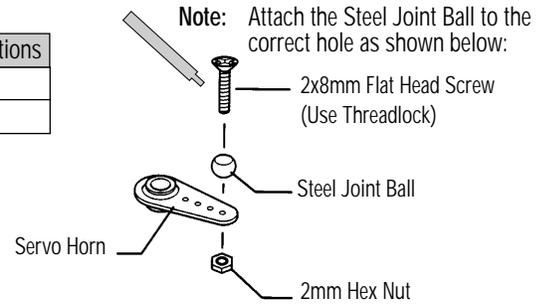
Z,Q



**Note:** Make certain the Collective Servo is in the neutral or hover position before securing the Servo Horn to the Servo.

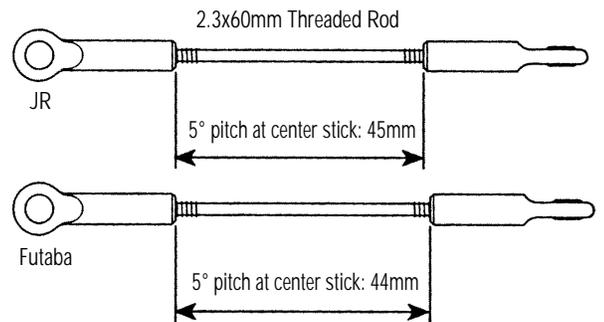
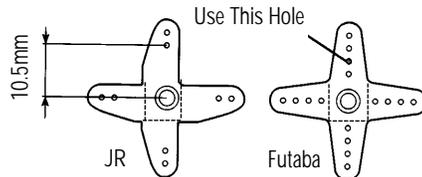


Servo Reversing Directions	
JR	Reverse
Futaba	Reverse



- ..... 1 pc  
2x8mm Flat Head Screw
- ..... 1 pc  
Steel Joint Ball
- ..... 1 pc  
2mm Hex Nut

### Servo Horn Hole Selection



**Note:** If 0° pitch at 1/2 stick is desired for 3D flight, it will be necessary to reduce the length of this control rod.

# 7-4

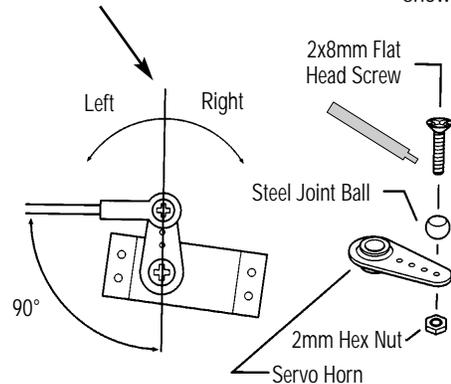
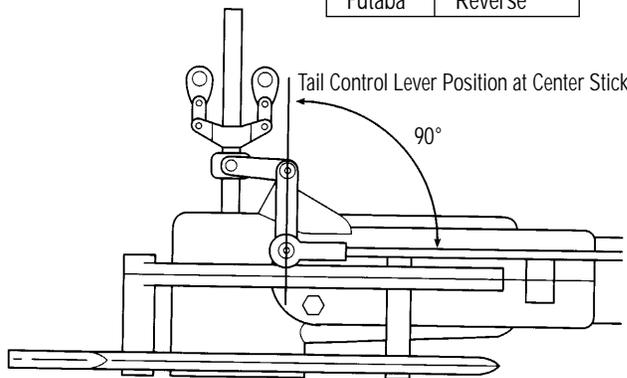
## TAIL CONTROL ROD SERVO CONNECTION

Z,Q

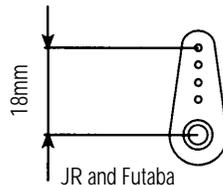
Servo Reversing Directions	
JR	Reverse
Futaba	Reverse

**Note:** Make certain the Tail Rotor Servo is in the neutral or hover position before securing the Servo Horn to the Servo.

**Note:** Attach the Steel Joint Ball to the correct hole as shown below:



### Servo Horn Hole Selection



Be sure to remove the excess Servo Horn Arms as necessary. Secure the Servo Horn using the Servo Horn Screw.



- ..... 1 pc  
2x8mm Flat Head Screw
- ..... 1 pc  
Steel Joint Ball
- ..... 1 pc  
2mm Hex Nut

**An Important Note:** Check to insure the Tail Control Rod can slide through the Tail Control Rod Guides smoothly before connecting it to the Servo. If resistance is felt, rotate the Tail Control Rod Guides slightly until the Control Rod slides smoothly.

# 7-5

## Z

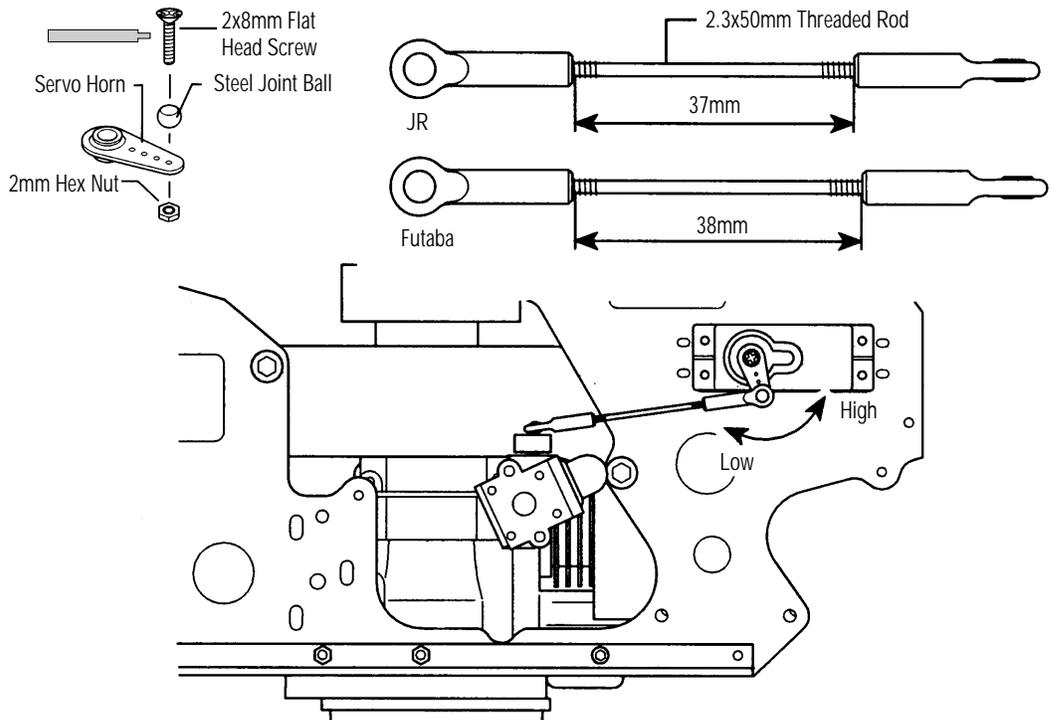
### THROTTLE LINKAGE INSTALLATION



- ..... 1 pc
- ..... 1 pc
- ..... 1 pc

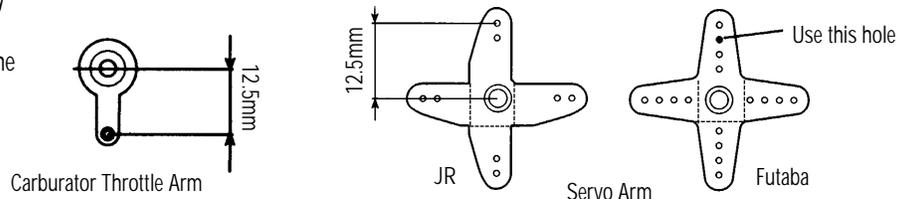
Servo Reversing Directions	
JR	Reverse
Futaba	Reverse

**Note:** Make sure the Throttle Trim is in the low position before attaching the Servo Horn.

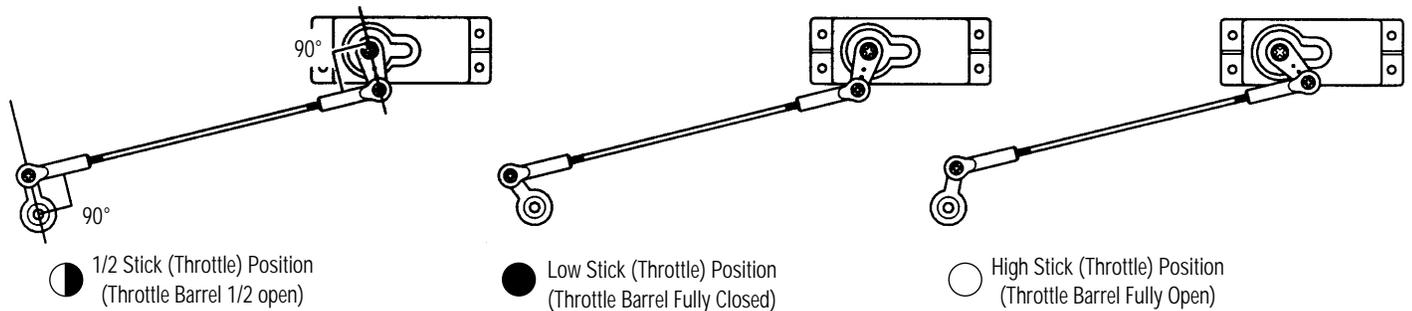


### SERVO HORN SELECTION/PREPARATION

When preparing the servo arm, it is very important that the distance of the hole selected is of equal distance to that of the carburetor throttle arm.



### THROTTLE ARM/SERVO HORN POSITIONS



\*To avoid differential throttle travel, make certain both the throttle arm and the servo horn are positioned as shown in the above diagrams.

To achieve the correct position of the throttle/servo arm, it may be necessary to re-position the throttle arm on the carburetor. It may also be necessary to adjust the length of the throttle linkage slightly to achieve full open and closed positions of the carburetor. It is also possible to increase/reduce the travel of the throttle servo through

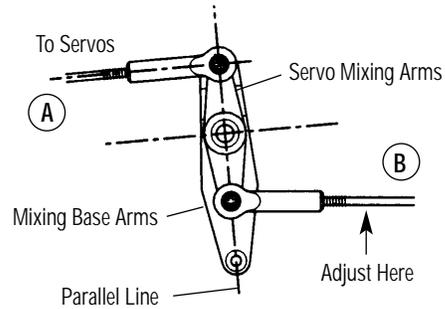
the travel adjust function found in most computer radio systems. If this function is used, make sure the values for the high and low positions remain equal (same value for high/low). If these values are not equal, this will create a differential, or uneven movement of the throttle, making rotor RPM adjustment and fine tuning more difficult.

# 7-6

## Z,Q

### CONTROL LEVER/LINKAGE ADJUSTMENT

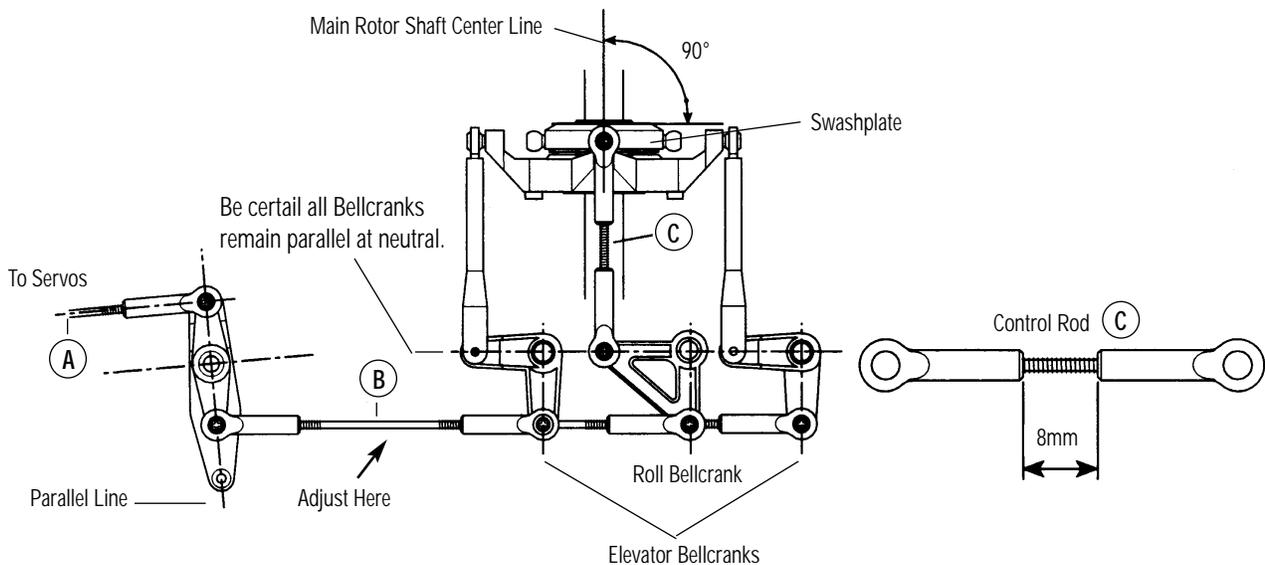
**Note:** The following adjustments are made with all servos in the center (1/2 stick) or neutral positions.



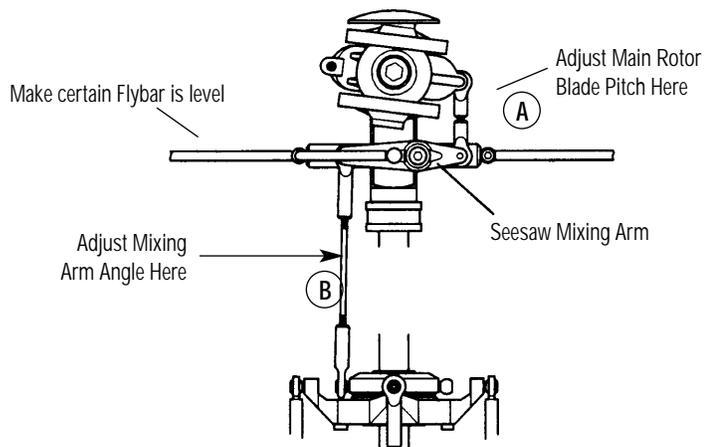
1. Check to insure that both the Elevator (2) and Aileron (1) Servo Mixing Arms are parallel (same angle) to the Mixing Base Arms (2) with all servos in the neutral (center) positions. If these items are not parallel, re-adjust the (B) Control Rods until proper alignment is achieved.

2. Next, check to be sure the Swashplate Assembly is at 90° in all directions (Fore/Aft, Left, Right) to the Main Rotor Shaft Assembly. If this is not the case, adjust Control Rod (B), making sure that both the Roll (1 pc) and Elevator

(2 pc) Bellcranks remain positioned parallel as shown. Also check to insure that control rod (C) is sized 8mm as shown below.



3. Check the Seesaw Mixing Arms (2) and adjust so that with the Flybar Assembly Level, and the Pitch at 1/2 stick (center), the Mixing Arms are level (parallel) as shown. If this is not the case, adjust the Control Rod (B) (2) until this positioning is achieved. Adjustment of the Main Rotor Blade Pitch to the desired settings can be achieved by using Control Rod (A) for adjustment. See page 46 Section 6A for Pitch range settings.



