

**KALT HELICOPTER**

# 20 BARON

**INSTRUCTION MANUAL**



- Become thoroughly familiar with this manual prior beginning construction.

We have carefully inspected the contents of this kit several times prior to shipment. However, should you find any parts missing, please contact your dealer. Become thoroughly familiar with all parts and components prior to assembly.

Specifications of the 20 Baron are subject to change without notice.

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# Prior to Construction

The construction of this kit is divided into 9 groups. For best results, construct in the order presented. The parts bags are numbered. Open only the bag required for the group you are constructing.

Additional equipment required for construction and flying the Baron :

4 or more channel R/C equipment.

Engine O.S. Max-25 FSR recommended.

Muffler O.S. for 25 FSR-H (NO. 22625028)

Muffler extension adapter for 762 (No. 22625103)

Fuel tubing and fuel filter.

Engine starting equipment. (Electric sterter, battery, etc.)

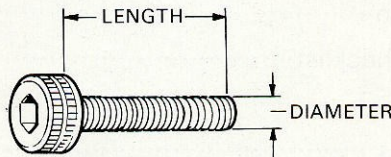
Required tools

Small ⊕ screwdriver, pliers, 5.5 & 7mm nut driver, 2,3 & 6mm drills, knife, file, tapered reamer, vinyl tape, cyanoacrylate adhesive, and epoxy glue.

## Nut and Bolt identification

This kit contains special nuts and bolts used in construction and are identified as follows :

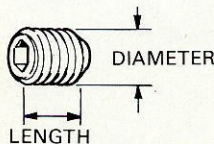
### ■ Cap Bolt



It has a hexagon hole in the head. Tighten with the hex wrench supplied.

(Example) M3 × 15 Cap B.  
 Diameter 3mm ————  
 Length 15mm ———— Abbreviation for Cap Bolt

### ■ Set Bolt (Grub Screw)



It has a hexagon hole in the end, but no head.

(Example) M4 × 4 Set B.  
 Diameter 4mm ————  
 Length 4mm ———— Abbreviation for Set Bolt

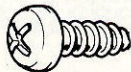
■ **Self locking nut**



It has a nylon insert in the top of the nut.

(Example)      M3      N.N.  
 3mm —————      ————— Abbreviation for Nylon Nut  
 Use a 5.5mm box wrench to tighten the M3 nuts:

■ **Self tapping screw**



These are hardened steel self tapping screws. Use the long ones for servo mounting, and the short ones for attaching the canopy to the cabin. Drill a 2mm hole prior to screwing them in.

■ **Plus screw**

These are the normal familiar round head screws. Use the ⊕ screwdriver for tightening.

■ **Serrated lock washer**



These are lock washers with gripping teeth around the edges.

■ All of the nuts, bolts and washers are called out by number as explained on pages 2 and 3.

■ **Use of the hexagon wrenches**

This kit contains 4 sizes of hex wrenches. Use for tightening cap and set bolts as follows:

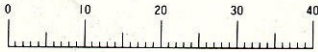
Dia.	Cap bolts	Set bolts
M3	2.5mm	1.5mm
M4	3mm	2mm

The necessary nuts, bolts and washers needed for each step in construction, are listed at the end of each step. Be careful to use the correct parts as called out, as only the required number of nuts, bolts and washers are provided in the kit.

(Example)

(M3 × 8 Cap B.……4)      Use 4 M3 × 8 Cap Bolts.

Scales are drawn at the top of each page for handy reference of bolt length.



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# 1 Main Frame Assembly

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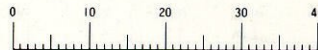
- 1** Assemble subframes and servo plate retainer, paying close attention to the proper angles.
- |                    |   |
|--------------------|---|
| M3 × 8 Cap B. .... | 4 |
| M3 N.N. ....       | 4 |
- 2** Attach body mounting bolt(F) to cross member(A).
- |              |   |
|--------------|---|
| M3 N.N. .... | 1 |
|--------------|---|
- 3** Bolt on the front bed and cross member(A), to the front end of subframes.
- |                             |   |
|-----------------------------|---|
| M3 × 12 ⊕ Bolt ....         | 2 |
| M3 N.N. ....                | 2 |
| M2.3 × 5 Tapping Screw .... | 4 |
- 4** Attach body mounting bolt(R) to the main frames.
- |              |   |
|--------------|---|
| M3 N.N. .... | 2 |
|--------------|---|
- 5** Bolt the radius support arm to the inner side of the right main frame.
- |                    |   |
|--------------------|---|
| M2 × 8 ⊕ Bolt .... | 2 |
| M2 Nut ....        | 2 |
- 6** The main frames bolt to the subframes. Make sure that the top face of the subframes and the front edge of the main frames cross correctly at 90 degree angles.
- |                    |   |
|--------------------|---|
| M3 × 8 Cap B. .... | 6 |
| M3 N.N. ....       | 6 |
- 7** Bolt cross member(B) between the main frames using serrated washers and cap bolts.
- |                         |   |
|-------------------------|---|
| M3 × 8 Cap B. ....      | 2 |
| M3 Serrated Washer .... | 2 |

