X-cell WHIPLASH

Assembly Instructions

Nitro
Helicopter Kit

MA1031-3 Flybarless

miniature aircraft usa

Step up to excellence with X-Cell

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Version 1.0 - Draft

01/05/2019

For updates to this manual, or any other Miniature Aircraft manual, go to www.miniatureaircraftusa.com.

Kit Introduction

Thank you for purchasing the X-Cell Whiplash by Miniature Aircraft. This model is the culmination of years of designing and manufacturing R/C helicopters. It is designed with the highest standards, and will provide years of enjoyment. Whether this is your first R/C model helicopter or you are an advanced R/C helicopter modeler, the X-Cell Whiplash is a fantastic choice for a “700 size” model.

R/C Helicopter Safety

A radio controlled model helicopter is not a toy, but rather a technically complex device that must be built and operated with care. It is also a fascinating and challenging part of the R/C sport, the mastery of which is very rewarding. A model helicopter must be built exactly in accordance with the building instructions. The kit manufacturer has spent much time and effort refining this product to make it reliable in operation and easy to build. The bolt together construction can proceed quite rapidly. This giver the builder a strong sense of accomplishment that encourages hasty progress from one construction phase to the next, so that the completed model can be more quickly seen and enjoyed. It is essential to recognize and guard against this tendency. Follow building instructions exactly. Vibration and stress levels are high and all fasteners and attachments must be secure for safe operation.

Note that this is the first use of the word SAFETY in these comments. Previously the kit manufacturer’s efforts to ensure reliable operation were mentioned. That is ALL that he can do. Safe operation is the responsibility of the builder/flyer and starts with careful construction and continues with selection and installation of reliable radio equipment and power systems.

The need for safety is nowhere greater than at the flying field. A number of guidelines for safe flight have been developed by experienced flyers and are set down here. It is urged that they be read, understood and followed.

Warning! – Risk of death or serious injury

Remote Control (“R/C”) Helicopters can be dangerous. Inexperienced pilots of R/C Helicopters should be trained and supervised by experienced operators. All operators should use safety glasses and other appropriate safety equipment. All operators should exercise necessary precautions when fueling, repairing, maintaining, flying and storing R/C Helicopters, and when using or storing R/C Helicopter accessories, equipment, fuels, and related materials. R/C Helicopters should be used only in open areas free of obstacles and far enough from people to minimize the possibility of injury from the helicopter or any of its components falling or flying in unexpected directions.

This helicopter is not a toy but a complex flying machine that must be assembled with care by a responsible individual. Failure to exert care in assembly, or radio or accessory installation, may result in a model incapable of safe flight or ground operation. Rotating components are an ever present danger and source of injury to operators and spectators. Since the manufacturer and his agents have no control over the proper assembly and operation of his products, no responsibility or liability can be assumed for their use.

General Guidelines for Safe R/C Helicopter Flight

- Fly only at approved flying fields and obey field regulations.
- Follow frequency control procedures. Interference can be dangerous to all.
- Know your radio. Check all transmitter functions before each flight.
- Be aware that rotating blades are very dangerous and can cause serious injury.
- Never fly near or above spectators or other modelers.
- If you’re a beginner, get help trimming the model first and seek flight training later.
- Don’t “track” the main blades by holding the tail boom. This is a temptation to builders who cannot hover yet and is very dangerous.
- Follow all recommended maintenance procedures for your model, radio and engine.

Academy of Model Aeronautics

Miniature Aircraft highly recommends joining the Academy of Model Aeronautics (AMA).

- AMA is the Academy of Model Aeronautics.
- AMA is the world's largest model aviation association, representing a membership of more than 195,000 from every walk of life, income level and age group.
- AMA is a self-supporting, non-profit organization whose purpose is to promote development of model aviation as a recognized sport and worthwhile recreation activity.
- AMA is an organization open to anyone interested in model aviation.
- AMA is the official national body for model aviation in the United States. AMA sanctions more than one thousand model competitions throughout the country each year and certifies official model flying records on a national and international level.
- AMA is the organizer of the annual National Aeromodeling Championships, the world's largest model airplane competition.
- AMA is the chartering organization for more than 2,500 model airplane clubs across the country. AMA offers its chartered clubs official contest sanction, insurance, and assistance in getting and keeping flying sites.
- AMA is the voice of its membership, providing liaison with the Federal Aviation Administration, the Federal Communications Commission, and other government agencies through our national headquarters in Muncie, Indiana. AMA also works with local governments, zoning boards, and parks departments to promote the interests of local chartered clubs.
- AMA is an associate member of the National Aeronautic Association. Through NAA, AMA is recognized by the Fédération Aéronautique Internationale (FAI), the world governing body of all aviation activity, as the only organization which may direct U.S. participation in international aeromodeling activities.