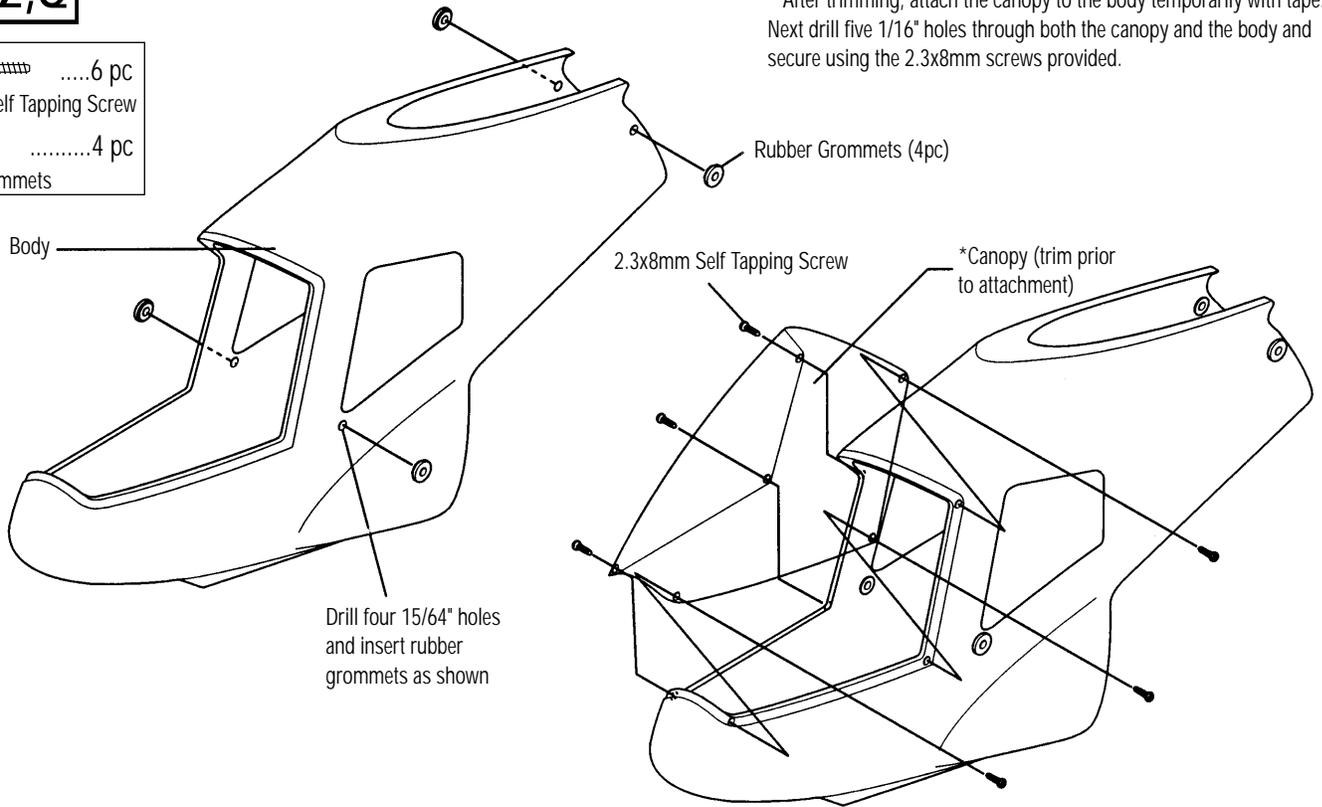
# 8-1

## BODY ASSEMBLY/CANOPY ATTACHMENT

Z,Q

-  .....6 pc  
2.3x8mm Self Tapping Screw
-  .....4 pc  
Rubber Grommets

\* After trimming, attach the canopy to the body temporarily with tape. Next drill five 1/16" holes through both the canopy and the body and secure using the 2.3x8mm screws provided.



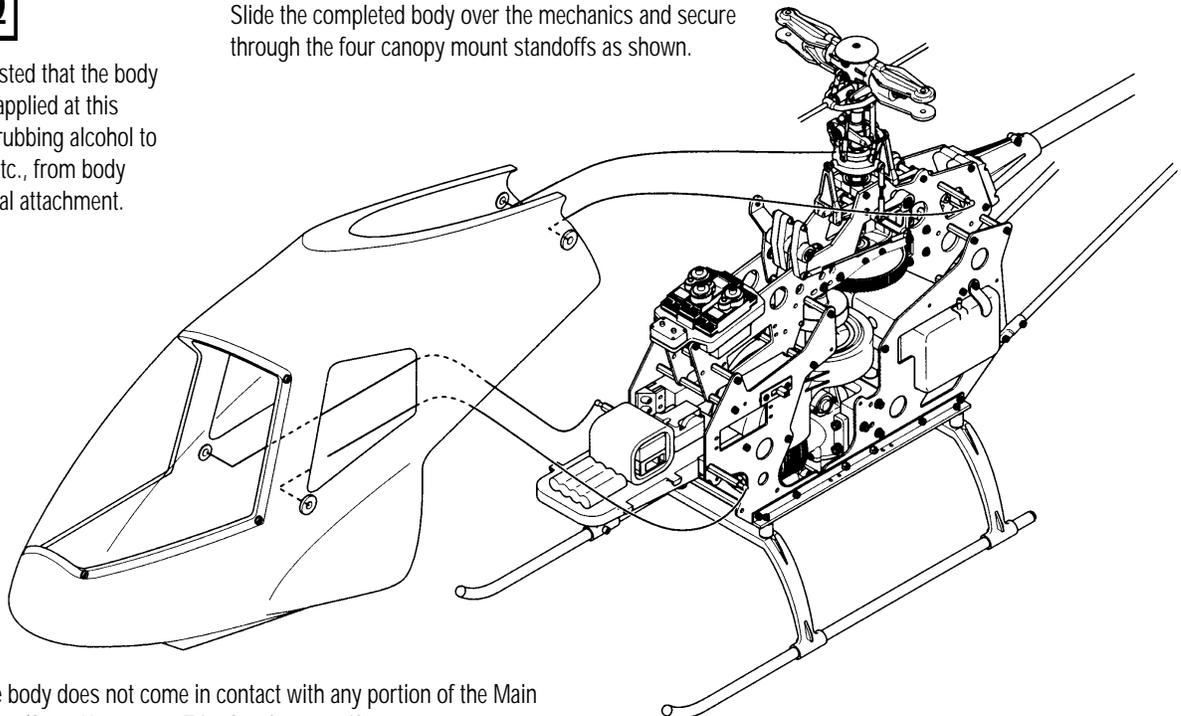
# 8-2

## BODY ATTACHMENT

Z,Q

**Note:** It is suggested that the body decals be applied at this time. Use rubbing alcohol to clean oil, etc., from body before decal attachment.

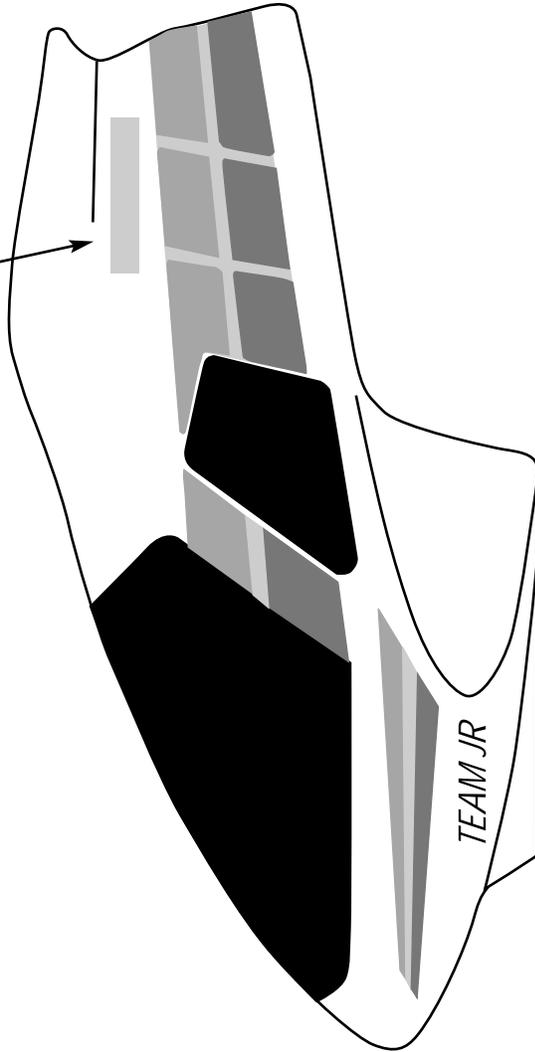
Slide the completed body over the mechanics and secure through the four canopy mount standoffs as shown.



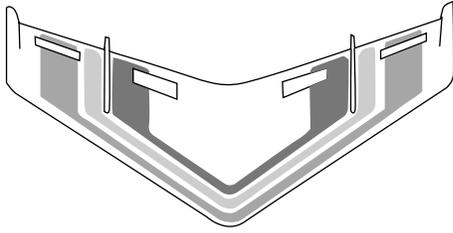
Check to insure the body does not come in contact with any portion of the Main Frame, Muffler, Servo/ServoHorns, etc. Trim for clearance if necessary.

**SrqqZ230**

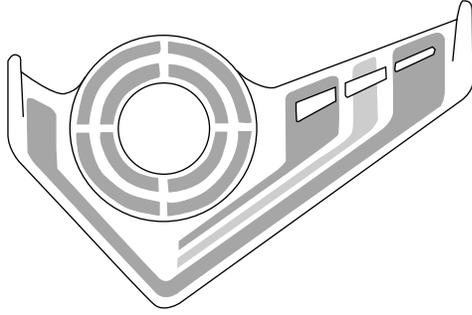
**Body**



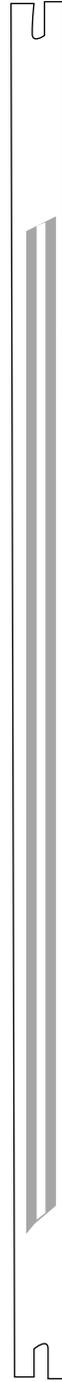
**Stabilizer**



**Fin**



**Tail Boom**



# 8-3

## MAIN ROTOR BLADE ASSEMBLY

Z,Q

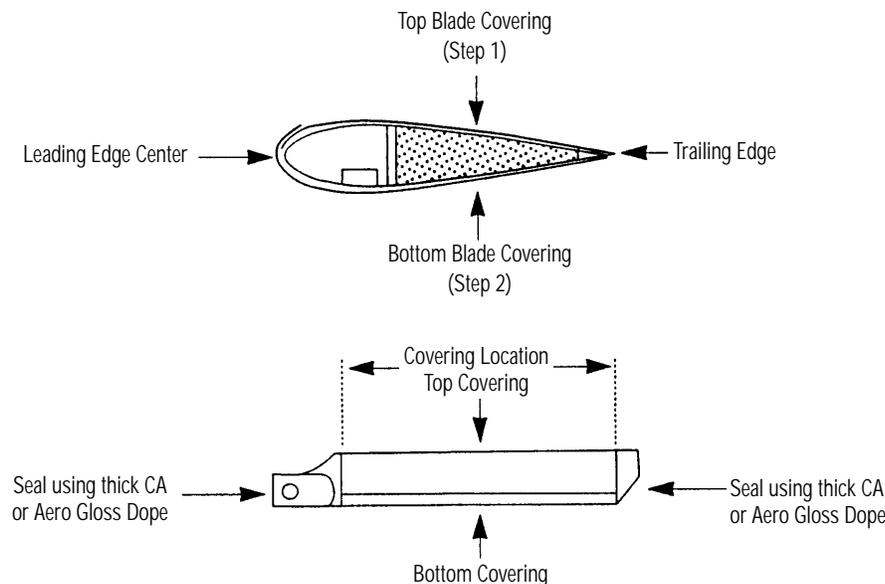
### Blade Weight Installation

1. Using 80-100 grit sandpaper, sand the blade weight strip (2) to produce a roughened surface. This will insure proper glue adhesion. Next, trim the blade weight strips to equal lengths.
2. Adjust the spanwise C.G. (center of gravity) of the blades by setting the blade weight strip into the blade slot and positioning them toward the front of the slot (closest to the tip of the blade). Refer to Section 8-4, Step 1 for clarification. Next, trim the blade weights until proper C.G. is obtained. It is suggested that the C.G. of the blades be matched within 1/16" of an inch for proper balancing.
3. Bond the blade weights to the blade slots by removing the weights and filling the blade slot completely with glue. We recommend either 6-minute epoxy or Pacer Blade Zap for this procedure. With the blade slot filled with the adhesive, submerge the blade weight to the bottom of the blade slot and completely cover with glue. It is suggested that the blades are not used for a 24 hour period after gluing to insure that the adhesive is thoroughly cured.
4. Lightly sand each rotor blade using 220 grit sandpaper and remove all sanding dust.

5. It is suggested that the root and tip of each blade be sealed prior to covering. We suggest either thick CA or Aero Gloss clear dope for this task. Sealing these areas will prevent the exposed wood from absorbing fuel and oil from the engine's exhaust, which can compromise the structural integrity of the rotor blades.

### Blade Covering Installation

1. Remove the adhesive backing and apply the top blade covering to the blades starting at the center point of the leading edge airfoil. Adhere the covering to the blades starting at the front and slowly moving toward the trailing edge of the blade, wrapping the additional length of the covering over the trailing edge and adhering it to the bottom of the blade as shown in the diagram.
2. Remove the adhesive backing and apply the bottom blade covering to the blades starting at the bottom edge of the trailing edge. Adhere the covering to the blade starting at the rear and slowly moving forward toward the leading edge of the blade, wrapping the additional length of the covering over the leading edge and adhering it to the top of the blades as shown in the diagram.

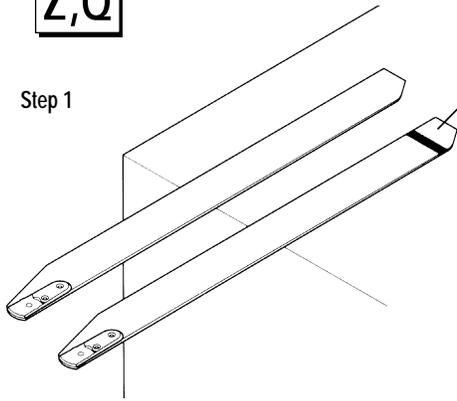


# 8-4

## MAIN ROTOR BLADE FINAL BALANCING

Z,Q

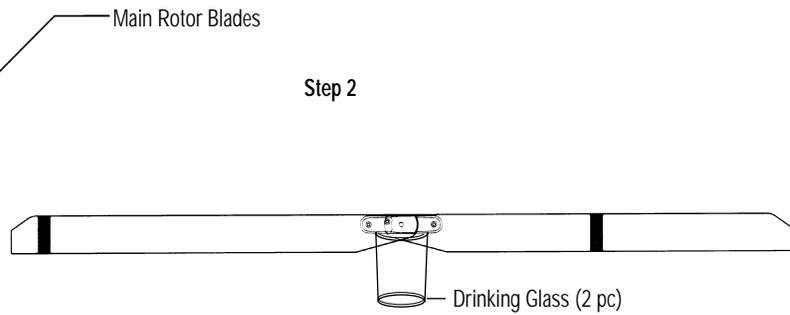
Step 1



### Spanwise C.G. Balancing

Place each rotor blade on a sharp edge of a table as shown and adjust so each rotor blade "teeters" on the edge of the table. If the blades are correctly balanced, they should be at an equal distance to the edge of the table. If they are not, apply tape to the center of the light or short blade until equal distance can be achieved.