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# 2 Ball Bearing Installation

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- 8** Assemble the pinion gear, clutch bell and the 626(1960) ball bearing.
- |                               |   |
|-------------------------------|---|
| M4 × 4 Set B. ....            | 2 |
| M3 × 8 Cap B. ....            | 1 |
| M3 × 10 × 1 Plate Washer .... | 1 |



- 9 Temporarily attach 8 into the main frame. [M3 × 30 Cap B. ....2]  
[M3 N.N. ....2]

- 10 Temporarily set 696(1960) ball bearings into the main frame. [M3 × 30 Cap B. ....4]  
[M3 N.N. ....4]

### 3 Power Unit Assembly

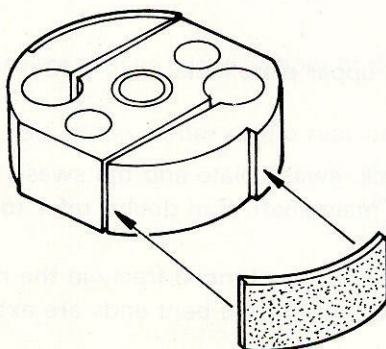
Note : When using the O.S. engine, remove the throttle lever and replace with the lever contained in this kit.

- 11 Enlarge the hole of the cooling fan using the tapered reamer, for a close fit. Do not over enlarge the hole.

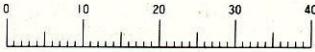
- 12 Install the cooling fan to the engine, without the prop washer, and tighten firmly.

- 13 Bond the clutch pad to the clutch with cyanoacrylate adhesive as shown. Cut and shape the pad using a knife and a file. Bolt the pulley and the finished clutch assembly to the cooling fan. [M3 × 20 Cap B. ....2]

When glueing the pad, insert a 2mm hex wrench to the slit.



- 14 Bolt the engine to the engine mounting block, aligning the bottom of the engine flange to the engine mounting block. [M3 × 10 Cap B. ....4]  
[M3 Plate Washer ....4]  
[M3 Serrated Washer ....4]



- 15** Bolt the cooling shroud to the main frames. Flanges of the shroud should be positioned in front of the bent plates of the main frames.

M3 × 10 Cap B. ....	2
M3 N.N. ....	2
M3 Plate Washer ....	2

- 16** Put the engine starting belt over the clutch bell, and mount the power unit into the main frame.

Note : Add a little grease to the clutch pilot bearing.

M3 × 8 Cap B. ....	6
M3 Plate Washer ....	6
M3 Serrated Washer ....	6

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## 4 Main Shaft, Drive Gear & Swash Plate Assembly

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- 17** Temporarily attach the slide ring assembly to the left side main frame with the slide ring pivot.

M3 N.N. ....	1
M3 Plate Washer ....	1
M2.3 "E" ring ....	1

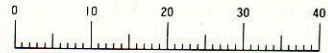
- 18** Insert one end of the pitch control rod into the hole in the pitch control ring, then slide the unit about half way into the main shaft, as shown in drawing.

- 19** Attach a ball joint to the upper plate lock. [M2 × 10 ⊕ Bolt ..... 1 ]

- 20** Insert the upper plate lock, swash plate and the swash plate collar, in that order, from the bottom of the main shaft. If in doubt, refer to the construction drawing for proper positioning.

Notice : The pitch control rod must move freely in the main shaft. If there is any friction, check to see that the bent ends are exactly 90 degrees.

- 21** Insert the main shaft through the top bearing, then insert the bent end of the pitch control rod into the 2mm hole of the slide ring, then drop the main shaft into the bottom bearing.