For more detailed information, contact the Academy of Model Aeronautics
5161 E. Memorial Drive, Muncie, Indiana, 47302
or telephone (800) 435-9262.
You may also visit the AMA website at www.modelaircraft.org

Kit Assembly

Your Whiplash kit will require a number of different supplies and tools to ensure the best final result. They are as follows:

Required Lubricants and Compounds:

1. Medium Strength Thread Locking Compound - Loctite Blue #243 (MA3200-20)
2. Tri-Flow Oil (MA3200-02)
3. Tri-Flow Synthetic Grease (MA3200-06)
4. Medium Cyanoacrylate (CA)
5. Retaining Compound - Loctite Green #648 (MA3200-22)

Required Tools:

1. M4 Nut Driver
2. M5 Nut Driver
3. M5.5 Nut Driver
4. M7 Nut Driver
5. 1.5mm Allen Driver
6. 2.0mm Allen Driver
7. 2.5mm Allen Driver
8. 3.0mm Allen Driver
9. 4.0mm Allen Driver x2
10. 5.0mm Allen Driver
11. Needle Nose Pliers
12. Phillips Screwdriver
13. Razor Knife (X-acto)

Other required components:

The X-Cell Whiplash is an airframe kit. To complete the model, several other items are required, but not included with the kit. There are many choices for these other required components, and any competent hobby retailer with R/C helicopter experience will be happy to make suggestions. You will need:

1. Engine, “90-120” size nitro helicopter engine.
2. Helicopter style muffler suited to the engine you choose.
3. Cyclic servos (Miniature Aircraft recommends high quality digital cyclic servos with no less than 80 oz. in. of torque.)
4. Throttle servo (Miniature Aircraft recommends a high quality ball bearing servo.)
4. R/C helicopter gyro (Miniature Aircraft recommends for Flybarless Kits a flybarless electronic unit with rudder gyro and for Flybar Kits only a tail “heading hold” style gyro is needed.)
5. Rudder servo suitable for use with the gyro you choose. Digital servo is recommended.
6. R/C helicopter transmitter and receiver with at least 6 channels, and eCCPM capabilities.
7. 690-710mm Main Blades and 105-115mm Tail Blades.
8. R/C helicopter starting and fueling equipment.
9. R/C helicopter engine governor is recommended, but not required for flight.

Important Assembly Tips - PLEASE READ

- Follow the instructions. The methods of construction documented in this manual have been proven to work. Do not rush the build of your model! You have purchased a world class model helicopter kit, take your time and realize that the final result is now up to you. Take the time to fully understand each step and if you are unsure please contact Miniature Aircraft, or a representative.

- Follow the order of assembly. The instructions have been organized into major sections and have been written in such a way that each step builds upon the work done in the previous step. Changing the order of assembly may result in unnecessary steps.

- Clean all metal parts. All of the steel parts in this kit are coated with a lubricant to prevent them from rusting. This coating can interfere with the adhesives and thread locks needed for assembly. Use a solvent such as alcohol or acetone to clean the various metal parts, especially threads. Be sure not to overtighten bolts as damage to bearings and other components will occur.

- It is very important to lightly sand the edges of all carbon fiber pieces. Miniature Aircraft recommends doing so prior to the assembly process. Carbon fiber edges can be sharp and can easily cut component wires and battery mounting straps. It is important to use safety precautions when creating carbon fiber dust. The use of a particulate mask, preferably one with a P100 HEPA filter is recommended. Always clean up carbon fiber dust with a damp rag right away.