Step 2



### Final Static Balancing

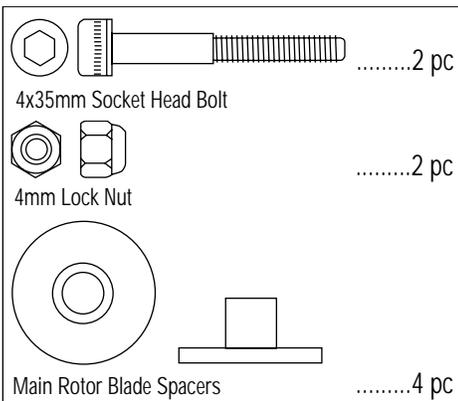
To static balance the main rotor blades, it is suggested to either attach each blade to a "seesaw" type blade balancer (RVO1001), or bolt each of the two blades together through the blade mounting holes shown and suspend this unit between two drinking glasses. Add blade tracking tape (from decal sheet) to the tip of the light or high blade until they each become level to the table surface.

# 8-5

## MAIN ROTOR BLADE ATTACHMENT

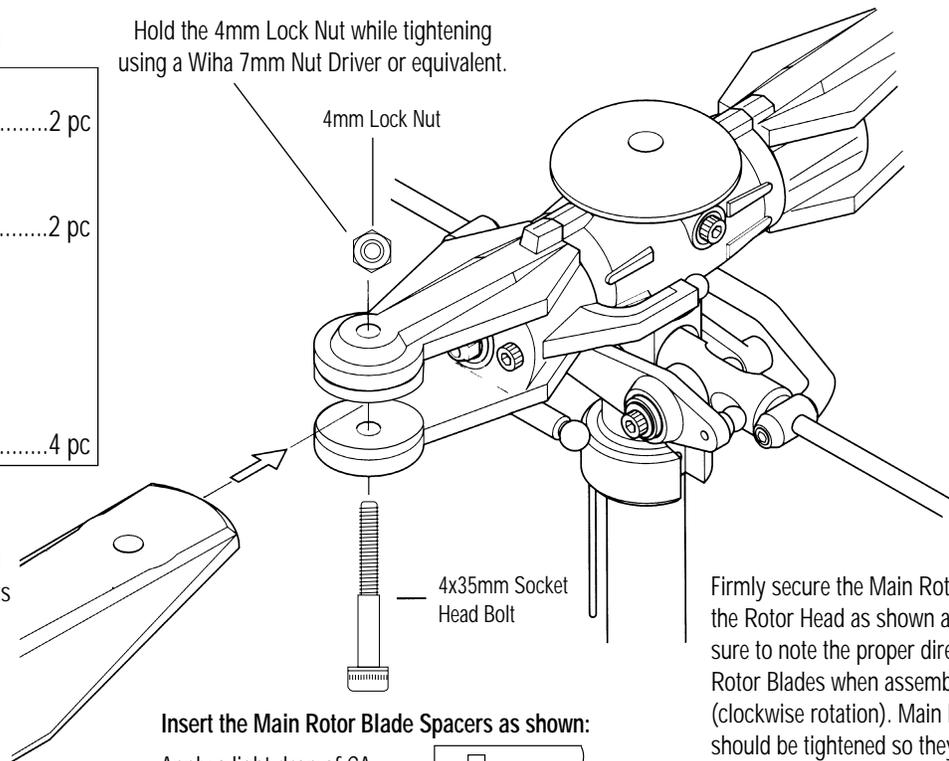
Z,Q

### TWO SETS REQUIRED



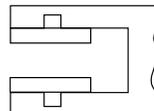
**Note:** The above items can be found attached to the Main Rotor Blade package. Please disregard the 5x35mm bolts and 5mm nuts included with this kit.

Hold the 4mm Lock Nut while tightening using a Wiha 7mm Nut Driver or equivalent.



### Insert the Main Rotor Blade Spacers as shown:

Apply a light drop of CA adhesive to hold the Main Rotor Blade Spacers in place.



Firmly secure the Main Rotor Blades to the Rotor Head as shown above. Be sure to note the proper direction of the Rotor Blades when assembling (clockwise rotation). Main Blades should be tightened so they can pivot when moderate pressure is applied. Do not allow the Main Blades to swing freely within the Main Blade Holders.

Now that the radio system is completely installed into the helicopter, it is necessary to check and adjust the following:

**1. Servo Direction (Servo Reversing)**

Check to insure that all servos have been set to the correct direction as shown in the Control Linkage Installation Section (Steps 7-1 to 7-5).

**2. Dual Rates**

It is suggested that for initial flights, the dual rate function values be set as follows:

- 0 Position (low rate) 70%
- 1 Position (high rate) 100%

**3. Exponential Settings**

It is suggested that the exponential rate settings remain in the 0 value position until the initial test flights. After initial flights, adjust the exponential values to achieve the desired control feel.

**4. Sub-Trim Settings**

It is suggested that the correct neutral settings be achieved without the use of the sub-trim feature. If sub-trim is used for final flight adjustments, it is not suggested that the sub-trim values exceed 10. If the sub-trim values are greater, readjust the control linkages and reset the sub-trims to 0.

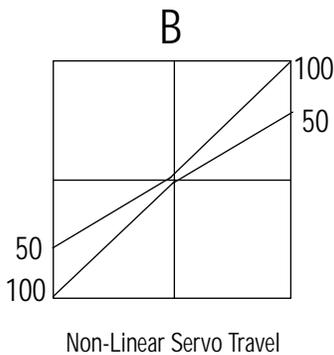
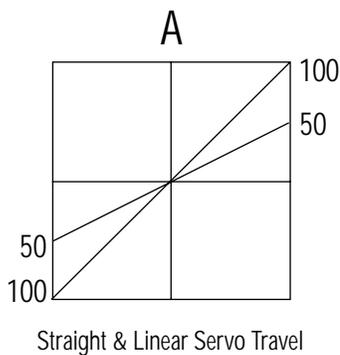
**5. Travel Adjustment**

The travel adjustment feature allows the control surface to be adjusted to achieve maximum travel, or surface deflection. When using this feature, it is extremely important that the high/low, up/down values for each channel be set at an equal value or a differential movement will occur (Diagram B). It is especially important the throttle and collective pitch travel limits are set to an equal value (Diagram A).

Please refer to the diagrams below for clarification.

**Correct**

**Incorrect**



**6. Pitch/Throttle Curve Adjustment**

It is very important the throttle and pitch curves are adjusted properly to achieve the best performance from your helicopter. When properly adjusted, the main rotor head RPM should remain consistent throughout all maneuvers and throttle stick positions. A constant RPM will also help to improve the effectiveness and accuracy of the tail rotor and gyro systems.

**A. Pitch Curve Adjustment**

Using a pitch gauge (optional) set the low, mid and high stick pitch settings as shown in the diagram below. Use the travel adjust feature to set the maximum high and low pitch required for all flight modes. This pitch travel can then be reduced by altering the pitch curves as shown below.

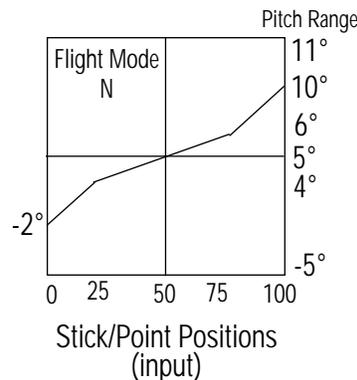
**Pitch Range Settings**

Flight Mode	Application	Low Pitch (Low Stick)	Hovering Pitch (Half Stick)	High Pitch (High Stick)
N	Hovering	-2°	5°	10°
I	Stunt & Aerobatic Flight	-5°	5°	9°
*2	3D Flight	-10°	0°	10°
H	Autorotation	-5°	5°	13°

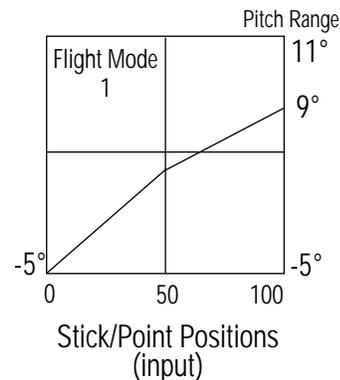
**\*Note:** To achieve these pitch range settings with the Ergo Z230, it will be necessary to install the optional Seesaw Mixing Arms (JRP960178) and adjust the collective linkage slightly at the Seesaw Arm Main Blade Holder, Swashplate/Seesaw Arm, and Servo to Collective Arm Linkages.

**Pitch Curve Settings**

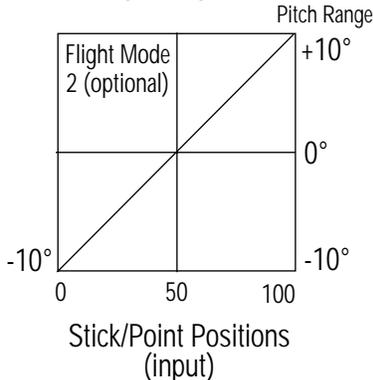
Hovering (Linear Curve)



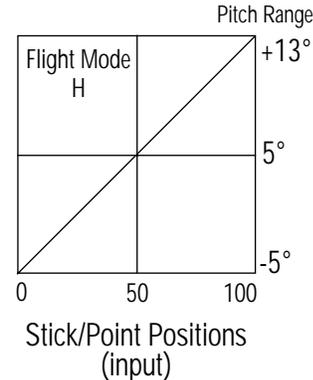
Stunt & Aerobatic Flight



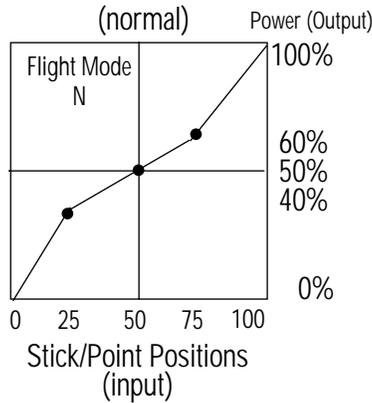
3D Flight (Ergo Z230)



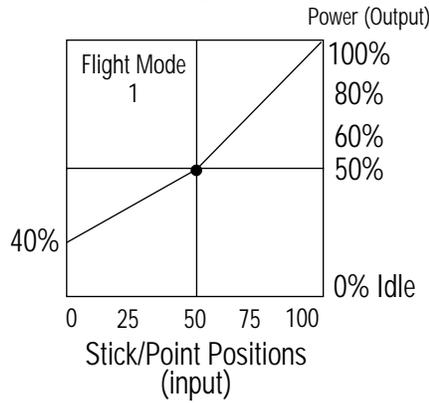
Autorotation



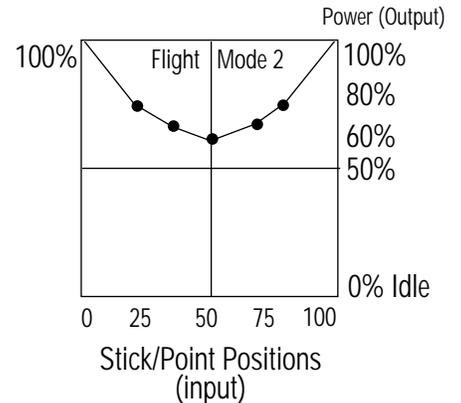
**Hovering Throttle Curve**  
(normal)



**Stunt & Aerobatic Flight**



**3D Flight (Optional)**



**Note:** The throttle curve examples shown correspond to the pitch curve examples show in Step 6A on the previous page.

**B. Throttle Curve Settings**

Below are several examples of possible throttle curves during various flight conditions.

Since throttle curves can vary, it will be necessary to fine tune and adjust these values during test flights to achieve a constant main rotor RPM.

It will also be necessary to set the correct idle speed of the engine when the throttle hold function is activated.

This idle value is located within the throttle hold function. This will allow the engine to remain at idle when practicing autorotations.

**7. Revolution Mixing**

It will be necessary to adjust the revolution mixing to properly compensate for the torque of the engine during all flight conditions (except autorotation).

Since there are many variables that can alter the value of the revolution mixing (engine, blade pitch, fuel, etc.), it will be necessary to fine tune this function during test flights.

\* The following values are shown only as a starting point toward achieving proper compensation:

Flight Mode N	Flight Mode 1	Flight Mode 2 (3D)
Up 40	Up 15	Up 15
Down 20	Down 10	Down 15

\* **NOTE:** When using a Piezo Gyro System, the values shown may need to be reduced 20-30% to achieve proper compensation rates.

**8. Gyro Gain Adjustment**

It will be necessary to adjust the “gain” or compensation of the gyro to create the correct amount of “holding power” necessary for a solid neutral tail rotor. The intent of the gyro is to compensate for abrupt movements, or wind direction changes, working in conjunction with the revolution mixing function.

For hovering, it is recommended that you start with the gyro gain at approximately 60°, and continue to increase slightly until the tail of the helicopter “hunts”, then reduce the value slightly.

This same adjustment will also be necessary to achieve proper forward flight. Generally, the gyro gain for forward flight will be approximately 10% - 20% less than that of the established hover gain due to aerodynamic forces present in forward flight.

If you are using a dual rate gyro, adjust the gain so you are using the “higher” gain setting for hover and the “lower” gain setting for forward flight.

It will also be necessary to confirm the direction the gyro compensates when the body of the helicopter is rotated.

To do this, turn the radio system on and suspend the helicopter by the main rotor head. Next, move the rudder stick to the right and watch the direction that the tail rotor servo arm travels. Now while watching the tail rotor servo arm, rotate the body of the helicopter counterclockwise. The servo arm should move in the same direction as when the rudder stick was moved to the left.

If the arm moves in the opposite direction, reverse the gyro and re-test.