- 22** Bolt the drive gear to the main shaft. 

[ M3 × 25 Cap B. ....1 ]
[ M3 N.N. ....1 ]
- 23** Pull the main shaft upwards, and push down the upper plate lock, then tighten up the bolt on the upper plate lock. At this time, the upper plate lock must be 90 degrees from the 3mm hole in the main shaft. 

[ M3 × 15 Cap B. ....1 ]
[ M3 N.N. ....1 ]
- 24** Adjust the backlash between the rotor drive gear and pinion by moving the bearing housings. When satisfied with the clearance, tighten up the screws.
- 25** Put the bevel pinion gear into the main frame, and adjust the clearance with the rotor drive gear. Tighten up the screws when satisfied. 

[ M3 × 30 Cap B. ....2 ]
[ M3 N.N. ....2 ]
- 26** Keep the slide ring assembly level, and push towards the rear. Fasten the pivot nut (Temporarily fastened in step 17), making sure that the slide ring moves smoothly.

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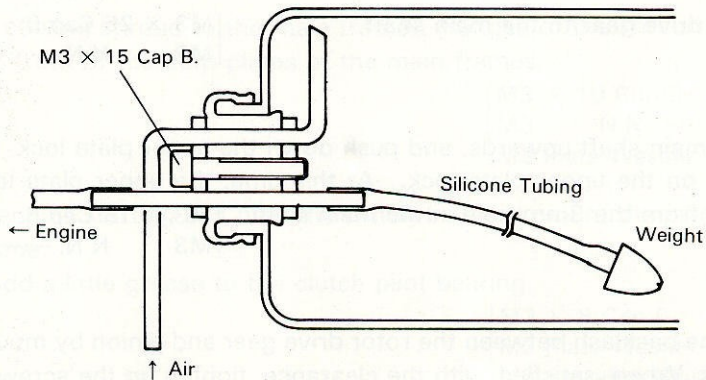
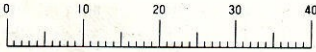
## 5 Landing Gear & Fuel Tank Installation

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- 27** Install the under carriage braces to the bottom of the main frames, then bolt on the clamps and skids.  
Notice : The 3mm hole in the center of the rear brace must face the rear. 

[ M3 × 8 Cap B. ....4 ]
[ M3 N.N. ....4 ]
[ M2.6 × 8 ⊕ Bolt .....8 ]
[ M2.6 Nut .....8 ]
- 28** Assemble the fuel tank cap as shown, then insert it into the tank, and secure with the M3 × 15 screw.

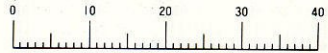




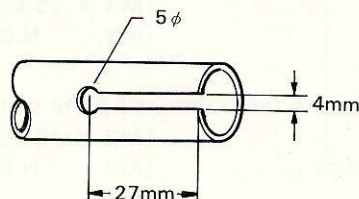
- 29 Place the completed fuel tank into the main frame.

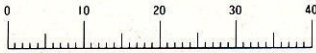
## 6 Tail Rotor Unit Assembly

- 30 Remove all oil from the tail rotor input shaft and the inner ring of ball bearing 1050. Using cyanoacrylate glue, bond the shaft and bearing inner ring together, being very careful not to get any glue elsewhere.
- 31 Put step 30 into the tail rotor gear housing (A), then another bearing 1050ZZ (sealed) onto the shaft, and bond the same way as in step 30.  
Note : There are 4 each of the 1050 bearings. One is sealed, which is to be used on the exposed end of the input shaft to protect the bearing from dirt etc.
- 32 Put the 1050 bearings on the tail output shaft. Place the shaft and bearings in the housing (A) and bond the bearings to the shaft like before.
- 33 Grease the gears and bearings well, then cover with housing(B).
- 34 Screw the housing together using the self tapping screws. Insert the tail gear housing ring to the housing and glue with cyanoacrylate.  
[ M2.3 x 5 Tapping Screw .....2 ]
- 35 Screw on tail rotor hub (counter clockwise) to the output shaft tightly and secure with cyanoacrylate.