- Use thread lock as indicated. Generally any bolt or screw that threads into a metal part requires thread lock. Model helicopters are subject to vibration and failing to use thread lock on any non-locking assembly may result in a part becoming loose or falling off in flight.

Kit Contents

Please take some time to familiarize yourself with the contents of the kit. The Whiplash kit has been broken down into three “bags.” Each bag contains parts and hardware. The hardware in each bag will be used only for that bag. There will be no left over parts after each bag is assembled. *The individual parts of the factory assembled parts are not listed out here. They can be found in the components section of the manual.*

Bag 1 - Whiplash Rotor Head FBL

Bag	Part No.	Part Description	Qty
1-A	0217	Swashplate - Factory	1
1-Hardware	0051	M3x3 Set Screw	2
1-Hardware	0107	M3x6 Threaded Steel Ball	3
1-Hardware	0109	M3x8 Threaded Steel Ball	4
1-Hardware	131-83	Anti-rotation Pin	1
1-B	0869	Washout Link	2
1-B	128-176	Washout Pin	2
1-B	128-195	Head Button	1
1-B	128-314	Swashplate Follower - Factory	2
1-B	131-368	FBL Head Block	1
1-Hardware	0067	M3x14 Socket Bolt	1
1-Hardware	0071	M3x18 Button Head Socket Bolt	2
1-Hardware	0447-1	M2 E-clip	2

Bag	Part No.	Part Description	Qty
1-C	131-161	Main Blade Grip - Factory	2
1-C	131-163	FBL Pitch Arm	2
1-C	131-187	Head Axle	1
1-Hardware	0107	M3x6 Threaded Steel Ball	2
1-Hardware	0061	M3x8 Socket Bolt	4
1-Hardware	0086-1	M5x16 Flanged Socket Bolt	2
1-Hardware	120-7-1	5x15 Safety Washer	2
1-Hardware	131-183	Washer	4
1-D	0133-1	M3x21.5 Ball Link	10
1-D	121-4	Servo To Swash Linkage Rod	3
1-D	121-7	Swash To PA Linkage Rod	2
1-D	131-408	FBL Main Shaft	1
1-Hardware	0021	M4 Lock Nut	1
1-Hardware	0023	M5 Nut	2
1-Hardware	0063	M3x10 Socket Bolt	2
1-Hardware	0082-4	M5x32 Shouldered Socket Bolt	2
1-Hardware	131-200	M4x33 Shouldered Socket Bolt	1

Bag 2 - Whiplash Tail Assembly

Bag	Part No.	Part Description	Qty
2-A-1	131-475	T/R Pitch Slider Assembly - Factory	1
2-A-2	131-129	Tail Box Assembly - Factory	1
2-A-3	131-130	Tail Pitch Control Bellcrank	1
2-A-3	131-131	C/F Bellcrank Bracket	1
2-A-3	131-132	Bellcrank Slider Cup	1
2-Hardware	0019	M3 Lock Nut	1
2-Hardware	0059-1	M2.5x6 Socket Bolt	1
2-Hardware	0064-3	M3x6 Button Head Socket Bolt	2
2-Hardware	0073	M3x20 Socket Bolt	1
2-Hardware	0107	M3x6 Threaded Steel Ball	1
2-A-4	131-64	T/R Hub	1
2-A-4	131-112	T/R Blade Grip - Factory	2
2-Hardware	0009	M3 Washer	2
2-Hardware	0019	M3 Lock Nut	2
2-Hardware	0056	M3x5 Dog-Point Set Screw	2
2-Hardware	0061	M3x8 Socket Bolt	2
2-Hardware	0069	M3x16 Socket Bolt	2
2-Hardware	0107	M3x6 Threaded Steel Ball	2