**XP783 DATA SHEET**  
**ERGO Z230, QUATTRO (INITIAL SET-UP)**

MODEL NO. \_\_\_\_\_

MODEL NAME ERGO Z230, Quattro

MODULATION S-PCM • Z-PCM • PPM

			AILE	ELEV	RUDD	AUTO D/R (POS.1)	ST-1	<input type="checkbox"/> INH • <input type="checkbox"/> ACT
D/R	0	D/R	90 %	90%	70 %		ST-2	INH • <input type="checkbox"/> ACT
		EXP	25%	25%	30%			
EXP	1	D/R	100%	100%	100%	AUX 2 INPUT		D/R • R HOLD
		EXP	%	%	40%			
STUNT TRIM	INH • <input type="checkbox"/> ACT		Adjust as necessary during flight					

\*\*

	THRO	AILE	ELEV	RUDD	GEAR	PITCH	AUX2
REVERSE SW	<input type="checkbox"/> NORM <input type="checkbox"/> REV						
SUB-TRIM	Adjust so that no trim is required						
TRAVEL ADJUST	Adjust for Full Power	L 100%	D 100%	L 150%	+ %	H 100%	+ %
	Adjust for Engine Off	R 100%	U 100%	R 150%	- %	L 100%	- %
FAIL-SAFE	S(TYPE)						
	Z(TYPE)	HOLD • 10S • 0.5S • 0.25S					

		L	1	2	3	H
THRO	N	0 %	40 %	50%	60%	100%
CURVE (TH:)	1	60%	50%	60%	80%	/
	*2	100%	80%	60%	80%	
PITCH CURVE (PI:)	N	-2° Pitch	4° Pitch	5° Pitch	6° Pitch	10° Pitch
	1	-5° Pitch		5° Pitch		9° Pitch
	*2	-10° Pitch		0° Pitch		10° Pitch
	H	-5° Pitch		5° Pitch		11° Pitch

THRO-HOLD (HOLD)	INH • <input type="checkbox"/> ACT	POS
		Adjust for Idle
INVERTED (INV.P)	<input type="checkbox"/> INH • ACT	OFFSET %

REVOLUTION MIX (RV)	NORMAL	UP (U.N.)	40%
		DOWN (D.N.)	20%
	STUNT	UP (U.S.)	15 %
		DOWN (D.S.)	15%
HOLD RUDD OFFSET			
ACC-MIX			%

		CHANNEL	+ POS	- POS	SW	OFFSET
PROGRAM MIX	MIX A	→	%	%	%	%
	MIX B	→	%	%	%	%

\* **Note:** Flight Mode 2 shown is for 3D type flying **only** with 0° pitch at half stick. This is not recommended for use by entry-level pilots.

\*\*Before flying, confirm that all controls function in the proper direction.

**XP8103 DATA SHEET**  
**ERGO Z230, QUATTRO (INITIAL SET-UP)**

**MODEL NO.**  
**MODEL NAME** ERGO Z230, Quattro  
**MODULATION** S-PCM • Z-PCM • PPM

			AILE	ELEV	RUDD
DUAL-RATE • EXP	0	D/R	90%	90%	70%
		EXP	25%	25%	30%
	1	D/R	100%	100%	100%
		EXP	%	%	40%
STUNT TRIM	INH • ACT		Adjust as necessary during flight		

AUTO D/R (POS. 1)	ST1	INH • ACT
	ST2	INH • ACT
	ST2	INH • ACT

INPUT SEL	AUX2	HOLD SW • PIT.TRIM • INH
	GEAR	ACT • INH

	THRO	AILE	ELEV	RUDD	GEAR	PIT	AUX2	AUX3
** REVERSE SW	NORM • REV	NORM • REV	NORM • REV	NORM • REV	NORM • REV	NORM • REV	NORM • REV	NORM • REV
SUB TRIM	Adjust so that no trim is required							
TRAVEL ADJUST	Adjust for	L 100%	D 100%	L 150%	+ %	H 100%	+ %	+ %
	full power	R 100%	U 100%	R 150%	- %	L 100%	- %	- %
FAIL SAFE (SPCM)	Adjust for engine off							

	EXP	L	1	2	3	H	
THROTTLE CURVE	N	OFF-ON	0%	40%	50%	60%	100%
	1	OFF-ON	60%	50%	60%	80%	100%
	2	OFF-ON	100%	80%	60%	80%	100%
PITCH CURVE	N	OFF-ON	-2° Pitch	4° Pitch	5° Pitch	6° Pitch	10° Pitch
	1	OFF-ON	-5° Pitch	%	5° Pitch	%	9° Pitch
	* 2	OFF-ON	-10° Pitch	%	0° Pitch	%	10° Pitch
	H	OFF-ON	%	%	%	%	%

GYRO SENS	INH • RUDD D/R • AUTO	0	85%
		1	60%
		NORM	0
		STNT	1
		HOLD	0
		INVT	

THRO HOLD	INH • ACT	POS Adjust for idle
-----------	-----------	---------------------------

THRO HOLD	INH • ACT	OFFSET
-----------	-----------	--------

REVO MIX	NORMAL	UP	40%
		DOWN	20%
	STUNT	UP	15%
		DOWN	15%
HOLD RUDD OFFSET			
ACC MIX			%

		CHANNEL	SW	EXP	L	1	2	3	H
PROGRAM MIX	MIX1	'		OFF-ON					
	MIX2	'		OFF-ON					
				+POS		-POS		OFFSET	
	MIX3	'		%		%			

\* **Note:** Flight Mode 2 shown is for 3D type flying only with 0° pitch at half stick. This is not recommended for use by entry level pilots.  
 \*\*Before flying, confirm that all controls function in the proper direction.

**PCM-10SX DATA SHEET**  
**ERGO Z230, QUATTRO (INITIAL SET-UP)**

MODEL NO. (84) \_\_\_\_\_

MODEL NAME (81) ERGO Z230, Quattro

MODULATION (85) SPCM-ZPCM-PPM

**	THRO	AILE	ELEV	RUDD	GEAR	PITCH	AUX2	AUX3	AUX4	AUX5
REVERSE SW (11)	<input type="checkbox"/> R <input type="checkbox"/> N	R N	R N	R N	R N					
TRAVEL ADJUST (12)	Adjust for Full Power	L 100%	D 100%	L 150%	+ %	+100%	+ %	+ %	+ %	+ %
	Adjust for Engine Off	R 100%	U 100%	R 150%	- %	-100%	- %	- %	- %	- %
SUB-TRIM (15)	Adjust so that no trim is required									
TRIM RATE (83)	%	%	%	%						

D/R EXP (13)	0	D/R	90%	90%	70%
		EXP	25%	25%	30%
		TYPE	NORM	NORM	NORM
	1	D/R	100%	100%	100%
		EXP	%	%	40%
		TYPE			
2	D/R	%	%	%	
	EXP	%	%	%	
	TYPE				
AUTO D/R (23)	ST-1	INH · <input type="checkbox"/> ACT	<input type="checkbox"/> 0 · 1 · 2	<input type="checkbox"/> 0 · 1 · 2	<input type="checkbox"/> 0 · 1 · 2
	ST-2	INH · <input type="checkbox"/> ACT	0 · <input type="checkbox"/> 1 · 2	0 · <input type="checkbox"/> 1 · 2	0 · <input type="checkbox"/> 1 · 2
	ST-3	INH · ACT	0 · 1 · 2	0 · 1 · 2	0 · 1 · 2
	ST-4	INH · ACT	0 · 1 · 2	0 · 1 · 2	0 · 1 · 2
	HOLD	INH · ACT	0 · 1 · 2	0 · 1 · 2	0 · 1 · 2
STUNT TRIM (25)	ST-1	INH · <input type="checkbox"/> ACT	Adjust as necessary during flight.		
	ST-2	INH · <input type="checkbox"/> ACT			
	ST-3	INH · ACT			
	ST-4	INH · ACT			

THROTTLE HOLD (16)	HOLD SW	INH · HOLD GEAR
	POS	Adjust for Idle
	AUTO CUT	INH · <input type="checkbox"/> ACT
		POS

FUNCTION SELECT (16)	FLIGHT EXTRA	<input type="checkbox"/> INH · GEAR AILE
	GEAR SW	<input type="checkbox"/> INH · GEAR HOLD
	INVERTED SW	<input type="checkbox"/> INH · INVT HOLD
	PIT. LEVER	LOW
HI		<input type="checkbox"/> INH · ACT

4→1 MIX (41)	R	%
	L	%
	MIX SW	INH · ACT

GYRO SENS (44)	INH AUX 3	0	85%				
		1	50%				
		2					
	AUTO	NR	S1	S2	S3	S4	HD
		0	1	1			

	CHANNEL		TRIM	SW	OFFSET	+GAIN		-GAIN						
	MASTER	SLAVE												
PROGRAM MIX (51) - (58)	1	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV									
	2	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV									
	3	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV									
	4	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV									
						EXP	L	1	2	3	4	5	6	H
	5	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV	OFF · ON	IN 0							100
	6	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV	OFF · ON	IN 0							100
	7	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV	OFF · ON	IN 0							100
8	INH · <input type="checkbox"/> ACT	→	OFF · ON	NR·S1·S2·S3·S4 MX·HD·INV	OFF · ON	IN 0							100	

**PCM-10SX DATA SHEET**  
**ERGO Z230, QUATTRO (INITIAL SET-UP) CONTINUED**

		EXP		L	1	2	3	4	5	6	H	
THRO CURVE (18) TH,TRIM=SLOW HOV.T=CENTER	N	OFF	IN	0	25	—	50	—	75	—	100	
		<input type="checkbox"/> ON	OUT	0	40	—	50% Power	—	60	—	100% Power	
			HOV.SEL	—	HOV	HOV	HOV	HOV	HOV	HOV	HOV	—
	1	OFF	IN	0	25	—	50	—				100
		<input type="checkbox"/> ON	OUT	% Power	50	—	60% Power	—				100% Power
	*2	OFF	IN	0	25	—	50	—				100
		<input type="checkbox"/> ON	OUT	100% Power	80	—	60% Power	—				100% Power
	3	OFF	IN	0								100
		<input type="checkbox"/> ON	OUT									
	4	OFF	IN	0								100
		<input type="checkbox"/> ON	OUT									
	PITCH CURVE (68) P,TRIM=CENTER HOV.P=CENTER	N	OFF	IN	0	25	—	50	—	75	—	100
<input type="checkbox"/> ON			OUT	-2° Pitch	4° Pitch	—	5° Pitch	—	6° Pitch	—	10° Pitch	
			HOV.SEL	—	HOV	HOV	HOV	HOV	HOV	HOV	HOV	—
1		OFF	IN	0								100
		<input type="checkbox"/> ON	OUT	-5° Pitch			5° Pitch					9° Pitch
*2		OFF	IN	0								100
		<input type="checkbox"/> ON	OUT	-10° Pitch			0° Pitch					10° Pitch
3		OFF	IN	0								100
		<input type="checkbox"/> ON	OUT									
4		OFF	IN	0								100
		<input type="checkbox"/> ON	OUT									
HOLD		OFF	IN	0								100
	<input type="checkbox"/> ON	OUT	-5° Pitch			5° Pitch					11° Pitch	
INVT	OFF	IN	0								100	
	<input type="checkbox"/> ON	OUT										

TRIM OFFSET (82)	HV.T	HV.P	LO.P	HI.P	AILE	ELEV	RUDD

ATS REVO-MIX (47)	RIGHT · LEFT	
	POS	HOV 6° Pitch ZERO 0° Pitch
NORM	UP	40
	DN	20
	-P	0
STNT1	+P	15
	-P	15
STNT2	+P	15
	-P	15
STNT3	+P	
	-P	
STNT4	+P	
	-P	
HOLD RUDD OFS.		

FAIL-SAFE (77)	Z	MODE	HOLD · 1.0s · 0.5s · 0.25s
		MEMORY	
	S	MEMORY	

SWASH TYPE (65)	TYPE		1s · 3s(90°) · 3s(120°)	
	1s	SWASH	+ · —	
		SW	NR · S1 · S2 · S3 · S4 · HD	
	3s	EXP		
GAIN		AILE	%	
		ELEV	%	
	PITCH	%		

ATS ACC-MIX (48)	VOL	%
	TIME	

\*Note: Flight Mode 2 shown is for 3D type flying only with 0° pitch at half stick.  
This is not recommended for use by entry-level pilots.

\*\*Before flying, confirm that all controls function in the proper direction.

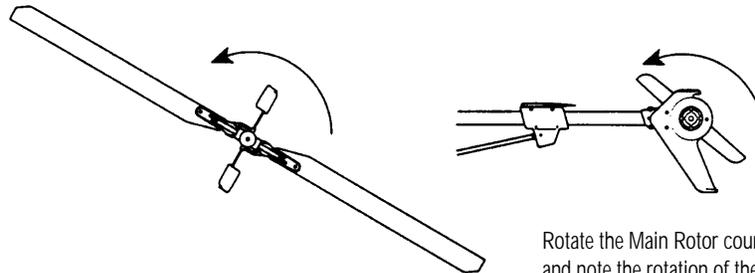
Once all assemblies have been completed, please review the following suggestions before attempting initial flights.

- Review the instruction book and confirm that all assembly steps have been completed thoroughly.
- Check to verify that the tail rotor assembly rotates in the correct direction (see the diagram below).
- Check to insure that all servos are operating smoothly and in the correct direction. Also verify that there is no binding in the control rods

and that each servo horn is secured with a servo horn mounting screw.

- Verify that the gyro is operational and compensating in the correct direction (detailed in Step 8, page 47).
- Make sure that both the transmitter and receiver have been fully charged (refer to your radio system instructions for proper charging procedures).
- Check to insure that the throttle is working properly and in the correct direction.

### Correct Main/Tail Rotor Rotation Direction



Rotate the Main Rotor counter clockwise (backward) and note the rotation of the Tail Rotor.

## BLADE TRACKING ADJUSTMENT

Blade “tracking” is an adjustment to the main rotor blade pitch that must be accomplished during the initial test flights.

Although the blade pitch angle in each blade may appear equal, it is still possible for a set of main rotor blades to run “out of track”, making adjustment necessary.

Main rotor blades that are out of track with one another can cause vibration, instability, and a loss of power due to additional drag.

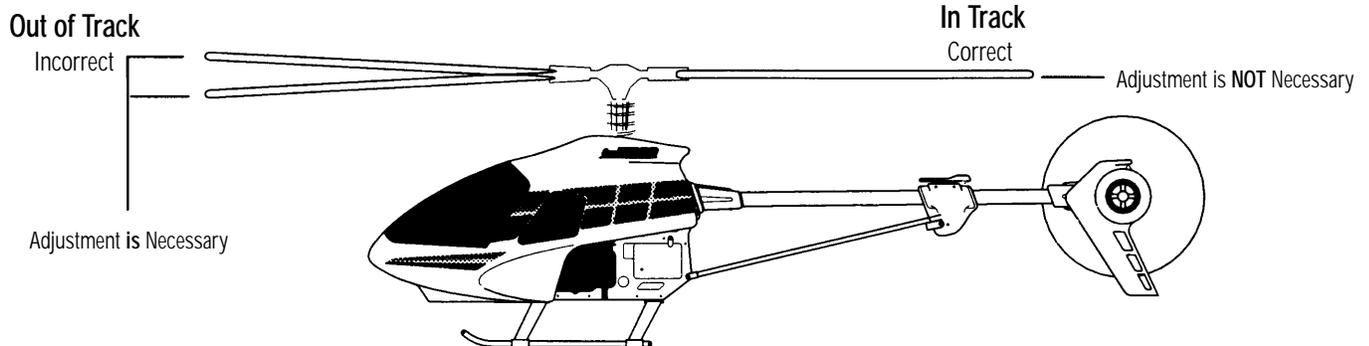
On the initial flight, it will be necessary to increase the blade speed to just before

lift-off RPM and view the rotor disc at eye level from a safe distance (approximately 15 to 20 feet).