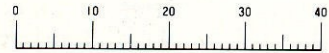


- 36** Place the tail rotor bearings into the blade grips and secure with nuts and bolts.  
 [ M2 × 10 ⊕ Bolt .....8 ]  
 [ M2 Nut .....8 ]
- 37** Bolt on the two ball joints to the arms of the blade grips.  
 [ M2 × 10 ⊕ Bolt .....2 ]
- 38** Bolt the tail pitch control bracket to the housing.  
 [ M3 × 6 Cap B. ....4 ]
- 39** Attach the tail pitch control lever to the tail unit, and connect up the plastic joint ball to the crank. Secure the crank in the bracket with a screw and plate washer. Do not screw down too tightly as the crank has to move smoothly.  
 [ M2 × 10 ⊕ Bolt .....1 ]  
 [ M2 Plate Washer .....1 ]
- 40** Attach the two universal links to the pitch control plate.  
 [ M2.3 × 8 ⊕ Bolt .....2 ]
- 41** Place, in order, the pitch control plate retainer, a washer, the pitch control plate, another washer, and another retainer to the pitch control lever. Temporarily hold the two retainers together with set bolts.  
 [ M2 Plate Washer .....2 ]  
 [ M3 × 4 Set B. ....4 ]
- 42** Insert the tail rotor drive music wire into the tail joint spacer and bend the wire at a 90 degree angle, 5mm from the end of the wire. Make sure of the spacers direction and do not bend the wire too sharply.
- 43** Put the bent end of the wire into the 2mm hole in the tail joint. Push the spacer into the tail joint and secure it with set bolts.  
 [ M4 × 4 Set B. ....2 ]
- 44** Insert the tail joint (with wire) into the input shaft of the tail unit and temporarily fasten.  
 [ M4 × 4 Set B. ....2 ]
- 45** Drill and cut the small diameter end of the tail boom as shown.





- 46** Insert the tail drive wire guide into the boom from the larger end and push it into the boom to a snug fit. Make sure it is in the proper direction, and not to use too much force.
- 47** Feed drive wire through the boom and position the tail unit into place. Bolt on the vertical fin with the two tail clamps. (The fin and horizontal stabilizer should already be painted or finished with covering material)
- |                  |          |
|------------------|----------|
| [ M3 × 12 ⊕ Bolt | .....2 ] |
| [ M3 N.N.        | .....2 ] |
- 48** Cut the wire, that extends from the boom, flush with the end of the boom. Remove the tail joint (fastened at step 44), and place the joint spacer over the wire. After checking the spacer for proper direction, bend the wire 90 degrees 5mm from the tip.
- 49** Attach the tail joint to the tip of the wire and affix another side tail joint to the tail gear shaft.
- |                 |          |
|-----------------|----------|
| [ M4 × 4 Set B. | .....2 ] |
|-----------------|----------|
- 50** Slide two tail clamps over the boom and retain the boom to the main frame with the tail boom retainers. At this time, insert the tail joint to the bevel gear shaft. Make sure that the vertical fin is parallel to the main shaft.
- |                  |          |
|------------------|----------|
| [ M3 × 30 Cap B. | .....4 ] |
| [ M3 N.N.        | .....4 ] |
- 51** Secure the tail joint to the bevel gear shaft with set screws.
- |                 |          |
|-----------------|----------|
| [ M4 × 4 Set B. | .....2 ] |
|-----------------|----------|
- 52** Epoxy the tail support ends to each end of the tail support. The ends must be 90 degrees to each other. After the epoxy has set, bend the front end to match the angle of the landing gear brace.
- 53** Bolt the finished tail supports to the landing gear brace and the tail clamp.
- |                  |          |
|------------------|----------|
| [ M3 × 10 Cap B. | .....2 ] |
| [ M3 N.N.        | .....2 ] |
- 54** Bolt on the tail rotor blades to the blade grips. Do not fasten too tightly, as the blades must be free to move.
- |                  |          |
|------------------|----------|
| [ M3 × 15 Cap B. | .....2 ] |
| [ M3 N.N.        | .....2 ] |
- 55** Attach the horizontal stabilizer to the tail boom using the clamp as shown.
- |                  |          |
|------------------|----------|
| [ M3 × 12 ⊕ Bolt | .....1 ] |
| [ M3 N.N.        | .....1 ] |