Bag	Part No.	Part Description	Qty
2-B-1	131-400	TT Ends	2
2-B-1	131-480	TT Bearing Cup	2
2-B-1	131-481	TT Bearing Cup O-Ring	4
2-B-1	131-482	TT Sleeve	2
2-B-1	131-485	TT Bearing	2
2-Hardware	0015	2mm Hex Nut	2
2-Hardware	0049-1	M2x12 Socket Bolt	2
2-B-2	131-558	TT	1
2-B-2	131-62	Tail Boom	1
2-B-2	131-69-1	T/R Control Rod	1
2-B-2	131-86	Tail Boom Support C/F Rod Assemly	2
2-B-3	0133	M2x21.2 Ball Link	2
2-B-3	128-80	Aluminum Front Boom Clamp	2
2-B-3	128-144	T/R Control Rod Guide	4
2-B-3	128-149a	Upper Rear Boom Support Mount	1
2-B-3	128-149b	Lower Rear Boom Support Mount	1
2-B-3	131-128	C/F Boom Clamp Plate	1
2-Hardware	0016-2	4mm External Serrated Lockwasher	2
2-Hardware	0060-1	M3x6 Socket Bolt	4
2-Hardware	0063	M3x10 Socket Bolt	1
2-Hardware	0065	M3x12 Socket Bolt	3
2-Hardware	0067	M3x14 Socket Bol	2
2-Hardware	0078	M4x12 Socket Bolt	2
2-B-4	131-60	C/F Vertical Tail Fin Painted	1