Note which blade is running low (by colored tracking tape) and increase the pitch of the low blade one turn of the ball link at a time until each blade runs in track (on the same plane).

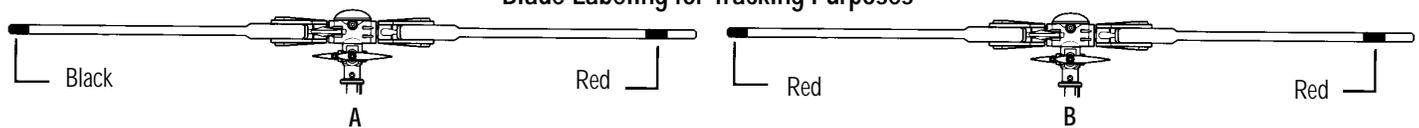
Please refer to the diagrams below to identify the different tracking situations, as well as several methods to mark each rotor blade for tracking identification.

## BLADE TRACKING IDENTIFICATION



**Caution:** Be sure to maintain a safe distance from the helicopter (15 to 20 feet) when tracking main rotor blades.

### Blade Labeling for Tracking Purposes



- A: Use two different blade tracking tape colors (e.g., black and red) at the tip of each main rotor blade.
- B: Use the same color blade tracking tape located at different positions on each rotor blade.

**Note:** Adding additional blade tracking tape to the rotor blades at this stage will make it necessary to re-static balance the main rotor blades.

## Fuel Requirements

93 octane (or higher) automotive gasoline with 2 cycle oil added (7oz. to 1gallon of gasoline).

## 2 Cycle Oil Requirements

Klotz 2 cycle oil: (7 oz. to 1 gallon of gasoline)

Klotz 2 cycle oil (or equivalent) can be found at most motorcycle specialty shops/dealerships.

RPP 2 cycle high performance oil: (7 oz. to 1 gallon of gasoline).

Robertson Performance Products (RPP) 2 cycle oil is designed specifically for use with gasoline-powered RC helicopters to provide the best performance/thermal protection for your engine. RPP oil is available your local hobby dealers or through:

Robertson Performance Products  
 Clairemore, OK  
 (918) 342-1133

It is not recommended that standard "lawn and garden" type 2 cycle oil be used as this oil is designed for use at operating temperatures below that of the Zenoah G23 in a helicopter application.

### IMPORTANT FIRE AND FUEL SAFETY RULES

This model uses combustible and highly flammable mixed oil and gasoline. Gasoline can explode and burn causing serious injury to you and others. Be extremely careful and use common sense at all times.

- Never expose fuel to open flame.
- Do not smoke when fueling or operating model.
- Wipe up spills or excess fuel from model.
- Fuel only with a suitable gasoline manual fuel pump. **Do not attempt** to fuel directly from gas container.
- Fuel only in well ventilated areas.

If an accidental fire does occur, use extinguisher or smother with a heavy cloth. **DO NOT** use your cleaning cloth as it may be contaminated with gasoline. If fire continues, call for help.



## Pre-start Engine Carburetor Tuning

Your Zenoah G23 engine is equipped with a Walbro carburetor with primer bulb. This carburetor has both a high and low speed needle valve for engine tuning. Before initial engine start-up, adjust the needle valves as follows:

Low speed needle valve: Close and open to 1-1/4 turns

High speed needle valve: Close and open to 1-1/2 turns

Although these settings may need to be re-adjusted during test flights, they will

provide an acceptable setting for initial starting.

Please also note the range in which each needle valve is active as compared to the throttle position:

Low speed needle valve: Idle through hover

High speed needle valve: Above hover to full throttle

## Initial Engine Start Up

It is recommended that on initial engine starts that the main and tail rotor blades be removed until it is established that the radio system range tests properly.

## Start Up Procedure

1. Locate fire extinguisher and have available at all times.
2. Fill fuel tank with gasoline.
3. Push primer bulb on carburetor to prime engine.
4. Turn on radio system and verify that the throttle is in the low (idle) position and that all controls function properly. Move throttle trim to 1/2 (center) position. Next, close the choke lever located on the carburetor air cleaner.
5. While holding the main rotor head securely and stepping on the landing skid with your foot, pull the pull starter until the engine starts. As soon as the engine starts it will be necessary to open the choke slowly or the engine will stall. Re-start the engine if necessary until a reliable idle is achieved.
6. To stop the engine, either move the radio throttle/trim lever to the off position, or close the choke.

Before further engine tuning or initial test flights are completed, it is suggested that engine off and engine on range tests be performed to insure proper radio operation and safety.

## Range Testing/Engine Off/Engine On

### Range Testing

Due to the additional RF interference generated by the Zenoah G23 gas engine, it is strongly recommended that range testing of your radio system be performed with the engine first off, and then with the G23 engine running prior to initial test flights. The following range testing procedure is designed for use with the recommended PCM radio systems. As previously mentioned, due to the additional RF interference generated by the Zenoah G23 engine, it is highly recommended that only a PCM (Pulse Code Modulation) radio system be used with the Ergo Z230.

### Range Testing: Engine Off

Initial range testing should be performed per the radio manufacturers suggested antenna down range requirements. For JR radio owners, the acceptable range test distance (antenna down) should be approximately 100 feet.

Before initial range testing, it is suggested that the helicopter be placed on the ground in an acceptable area for initial engine test starts. During the Engine Off Range Tests, it is suggested that the maximum antenna down range be established (the point when the radio system stops operation), and that position be marked so that a comparison of Engine Off, Engine On Range Testing is possible. If your radio system passes this Engine Off Range Test, proceed to the Engine On Range Testing below. If your system does not achieve the specific manufacturer test results, please contact your radio manufacturer before proceeding.

### Range Testing: Engine On

Preparation: Remove the main and tail rotor blades from your Ergo Z230 before initial Engine On Range Tests are performed.

### PCM Fail Safe Preparation

It is suggested that for these initial Engine On range tests, your PCM Fail Safe positions be set so that the engine throttle will return to an idle position if a fail safe situation occurs. Please refer to your specific radio system's instructions for information on PCM Fail Safe adjustment.

### Range Testing: Engine On

Turn on your radio system first and verify that the PCM setting brings the throttle to the idle position before starting the Zenoah G23 engine.

Start the engine and perform an antenna down range test using the same positioning/path as the previous Engine Off Range Test.

Before beginning the walk, set the throttle stick to approximately 1/3 throttle so that when you reach the end of the range test and the system goes into PCM fail safe, you will hear the engine change from 1/3 throttle to idle. This will accurately establish the engine on range test distance. To verify that the Engine On Range Test is acceptable, compare the Engine Off and Engine On Range Tests maximum distances. If acceptable, the Engine On Range Test should be no more than 20% less than the Engine On Range Test. Due to the additional RF interference generated by the Zenoah G23 engine, it is normal to note this slight reduction in range. If your range test comparison shows greater than a 20% loss of range, recheck your engine and coil installation to make certain that the engine and coil are properly grounded and retest. If the same results are achieved, contact your radio manufacturer for further instructions.

### Engine Tuning/Initial Test Flights

Once the Engine On Range Tests have been performed and approved, it is now time to reattach the main and tail rotor blades and begin initial test flights and tuning.

As gasoline engines operate and tune differently than glow engines, it may take some time to become familiar and comfortable with the tuning procedures of the Zenoah G23.

Although the Zenoah G23 is a 2 cycle engine, the smoke levels emitted by the exhaust are much less than with most common 2 cycle glow engine. Therefore, it is nearly impossible to tune the engine by the volume of smoke it produces.

Another factor in tuning is the increased operating temperatures that a gasoline engine operates, as compared to a glow engine, and also the amount of time it takes for the Zenoah G23 to reach its constant operating temperature.

### Engine Tuning: Hover

In most cases, the Zenoah G23 engine will need to operate for between 2-4 minutes in an initial Hover before the final operating temperature is achieved.

During this time, the Zenoah G23 needs to be adjusted so that it starts off in a "rich" condition, since as the engine temperature increases, the fuel mixture setting will continue to "lean" and will not stabilize until the engine operating temperature also stabilizes.

Given this information, a properly tuned Zenoah G23 engine will actually start off "rich" and slowly transition to the correct fuel mixture after 2-4 minutes of sustained hovering. How do you tell if the fuel mixture is set properly? Here's how:

If the Zenoah G23 is adjusted to a "rich" condition, the engine will occasionally sound as if it has a "miss." This "miss" indicates that the fuel mixture is rich and the engine is going into a "4 cycle" condition momentarily. A properly-tuned Zenoah will "4 cycle" during the initial 2-4 minutes of flight until the engine reaches the final operating temperature. Once this temperature is achieved, the engine should run smoothly with no "miss" or "4 cycle". If the engine continues to 4 cycle after 4 minutes, land the helicopter and turn the low speed needle in 1/16th of a turn and retest. Continue this until smooth operation is achieved. As mentioned previously, the low speed needle valve of the carburetor sets the fuel mixture for hover and below. Adjustment of the high speed needle valve will not remove the "4 cycle" condition if the low speed needle valve is adjusted to rich.

### Zenoah G23 Engine Break In

Once the low speed needle valve has been adjusted correctly, it is suggested that one full tank of fuel be "hovered" through the engine to insure proper piston ring seating before initial High Power Forward Test Flights.

### Engine Tuning: Forward Flight

As mentioned previously, since the volume of smoke created by the Zenoah G23 is much less than a standard 2 cycle "glow" engine, forward flight tuning relies more on "power output" than smoke or engine sound.

To set the high speed needle valve, transition into forward flight to a safe altitude. Next, while in forward flight, move the throttle stick to and sustain full power. If rotor RPM appears low, either reduce main rotor blade pitch (not below 9 degrees), or lean the high speed needle valve slightly. Repeat this procedure until the proper RPM and power output is established.

Once this has been achieved, continue to fly the Ergo Z230 in forward flight while monitoring the engines power output levels. If during the flight the engine begins to loose power or "sag", land the model immediately and richen the high speed needle valve. Continue this procedure until the engine runs consistently, with no loss of power.

**Warning:** Use caution during these tests as if the Zenoah G23 is set to an extreme lean position, it is possible for the engine to stop abruptly at high power with little or no warning. Also, an extreme "lean" condition such as this can cause severe damage to the internal components of the engine due to excessive heat and lack of lubrication.

### **Engine**

After each day of flying, fully drain the fuel tank. Then start the engine and let it idle until the engine and the fuel line are completely burned off.

### **Tail Rotor Belt**

Periodically check the tension on the Tail Drive Belt (as shown in Step 5-7, page 31) to insure that it has sufficient tension for proper engagement. It is especially important to check this after initial test flights.

### **Check All Nuts and Bolts**

A helicopter is subject to high vibration during flight. It is important to check that all screws, nuts and bolts are properly secured after each day of flying. It is also suggested that you perform a “quick” inspection between each initial test flight for approximately the first 6 to 10 flights.

### **Check Ball Link Wear**

Check to insure that all universal links fit freely but securely to the control balls.

If there is excessive play noted, replace the universal link in question.

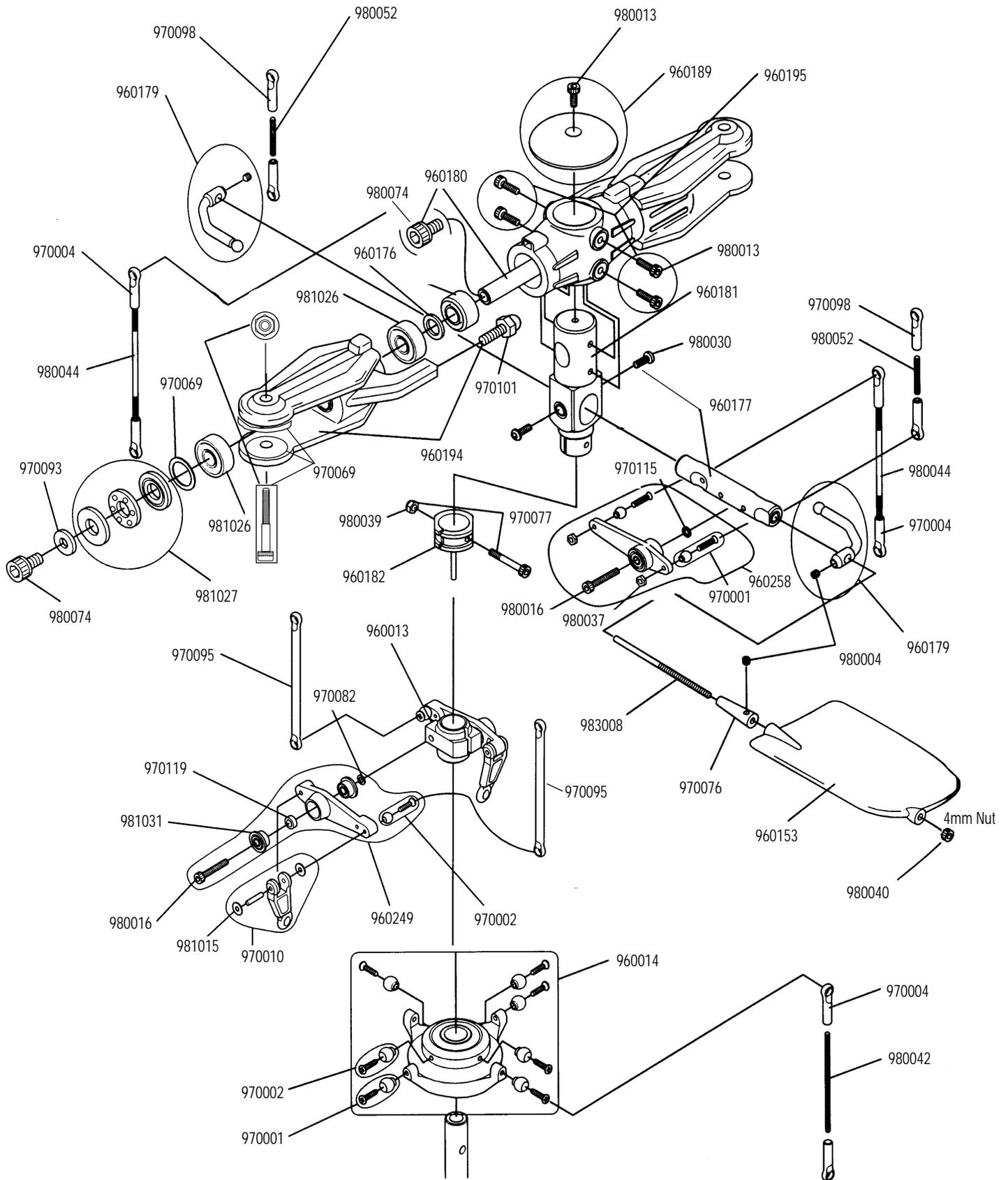
### **Battery Maintenance**

Check to insure that your batteries are properly mounted and charged. The most frequent cause of crashes (aside from pilot error) is battery failure or disconnection. Be certain that your batteries are fully charged and limit your flight time to 3 or 4 flights between charging. If more flight time is required, purchase a reliable quick field charger.