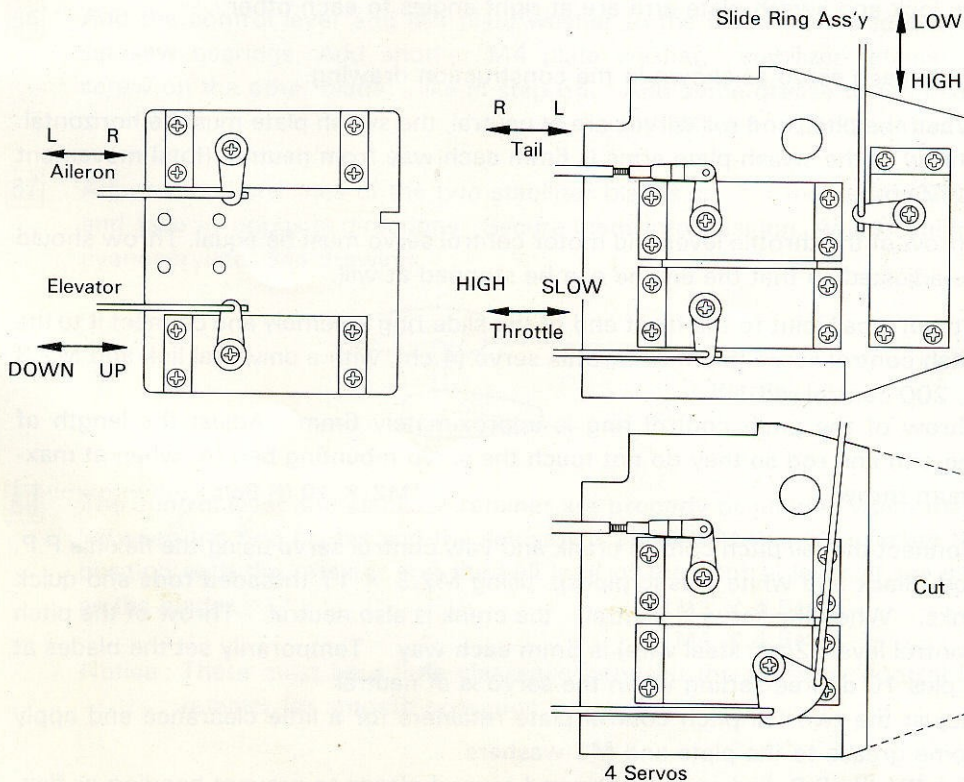


## 7 R/C Equipment and Linkage Installation

- 56 Trim the servo mounting beds to fit your servos. Epoxy the servo mounting beds (A) and (B) to exactly 90 degrees. If using 4 channels, cut the front part of bed (B) away.
- 57 After the epoxy has cured, place the beds into the main frame and glue the wood stock (10mm × 10mm) to servo bed (B) matching the servo plate retainer.
- 58 When cured, drill 3mm holes in the stock and paint it.
- 59 Install the servos to their beds and bolt the completed unit to the frame.

M2.3 × 10 Tapping Screw	20
M3 × 10 Cap B.	4
M3 × 15 Cap B.	2
M3 N.N.	6

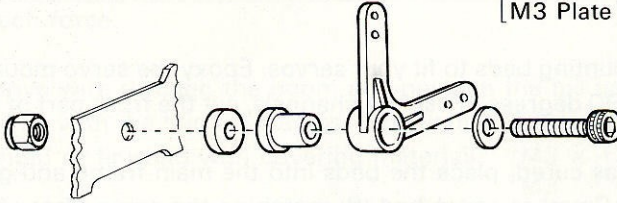
Note : Make sure of the servo's direction of rotation prior to installation. There may be a requirement for a reverse servo.





**60** Bolt bell cranks to the main frames.

M3 × 18 Cap B. ....	2
M3 N.N. ....	2
M3 Plate Washer ....	2



**61** Attach a ball joint to the top of the radius support.

M2 × 10 ⊕ Bolt ....	1
M2 Nut ....	1

**62** Connect up the radius support and the short arm of the swash plate with two universal links and M2.3 × 62 threaded rod. Adjust the length of the rod so that the short arm of the swash plate is 90 degrees to the main frame.

**63** Connect the upper plate lock and the arm of the swash plate with two universal links and the M2.3 × 17 threaded rod. Adjust the length of the rod so that the upper plate lock and swash plate arm are at right angles to each other.

**64** Link up each servo as shown in the construction drawing.

- When the pitch and roll servos are at neutral, the swash plate must be horizontal. Throw of the swash plate arms is 6mm each way from neutral. (total movement is 12mm)

- Throw of the throttle lever and motor control servo must be equal. Throw should be adjusted so that the engine can be stopped at will.