### **Cleaning**

At the end of each flight or flying session, wipe down your helicopter with a clean towel or rag. This is also a good time to inspect all parts for tightness or fatigue. Remember, a clean, well-maintained helicopter will provide you with many hours of trouble-free flight.

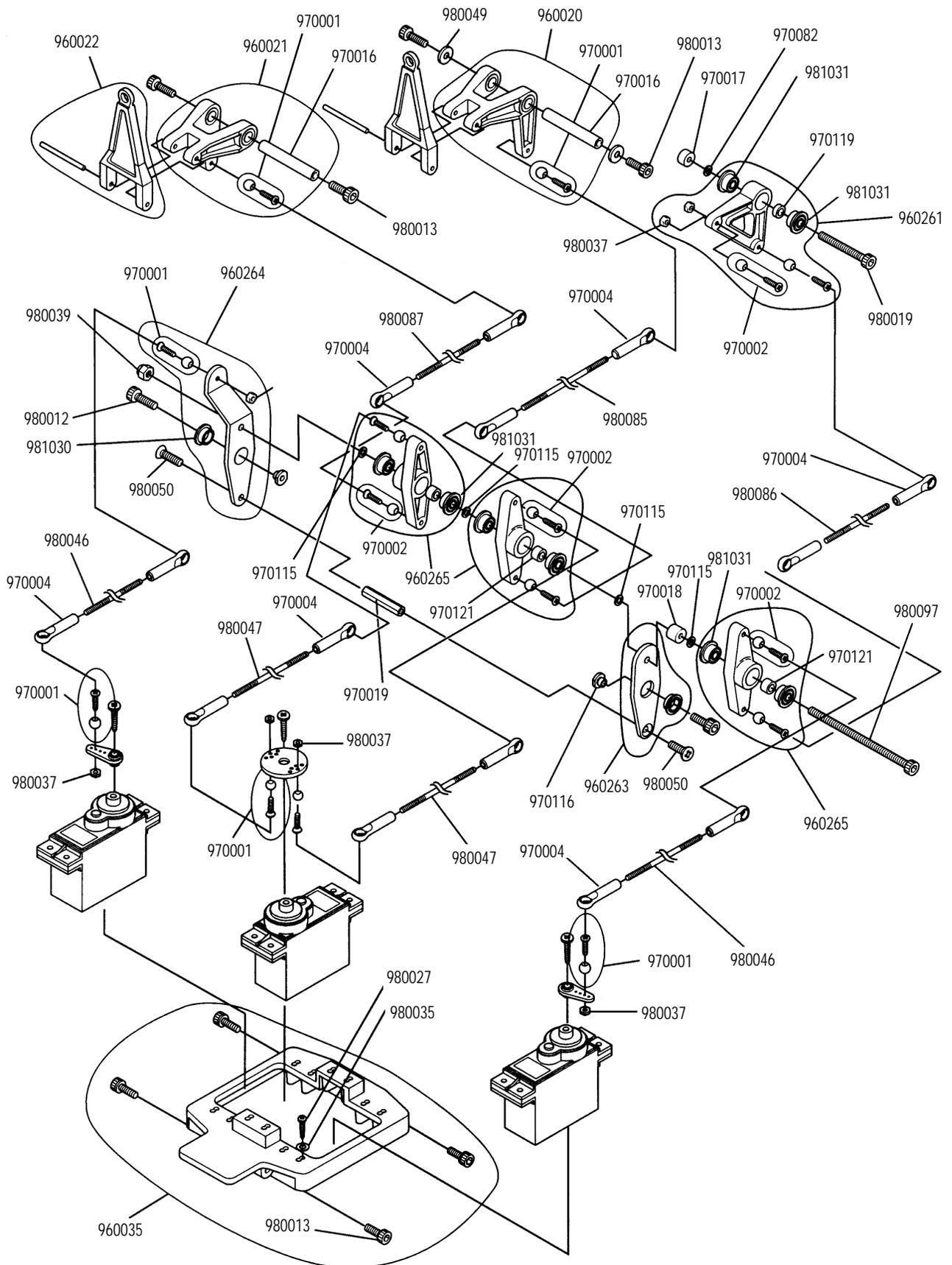
# ROTOR HEAD/SWASHPLATE/WASHOUT ASSEMBLY



## ROTOR HEAD/SWASHPLATE/WASHOUT ASSEMBLY PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960013	Washout Base	1	
960014	Swashplate Assembly	1	3 - 2x8mm Flat Head Screws 4 - 2x10mm Flat Head Screws 7 - Steel Joint Balls
960153	Flybar Paddles	2	
960176	Blade Holder Spacer, Silver	2	
960177	Seesaw Shaft	1	2 - 3x5mm Button Head Cap Screws 2 - Ball Bearings
960179	Flybar Control Arm	2	2 - 4mm Set Screws 2 - 2x8mm Flat Head Screws 2 - Steel Joint Balls
960180	Blade Spindle Shaft	1	2 - 5x10mm Socket Head Bolts
960181	Main Rotor Hub	1	2 - Ball Bearings
960182	Phase Adjusting Ring	1	
960184	Blade Damper Rubber	2	
960189	Head Button	1	1 - 3x6mm Socket Head Bolt
960194	Main Blade Holder	2	
960195	Main Rotor Body	1	Complete w/4 3x8mm Socket Head Bolts
960249	Washout Arm	2	4 - Washout Arm Bearings 2 - Bearing Spacers 2 - 3x15mm Socket Head Bolts 2 - 3mm Flat Washers
960258	Seesaw Mixing Arms	1	Complete w/Bearings
970001	Steel Joint Ball w/2x8mm Screw	10	10 - 2x8mm Flat Head Screws
970002	Steel Joint Ball w/2x10mm Screw	10	10 - 2x10mm Flat Head Screws
970004	Universal Ball Links	10	
970010	Washout Link	2	2 - Washout Link Pins
970029	Seesaw Spacer Collar	2	
970069	Main Blade Bolt Set w/Spacers	2	2 - 4mm Lock Nuts 4 - Aluminum Blade Spacers
970076	Flybar Weights	2	4 - 3x8mm Socket Head Bolts
970077	Main Rotor Shaft Bolts	2	2 - 3x22mm Socket Head Bolt 2 - 3mm Washers
970082	Washer, 3x4.5x.4mm		
970093	Spindle Washer, Black	2	
970095	Double Link (Long)	2	
970098	Universal Ball Links (Short)	5	
970099	Washer, 12x16x.5mm	2	
970101	Control Ball, 4.5mm	2	
970115	Flat Washer, 3x4.5x5.7mm	10	
970119	Spacer, 3x.5x1.8mm	10	
980004	Set Screw, 4x4mm	10	
980013	Socket Head Bolt, 3x8mm	10	
980016	Socket Head Bolt, 3x15mm	10	
980030	Button Head Bolt, 3x5mm	10	
980037	Hex Nut, 2mm	10	
980039	Nylon Lock Nut, 3mm	10	
980040	Nylon Lock Nut, 4mm	10	
980042	Control Rod, 2.3x30mm	2	
980044	Control Rod, 2.3x40mm	2	
980052	Control Rod, 2.3x15mm	2	
980074	Spindle Bolts, 5x10mm	10	
981015	CA Stopper Ring, 2mm	10	
981026	Main Blade Holder Bearing	2	
981027	Thrust Bearing Ring, 8x16x5	2	
981031	Bearing, 5x8x4mm	2	
983008	Flybar, 710mm	2	
984003	Rotor Head Assembly	1	Complete w/all Components

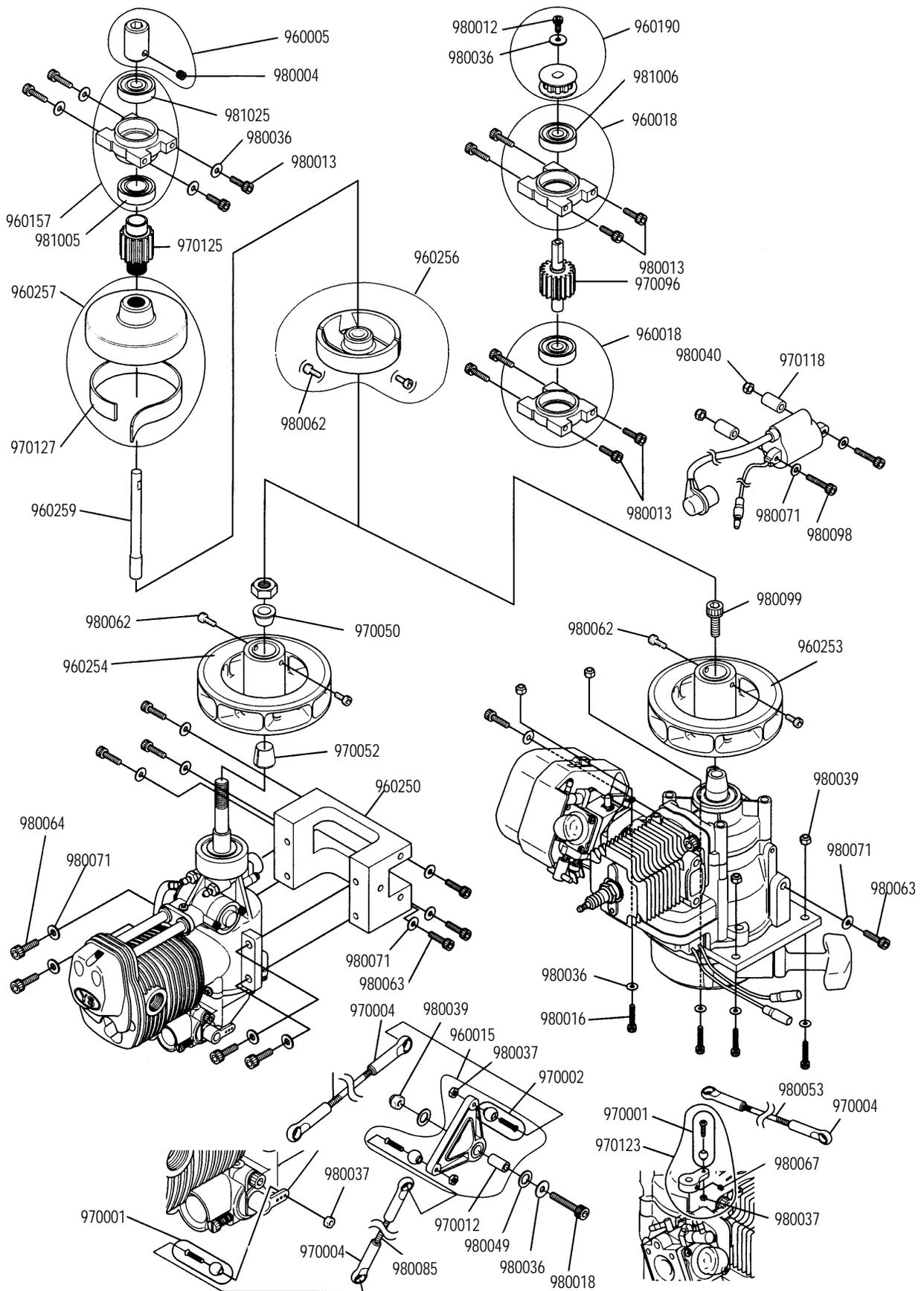
# CYCLIC MIXING ARMS/ELEVATOR/AILERON CONTROL ARMS



## CYCLIC MIXING ARMS/ELEVATOR/AILERON CONTROL ARMS PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960020	Elevator Arm: Front	1	Complete w/Bushing Steel Joint Ball 2x8mm Flat Head Screw
960021	Elevator Arm: Rear	1	Complete w/Bushing Steel Joint Ball 2x8mm Flat Head Screw
960022	Swashplate A Arm	2	Complete w/2 A-Arm Pins
960035	Upper Servo Tray	1	4 - 3x8mm Socket Head Bolts 12 - 2.6x12mm Self Tapping Screws 12 - 2.6mm Flat Washers
960261	Roll Bellcrank	1	Complete w/Bearings 2 - Steel Joint Balls 2 - 2x8mm Flat Head Screws 2 - 2mm Hex Nuts
960263	Mixing Base Arm: Roll	1	Complete w/Bearings
960264	Mixing Base Arm: Collective	1	Complete w/Bearings 2 - Steel Joint Ball 2 - 2x8mm Flat Head Screw 2 - 2mm Hex Nut
960265	Mixing Lever: Cyclic	3	Complete w/Bearings 6 - Steel Joint Balls 6 - 2x8mm Flat Head Screws
970001	Joint Ball w/2x8mm Screw	10	
970002	Steel Joint Ball w/2x10mm Screw	10	
960116	Mixing Base Nut	2	
970004	Universal Ball Link	10	
970016	Elevator Arm Bushing	2	
970017	Roll Bellcrank Spacer	2	
970018	Mixing Lever Spacer	2	
970019	Mixing Base Cross Member	1	
970082	Washer, 3x4.5x.4mm	10	
970115	Mixing Lever Bushing B	2	
970119	Spacer, 3x.5x1.8mm	10	
980012	Socket Head Bolt, 3x6mm	10	
980013	Socket Head Bolt, 3x8mm	10	
980019	Socket Head Bolt, 3x22mm	10	
980027	Self Tapping Screw, 2.6x12mm	10	
980035	Plate Washer, 2.6mm	10	
980037	Hex Nut, 2mm	10	
980046	Control Rod, 2.3x60mm	2	
980047	Control Rod, 2.3x75mm	2	
980050	Flat Head Screw, 3x8mm	10	
980085	Control Rod, 2.3x55mm	2	
980086	Control Rod, 2.3x90mm	2	
980087	Control Rod, 2.3x120mm	2	
981031	Bearing, Flanged, 5x8x4mm	2	