- Attach a ball joint to the front end of the slide ring assembly and connect it to the pitch control servo (5 ch) or throttle servo (4 ch), with a universal link and M2.3 × 200 control rod.

Throw of the pitch control ring is approximately 6mm. Adjust the length of the arm and rod so they do not touch the servo mounting bed (A) when at maximum throw.

[M2 × 10 ⊕ Bolt ....	1
----------------------	---

- Connect the tail pitch control crank and yaw control servo using the flexible P.P. rod (Black and white plastic pipes), using M2.3 × 17 threaded rods and quick links. When the servo is neutral, the crank is also neutral. Throw of the pitch control lever (2mm steel wire) is 5mm each way. Temporarily set the blades at a plus 10 degree setting when the servo is at neutral.

Adjust the two tail pitch control plate retainers for a little clearance and apply some grease to the plate and M2 washers.

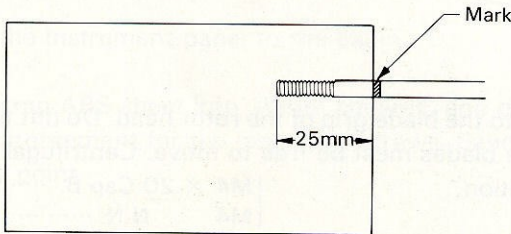
The flexible P.P. rod must be secured several places to prevent bending or flexing during operation. Use the P.P. rod brackets and tape.



- Install the receiver and battery, using foam rubber and tape for vibration protection. Protect the servo leads from the sharp edges of the metal parts by tying or taping together.

## 8 Rotor Head Assembly and Installation

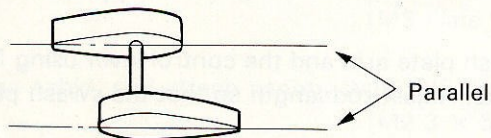
- 65** Make a mark 25mm from each tip of the stabilizer bar, and screw on one stabilizer blade to exactly line up with the mark. See drawing.



- 66** Add the control lever and M4 plate washer to the bar, then feed it through the see-saw bearings. Add another M4 plate washer, stabilizer retainer and then screw on the other blade, like in step 65. Add some grease to the bearings.

[ M4 × 8 × 0.5 Plate Washer .....2 ]

- 67** Adjust the chord lines of the two stabilizer blades so that they are exactly parallel and face in opposite directions. Secure them into position, when satisfied, with cyanoacrylate. See drawing.



- 68** The control lever and stabilizer retainer are properly positioned when the distance between the two blades and the see-saw is equal. At this time secure the bar in position with the retainer and the ball joint of the control lever at the same level as the blades.

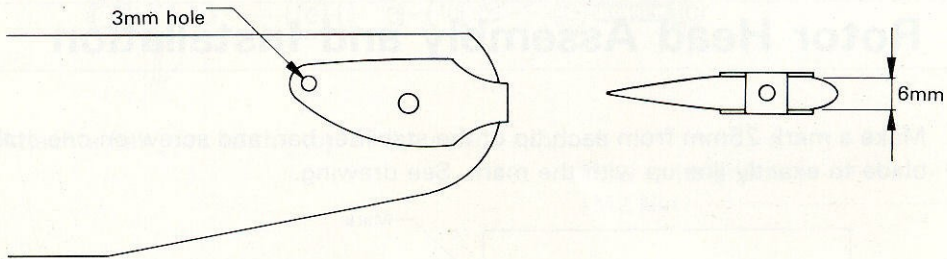
[ M3 × 4 Set B. ....2 ]  
[ M4 × 4 Set B. ....1 ]

Notice : There must be a little clearance between the see-saw, control lever and retainer for smooth operation.



- 69** Shave down the root end of the main rotor blades to a 6mm thickness. Add the blade reinforcement, drill 3mm holes and bolt them to the blades. See drawing.

M3 × 12 Cap B.	.....2
M3 N.N.	.....2



- 70** Install the main rotor blades to the blade grip of the rotor head. Do not tighten down the screws too tightly as the blades must be free to move. Centrifugal force keeps them in position during rotation.

M4 × 20 Cap B.	.....2
M4 N.N.	.....2

Note : These screws and nuts are temporarily screwed into the rotor head grips, for shipment.