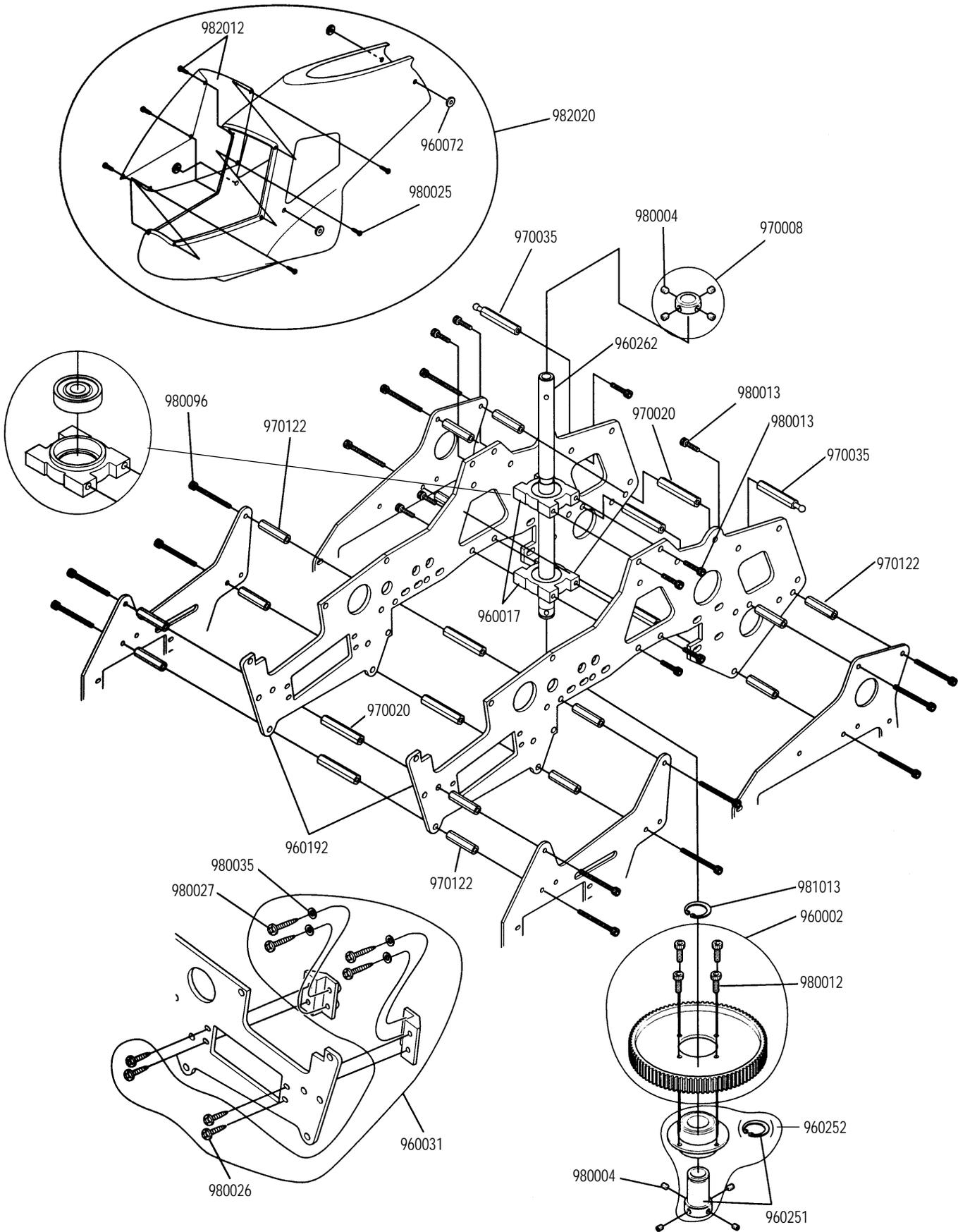
# START SHAFT/CLUTCH/ENGINE ASSEMBLY



## START SHAFT/CLUTCH/ENGINE ASSEMBLY PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960005	Starter Hex Adaptor	1	Complete w/One 4x4mm Set Screw
960018	Tail Drive Pinion Bearing Block	1	Complete w/Bearing
960157	Start Shaft Bearing Block	1	Complete w/Bearings
960190	Front Tail Belt Pulley	1	Complete w/One 3x6mm Socket Head Bolt 1 - 3mm Washer
960250	Engine Mount Quattro	1	Complete w/Four 3x6mm Socket Head Bolts
960253	Cooling Fan Z230	1	
960254	Cooling Fan Quattro	1	
960256	Clutch Assembly	1	Complete w/One-Way Bearing 2 - 4x6mm Socket Head Bolts
960257	Clutch Bell Assembly	1	Complete, Clutch Lining and Bearing
960259	Start Shaft Assembly	1	
970001	Joint Ball w/2x8mm Screw	10	
970002	Joint Ball w.2x10mm Screw	10	
970004	Universal Ball Link	10	
970012	Washout Arm Bushing	1	
970050	Taper Collet Upper	1	
970052	Taper Collet Lower	1	
970096	Tail Drive Pinion w/Shaft	1	
970118	Coil Spacer	2	
970125	Pinion Gear (13T)	1	
970127	Clutch Lining	1	
980004	Set Screw, 4x4mm	10	
980012	Socket Head Bolt, 3x6mm	10	
980013	Socket Head Bolt, 3x8mm	10	
980015	Roll Bellcrank	1	
980016	Socket Head Bolt, 3x15mm	10	
980018	Socket Head Bolt, 3x18mm	10	
980036	Plate Washer, 3mm	10	
980037	Hex Nut, 2mm	10	
980040	Nylon Lock Nut, 4mm	10	
980049	Nylon Washer, 5mm	10	
980053	Control Rod, 2.3x50mm	2	
980062	Socket Head Bolt, 4x6mm	10	
980063	Socket Head Bolt, 4x12mm	10	
980064	Socket Head Bolt, 4x15mm	10	
980067	Set Screw, 3x3mm	10	
980071	Plate Washer, 4mm	10	
980085	Control Rod, 2.3x55mm	2	
980098	Socket Head Bolt, 4x30mm	2	
980099	Socket Head Bolt, 6x18mm	10	
981005	Bearing, 19x10x22mm	2	
981006	Bearing, 191022	1	
981025	Bearing, Sealed 5x19x6mm	2	

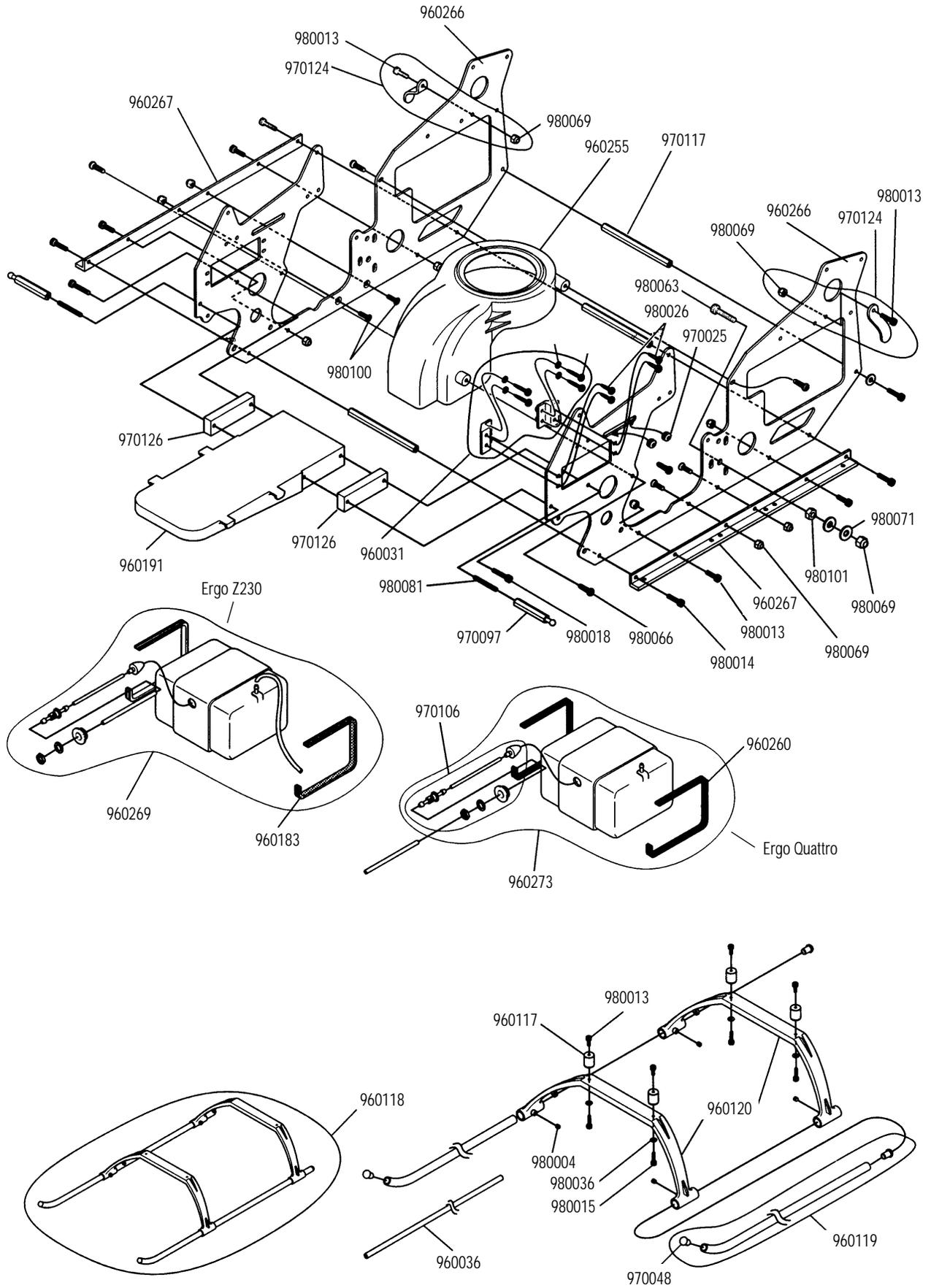
UPPER MAIN FRAME/RADIO TRAY/BODY SET ASSEMBLY PARTS LIST



## UPPER MAIN FRAME/BODY SET PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960252	Autorotation Assembly	1	
960002	Main Drive Gear 88T	1	Complete w/Four 3x6mm Socket Head Bolts
960017	Main Shaft Bearing Block	1	Complete w/Bearing
960031	Servo Mounting Plates	4	8 - 2.6x8mm Self Tapping Screws 8 - 2.6x12mm Self Tapping Screws 8 - 2.6mm Flat Washers
960072	Rubber Grommet	4	
960192	Upper Main Frame	2	
960262	Main Rotor Shaft	1	
970008	Main Shaft Collar	1	Complete w/Four 4x4mm Set Screws
970020	Main Frame Standoff, 32mm	2	
970035	Body Mounting Standoff, 29mm	4	2-3x8mm Socket Head Bolts
970122	Main Frame Spacer, 22mm	14	
970251	Autorotation Shaft Hub Sleeve	1	Complete w/Clip
980004	Set Screw, 4x4mm	10	
980012	Socket Head Bolt, 3x6mm	10	
980013	Socket Head Bolt, 3x8mm	10	
980025	Self Tapping Screw, 2.3x8mm	10	
980026	Self Tapping Screw, 2.6x8mm	10	
980027	Self Tapping Screw, 2.6x12mm	10	
980035	Platwasher, 2.6mm	10	
980096	Socket Head Bolt, 3x32mm	10	
981005	Main Rotor Shaft Bearing	2	2 - 19mm x 10mm x 7mm Bearings
981013	C Stopper Ring	10	
982012	Ergo Z230/Quattro Canopy	1	6 - 2.3x8mm Self Tapping Screws
960270	Ergo Z230/Quattro Decal Set	1	
982020	Ergo Z230/Quattro Body Set	1	4 - Rubber Grommets 6 - 2.3x8mm Self Tapping Screws

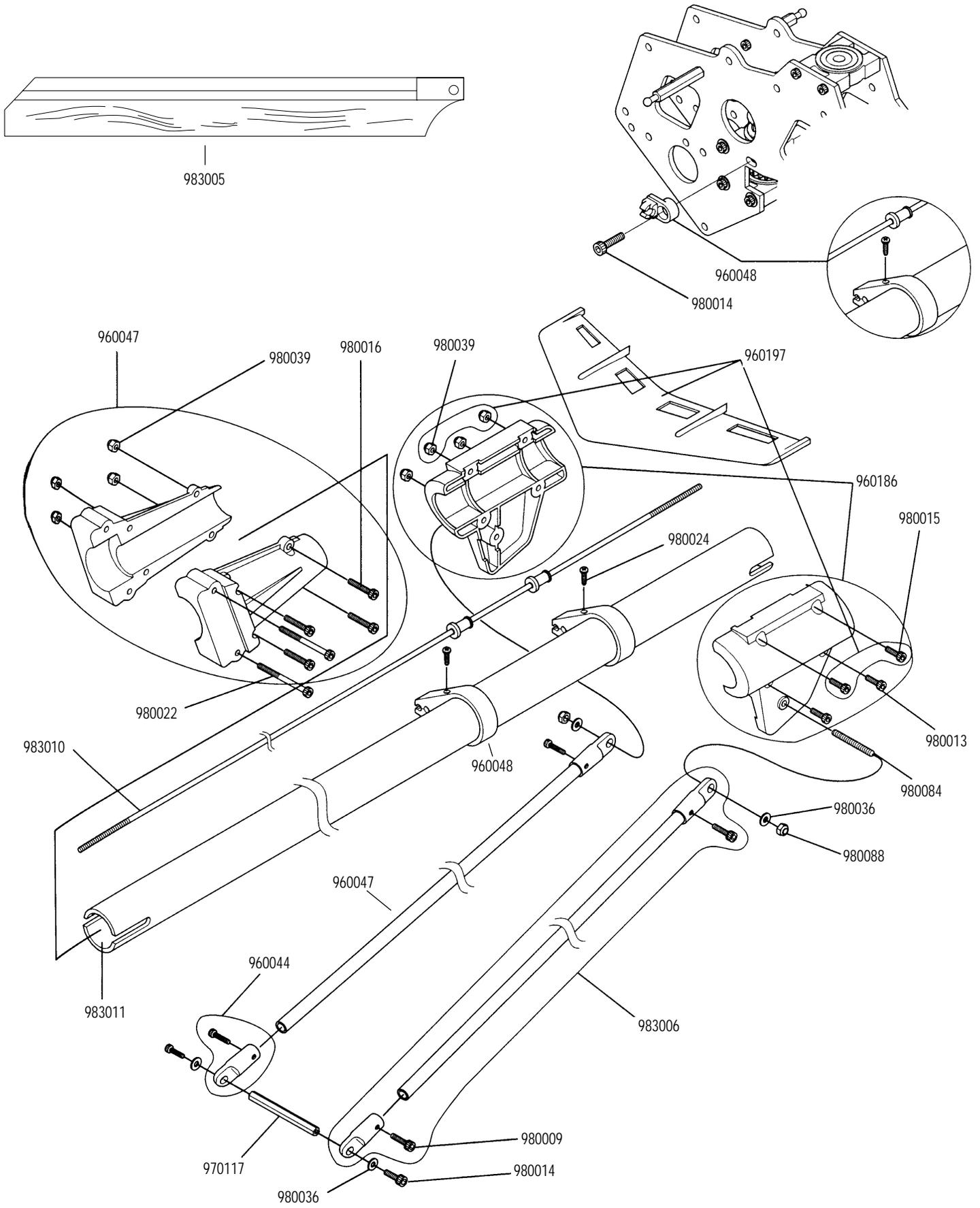
# LOWER MAIN FRAME/LANDING GEAR/FUEL TANK



## LOWER MAIN FRAME/LANDING GEAR/FUEL TANK PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960031	Servo Mounting Plate Set	4	8 - 2.6x8mm Self Tapping Screws 8 - 2.6x12mm Self Tapping Screws 8 - 2.6mm Flat Washers
960036	Antenna Tube	3	
960117	Landing Gear Damper	4	
960118	Landing Gear Set	1	2 - Landing Skids 2 - Landing Struts 4 - Skid Caps 4 - 4mm Set Screws
960119	Landing Skids	2	4 - Skid Caps
960120	Landing Struts	2	
960183	Tank Mounting Rubber	2	
960193	Lower Main Frame	2	
960225	Cooling Fan Shroud	1	4 - 2.6x8mm Self Tapping Screws
960260	Tank Mounting Rubber	2	
960266	Front Radio Bed	1	
960267	Lower Frame Angles	2	
960269	Fuel Tank Set Ergo Z230	1	<b>Quattro</b> <b>Z230</b> 1 - Fuel Tank                      1 - Fuel Tank
960273	Fuel Tank Set Ergo Quattro	1	1 - Fuel Stopper                      1 - Fuel Stopper 1 - Tank Grommet                      1 - Tank Grommet 2 - Installation Rubbers                      2 - Installation Rubbers 1 - Silicone Fuel Tubing                      Gasoline Fuel Tubing 1 - Fuel Clunk                      1 - Fuel Clunk 1 - 7x12x1 Washer                      1 - 7x12x1 Washer 1 - 7mm Nut                      1 - 7mm Nut
970025	Switch Damper Rubber	4	
970048	Landing Skid Caps	4	
970097	Body Mounting Standoff, 28mm	4	
970106	Tank Fitting Set Ergo Quattro	1	2 - 3x8mm Socket Head Bolt 1 - Fuel Tank Stopper 1 - Tank Grommet 1 - Silicone Fuel Tubing 1 - Fuel Tank 1 - 7x12x1 Washer 1 - 7mm Nut
970117	Main Frame Standoff	2	
970124	Fuel Tank Holder Clips	2	
970126	Radio Bed Spacer	2	
980004	Set Screw, 4x4mm	10	
980013	Socket Head Bolt, 3x8mm	10	
980014	Socket Head Bolt, 3x10mm	10	
980015	Socket Head Bolt, 3x12mm	10	
980018	Socket Head Bolt, 3x18mm	10	
980026	Self Tapping Screw, 2.6x8mm	10	
980036	Plate Washer, 3mm	10	
980063	Socket Head Bolt, 4x12mm	10	
980066	Self Tapping Screw, 3x8mm	10	
980071	Plate Washer, 4mm	10	
980081	Set Screw, 3x25mm	10	
980100	Flat Head Screw, 3x10mm	10	
980101	Hex Nut, 4mm	10	

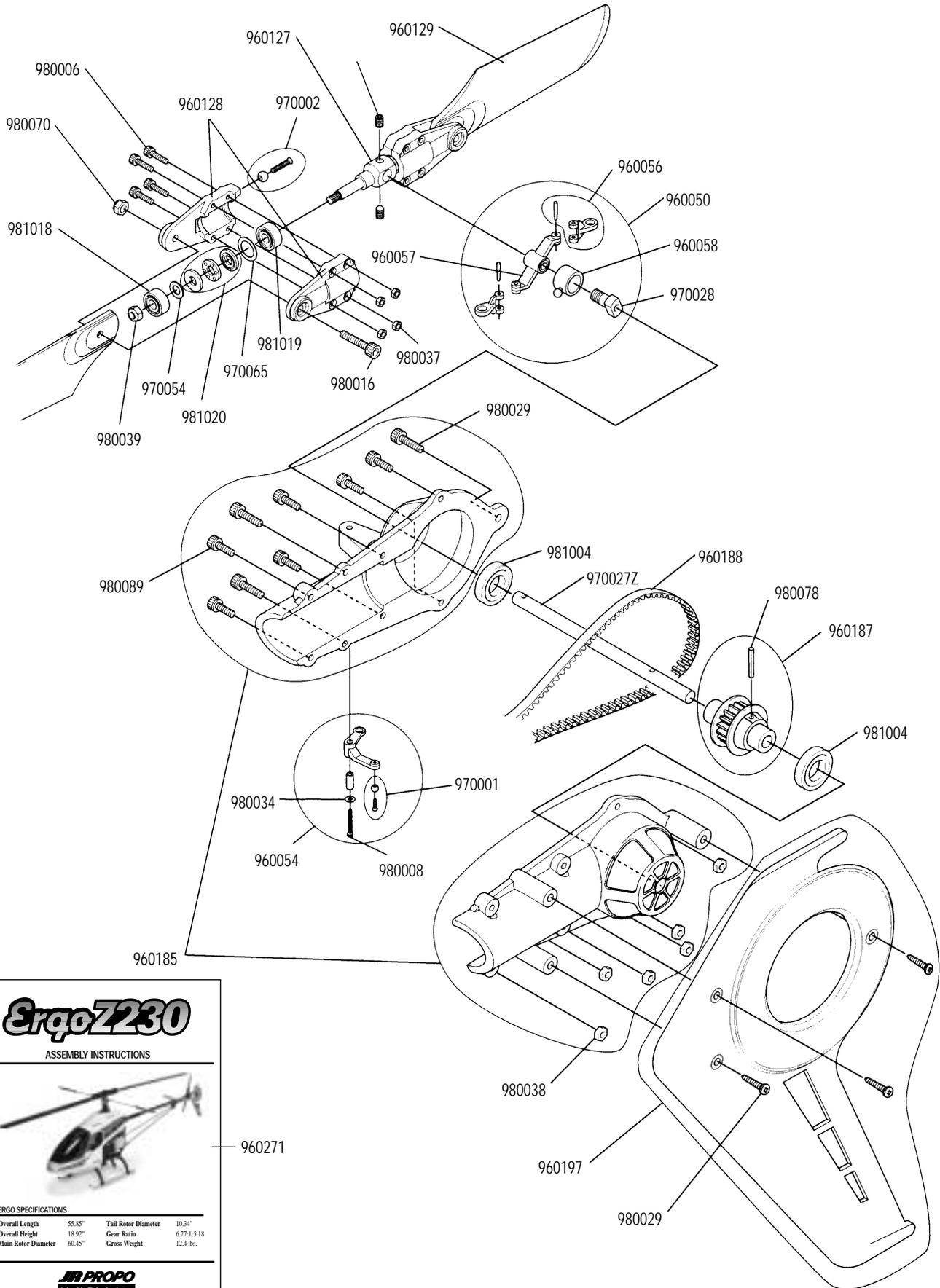
# TAIL BOOM/TAIL BRACE/TAIL BOOM CARRIER PARTS LIST



## TAIL BOOM/TAIL BRACE/TAIL BOOM CARRIER PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960044	Tail Brace Connector	1	1 - 2.6x12mm Socket Head Bolt
960047	Tail Brace Tube	1	
960047	Tail Boom Carrier	1	2 - 3x40mm Socket Head Bolts 4 - 3x15mm Socket Head Bolts 6 - 3mm Lock Nuts
960048	Tail Rod Guide Set	4	4 - Tail Rod Guides 5 - Tail Rod Guide Collars 1 - Tail Control Rod Guide 4 - 2x8mm Self Tapping Screws 1 - 3x10mm Socket Head Bolt
960186	Horizontal Tail Fin/Brace Clamp	1	2 - 3x8mm Socket Head Bolts 2 - 3x12mm Socket Head Bolts 4 - 3mm Lock Nuts
960197	Tail Fin Set	1	1 - Vertical Fin 1 - Horizontal Fin 3 - 3x12mm Self Tapping Screw 2 - 3x12mm Socket Head Bolts 2 - 3mm Lock Nuts
970117	Main Frame Standoff		
980009	Socket Head Bolt, 2.6x12mm	10	
980013	Socket Head Bolt, 3x8mm	10	
980014	Socket Head Bolt, 3x10mm	10	
980015	Socket Head Bolt, 3x12mm	10	
980016	Socket Head Bolt, 3x15mm	10	
980022	Socket Head Bolt, 3x40mm	10	
980024	Self Tapping Screw, 2x8mm	10	
980036	Platwasher, 3mm	10	
980039	Loxknut, 3mm	10	
980084	Set Screw, 3x30mm	5	
980088	Dome Nut, 3mm	10	
983005	Main Rotor Blade Set: 680mm	1 Set	Complete w/weights and covering
983006	Tail Brace Set	1	2 - Tail Brace Tube 4 - Tail Brace Connector 4 - 2.6x12mm Socket Head Bolt
983010	Tail Control Rod	1	
983011	Tail Boom	1	

# TAIL CASE/TAIL BLADE HOLDERS/TAIL PITCH PLATE



## ERGO Z230

ASSEMBLY INSTRUCTIONS



ERGO SPECIFICATIONS			
Overall Length	55.85"	Tail Rotor Diameter	10.34"
Overall Height	18.92"	Gear Ratio	6.77:1:5.18
Main Rotor Diameter	60.45"	Gross Weight	12.4 lbs.

**JR PROPO**  
Helicopter Division

## TAIL CASE/TAIL BLADE HOLDERS/TAIL PITCH PLATE PARTS LIST

PART #	DESCRIPTION	QUANTITY	COMMENTS /ADDITIONAL CONTENTS
960050	Tail Slide Ring Assembly	1	Complete w/All Components
960054	Tail Pitch Control Lever	1	1 - Lever Bushing 1 - 2x20mm Socket Head Bolt 1 - 2mm Flat Washer 1 - Steel Joint Ball 1 - 2x8mm Flat Head Screw
960056	Tail Pitch Link	2	Complete w/2 Link Pins
960057	Tail Pitch Plate	2	
960058	Tail Slide Ring	1	Complete w/Bearing
960271	Ergo Z230 Assembly Manual	1	
960127	Tail Center Hub	1	
960128	Tail Blade Holder Set	1 Set	
960129	Tail Rotor Blades	2	
960185	Tail Case Set (L&R)	1	6 - 2.6x10mm Socket Head Bolts 6 - 2.6mm Hex Nuts 3 - 3x10mm Socket Head Bolt
960187	Tail Case Pulley	1	1 - Pressure Pin
960188	Tail Drive Belt	1	
960197	Tail Fin Set	1	1 - Horizontal Fin 1 - Vertical Fin 3 - 3x12mm Self Tapping Screws 2 - 3x12mm Socket Head Bolts 2 - 3mm Lock Nuts
970001	Steel Joint Ball w/2x8mm Screw	10	
970002	Joint Ball w/2x10mm Screw	10	
970027Z	Tail Output Shaft	1	
970028	Tail Slide Ring Sleeve	1	
970054	Tail Washer, 4x7x5mm	2	
970065	Tail Washer, 7x10x1mm	2	
980006	Socket Head Bolt, 2x8mm	10	
980008	Socket Head Bolt, 2x20mm	10	
980016	Socket Head Bolt, 3x15mm	10	
980029	Self Tapping Screw, 3x12mm	10	
980034	Platewasher, 2mm	10	
980037	Hex Nut, 2mm	10	
980038	Hex Nut, 2.6mm	10	
980039	Nylon Lock Nut, 3mm	10	
980078	Tail Pulley Spring Pin	1	
980089	Socket Head Bolt, 2.6x10mm	10	
981004	Tail Output Shaft Bearing	2	
981018	Tail Rotor Bearing (Open)	2	
981019	Tail Rotor Bearing (Sealed)	2	
981020	Tail Thrust Bearing	2	

**Warranty Information**

Your Zenoah G23 engine is warranted for 3 years against defects in parts and workmanship. This warranty does not cover damages occurred in a crash, or from improper use and tuning resulting in damage to the engine.

**Return Information**

1. Use the original carton/packaging (molded foam container), or equivalent, to ship your unit. Do not use the carton itself as a shipping carton; you should package the equipment carton within a sturdy shipping container using additional packing material to safeguard against damage during transit. **Include complete name and address information inside the carton, as well as clearing writing it on the outer label/return address area.** Ship your equipment fully insured and prepaid. Horizon Service Center is not responsible for any damages incurred during shipping.
2. Include detailed information explaining your operation of the equipment and problem(s) encountered. Provide an itemized list of equipment enclosed and identify any particular area/function which may better assist our technicians in addressing your concerns. Date your correspondence and include your name, mailing address, and **a phone number where you can be reached during the business day.**
3. **Warranty Repairs.** To receive warranty service you must include a legible photocopy of your original dated sales receipt to verify your proof-of-purchase date. Providing that warranty conditions have been met, your radio will be repaired without charge.
4. **Normal Non-Warranty Repairs.** Should you repair cost exceed 50% of the retail purchase cost, you will be provided with an estimate advising you of your options.

Within your letter, advise us of the payment method you prefer to use. Horizon Service Center accepts VISA or MasterCard, or we can return the equipment C.O.D. cash-only. If you prefer to use a credit card, include your card number and expiration date.

Mail your system to:  
**Horizon Service Center**  
 4105 Fieldstone Road  
 Champaign, Illinois 61821  
 (217) 355-9511

**Replacement Parts**

All Zenoah G23 replacement parts are stocked and available through:

ISC International  
 P.O. Box 40116  
 Indianapolis, IN 46240  
 (317) 844-1978

ISC International is the exclusive distributor of Zenoah Radio Controlled Model Engines in the U.S.A., and offer complete parts support for the Zenoah engine line, as well as professional non-warranty service and repairs.

**Zenoah G23 Helicopter Engine Parts Listing**

Item #	Part Description
19821	Crankcase Assembly Bolt
19762	Coil Mounting Screw
19761	Cover Mounting Screw
19806	Insulator Screw
19807	Carburetor Mounting Screw
19549	Bolt (EI)
19564	Insulator Screw (EI)
19808	Carb Mounting Nut
19817	Front Bearing Retainer
19820	Front Oil Seal
19789	Piston Pin
19792	Conrod B/B Spacer
19809	Cylinder Gasket
19764	Muffler Gasket
19811	Insulator Gasket
19791	Conrod Bearing
19796	Spacer, Crankshaft
19802	Cover Complete
19745	Carburetor Mounting Washer
19803	Cylinder
19765	Muffler Spacer
19563	Carburetor (WA 167)
19763	Stud (Muffler)
19810	Carburetor Gasket
19812	Insulator
19797	Magneto Assembly
19798	Rotor
19801	Condenser
19751	Hi-Speed Needle
19566	Muffler
19550	Crankcase (EI)
19818	Crankcase Bearing
19555	Crankshaft (EI)
19565	Rotor (EI)
19790	Piston Pin Retainer
19556	Rotor Nut
19788	Piston Ring (2)
19551	Rear Seal (EI)
19805	Cylinder Assembly Bolt
19548	Bolt (M5x20) (EI)
19767	Muffler Nut
19773	Spark Plug
19787	Piston
19567	Muffler Bolt
19561	Carburetor Screw
19562	Air Cleaner
19814	Recoil Starter
21574	Source Coil
19557	Pulley
19559	Plug Cap/Red

**Note:** (EI) denotes Electronic Ignition



***JR PROPO***

**Heli Division**

Exclusively distributed by  
Horizon Hobby Distributors  
4105 Fieldstone Road  
Champaign, IL 61821