- 71** Hold the stabilizer bar horizontally and balance the blades. If they are not in balance, apply tape to the lighter blade tip. Even if the blades are in balance, place different colored tape on each blade tip for tracking adjustment.

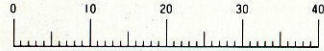
- 72** Attach the completed rotor head to the main shaft.

M3 × 20 Cap B.	.....1
M3 N.N.	.....1

- 73** Connect the swash plate arm and the control lever using M2.3 × 85 threaded rod and universal links. Adjust rod length so that the swash plate and stabilizer bar are parallel.

- 74** Connect the see-saw arms and the pitch control ring with the two bent M2.3×50 threaded rods and universal links. Adjust the length of the rods (both are same length) so that the see-saw arm is approximately 10 degrees down from the horizontal when the servo is in low pitch position.

- 75** Cut four (4) universal links 6mm from the end and screw M2.3 × 17 rods into them. Remove the universal links from the see-saw arms and join the pitch arms on the blade grip to the see-saw with these new joiners. Adjust the length of the rods so that when the servo is in low position, the main blades are at neutral (0 degree) pitch.



- 76 Adjust the throw of the pitch control, using your transmitter. Maximum pitch is approximately 8 degrees. Minimum pitch is approximately 0 degrees. For measuring blade pitch, paste the drawing of the pitch gauge on 3mm plywood, and cut out, or utilize the Kalt universal pitch gauge.

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## 9 Cabin Construction

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- 77 Glue both cabin halves together, using liquid glue and a small brush.
- 78 Glue the instrument panel to the cabin.
- 79 Cut scrap ABS sheet into 10mm squares, and glue to the inside of the cabin walls as reinforcement for the mounting screws. Sandwich two or three squares at each screw point.
- 80 Drill three(3) 6mm holes for the body mounting bolts and put in the rubber grommets.
- 81 Cut a clearance hole for the elevator rod to exit. Also cut or drill for the switch mounting and antenna exit.
- 82 Trim the cockpit canopy to match the cabin body and temporarily attach to the body with tape. Drill three (3) 2mm holes at the reinforced areas done in step 79.
- 83 Mount the cabin to the body mounting bolts. 

[ M3 × 10 Cap B. ....	3 ]
[ M3 Plate Washer .....	3 ]
- 84 Install switch to the cabin, and attach canopy with self tapping screws. 

[ M2.3 × 5 Tapping Screw.....	3 ]
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## After Construction Checklists

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Upon completion of this kit, go back over every step to make sure that there are no loose nuts, bolts, misalignment or binding of movable components. Check all linkages for proper movement by using the transmitter.

■ **Center of gravity**

This position is very critical and is located between the center of the main shaft and 5mm forward, without fuel.



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## In Flight Adjustments

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Range check your R/C equipment prior to starting the engine.

■ **Tracking of main rotor blades.**

Gradually open up the throttle, and when the helicopter is almost ready to lift off, watch the rotor blades to see if they are tracking the same. If not, adjust the pitch of one blade, so that they then both track the same.

■ **Needle valve adjustment**

Adjust mixture control screw and needle valve according to the manufacturers instructions. If after flight fine adjustment is required, make sure that it is not adjusted too lean.

■ **Tail rotor pitch**

Face the helicopter into the wind, and gradually open up the throttle. If the tail boom moves to the right (nose moving left) increase the pitch, and if it moves opposite, decrease the pitch. To adjust the tail mixing system of your transmitter, refer to the manufacturers instructions.

■ **Adjustment of main blade pitch**

In small sized helicopters, the RPM of the main blades must be higher, due to the small diameter of the blade sweep, and the fact that the blades are lighter. It is recommended that the main blades rotate at between 1300 and 1500 RPM. If you have an electronic tachometer available, you can check the rotation of the tail rotor, and since it rotates 4.5 times that of the main rotor, and RPM of from 5850 to 6750 is correct.

When the main blade pitch is too much, it rotates slower and the helicopter will not fly well.

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## Repairs and Spare parts

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Should you have an accident or crash the helicopter, check the entire airframe over for broken or damaged parts, and replace those that are obviously broken, and those that you are in doubt about.

Spares can be obtained from your dealer, using the parts number and name. Follow this instruction manual when re-building or repairing.

Notice : The hub plate of the main rotor head is very critical. Do not use it for hanging the model or transporting it.



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