Bag 3 - Nitro Frame Assembly

Bag	Part No.	Part Description	Qty
3-A	128-57	3mm Tray Mount	3
3-A	131-52	Delrin Tray Mount	2
3-A	131-53	C/F Gyro Plate	1
3-A	131-55	C/F Angled Battery Tray	1
3-Hardware	0032-2	M3x8 Tapping Screw	4
3-Hardware	0064-3	M3x6 Button Head	6
3-Frames	131-487	C/F Left Frame - Nitro	1
3-Frames	131-488	C/F Right Frame - Nitro	1
3-Hardware	0003	3mm Washer	20
3-Hardware	0009	3mm Washer small	10
3-Hardware	0032	2.9x9.5 Tapping Screw	4
3-Hardware	0060-1	M3x6 Socket Bolt	30
3-Hardware	0061	M3x8 Socket Bolt	40
3-Hardware	0063	M3x10 Socket Bolt	5
3-B	128-58	Frame Spacer	11
3-B	131-21	Upper Main Bearing Block	1
3-B	131-46	P/A Servo Rail	2
3-B	131-47	C/F Servo Rail Spacer	2
3-B	131-137	Rear Doubler	2
3-B	131-186	C/F Anti-rotation Bracket	1
3-B	131-420	Mid Main Bearing Block	1
3-B	131-429	C/F X-Brace	1
3-B	132-59	Front Doubler	2
3-Hardware	0060-1	M3x6 Socket Bolt	4
3-Hardware	0063	M3x10 Socket Bolt	2
3-Hardware	0065	M3x12 Socket Bolt	2
3-C	128-118	6mm Hex Adaptor	1
3-C	131-3	Start Shaft w/Sleeve	1
3-C	131-117	Nitro Fan Hub	1
3-C	131-119	Nitro Clutch	1
3-C	131-120	Ntro Fan	1
3-C	131-122	Left Engine Mount	1
3-C	131-123	Right Engine Mount	1
3-C	131-179	X-Block	1
3-C	131-411	Assembled Nitro Clutch Bell	1
3-Hardware	0004	4mm Washer	4
3-Hardware	0057	M4x4 Set Screw	2
3-Hardware	0064-3	M3x6 Button Head Socket	4
3-Hardware	0078-4	M4x8 Socket Bolt	2
3-Hardware	0081	M4x16 Socket Bolt	4
3-S	0818-3	Mounting Block	2
3-S	131-50	Elevator Servo Mount	2
3-S	131-148	C/F Servo Plates	14
S-Hardware	0017-2	2.5mm Hex Nut	5
S-Hardware	0059-1	M2.5x6 Socket Bolt	4
S-Hardware	0059-4	M2.5x12 Socket bolt	16
S-Hardware	0059-7	M2.5x20 Socket Bolt	4
S-Hardware	0116	M2.5 Threaded Steel Ball	5
3-D	0133	Plastic Ball Link	2
3-D	0133-1	Plastic Ball Link	2
3-D	131-69	M2x315 Linkage Rod	1
3-D	131-85	C/F Rod	1
3-D	131-109	Swing Arm Pivot Mount	1
3-D	131-115	C/F Bottom Plate - Nitro	1
3-D	131-136	Struts	4
3-D	131-139	Skids	2
3-D	131-454	4mm Tray Mount	2
3-D	2500-39	Tuf-Strut II End Cap Black	4
3-D	2500-40	Tuf-Strut II End Cap White	4
3-Hardware	0057	M4x4 Socket Screw	4
3-Hardware	0060-1	M3x6 Socket Bolt	2
3-Hardware	0061	M3x8 Socket Bolt	4
3-Hardware	0107	M3x6 Threaded Steel Ball	2
Bag	Part No.	Part Description	Qty
3-Hardware	0069	M3x16 Socket Bolt	1
3-Hardware	0081	M4x16 Socket Bolt	4
3-E	0390	Wire Retainers	5
3-E	0875-1	10mm Split Main Shaft Collar	2
3-E	131-424	Main Gear Hub	1
3-E	131-440	Lower Main Bearing Block	1
3-E	131-466	Auto Hub	1
3-E	131-469-1	Gear Support	1
3-E	131-470	70T Machined Crown Gear	1
3-E	132-117-B	124T Main Gear	1
3-E	3200-30	20” Spiral Band for Wire and Cable	1
3-E	3200-48	20” 3/4 Hook and Loop Tape	1
3-E	3200-54	17” Adhesive Hook and Loop	1
3-Hardware	0021	4mm Lock Nut	1
3-Hardware	0059-2	M2.5x8 Socket Bolt	2
3-Hardware	0088	M3x8 Tapered Socket Bolt	8
3-Hardware	0088-3	M3x7 Tapered Socket Bolt	5
3-Hardware	0620-01	15x21x.10 Shim Washer	1
3-Hardware	0620-02	15x21x.20 Shim Washer	1
3-Hardware	0620-03	15x21x.30 Shim Washer	2
3-Hardware	131-202	Jesus Bolt OWB V2	1
3-E-1	0133-1	M3x21.2 Ball Links	2
3-E-1	122-94	M3x97 Threaded Control Rod	1
3-E-1	128-59	M4 Front Boom Support Brace	1
3-E-1	131-150	Front Canopy Post	2
3-E-1	131-151	Rear Canopy Post	2
3-E-1	131-153	C/F Canopy Breakaway Tabs	4
3-Hardware	0003	3mm Washer	2
3-Hardware	0016-2	M4 External Serrated Lock Washer	2
3-Hardware	0015	2mm Hex Nut	1
3-Hardware	0081	M4x16 Socket Bolt	2
3-Hardware	0103	2mm Threaded Steel Ball	1
3-F	115-65	Fuel Line	1
3-F	125-24	Fuel Filtered Pick-Up Magnet	1
3-F	128-92	Fuel Tank Plug	1
3-F	128-94	Fuel Nipple	1
3-F	131-138	Whiplash Nitro Fuel Tank	1
3-F	131-144	Rubber Fuel Tank Mount	4
3-F	131-145	Tank Mounting Studs	2
3-F	131-146	C/F Nitro Fuel Tank Plate	1
3-Hardware	0011-5	Washer	1
3-Hardware	0014F	5mm Hex Nut - Fine Threaded	1
3-Hardware	0053-5	Set Screw	2
3-Hardware	0060-1	M3x6 Socket Bolt	4
3-Hardware	0061	M3x8 Socket Bolt	2
3-Hardware	0063	M3x10 Socket Bolt	4
BOX	131-252	Whiplash Canopy - Stomp	1
	106-22	Rubber Canopy Grommet	4
	131-154	Thumb Screw	4
	0063	M3x10 Socket Bolt	4
BOX	131-233	Whiplash Nitro Instruction Manual	1
BOX	3000-73	MA Towel	1
BOX	3700-160	Blade Holder	1

Whiplash - Flybarless Head Assembly Parts

0021
M4 Hex Locknut

0023
M5 Hex Locknut

0051
M3x3 Socket Set Screw

0061
M3x8 Socket Bolt

0063
M3x10 Socket Bolt

0067
M3x14 Socket Bolt

0071
M3x18 Socket Bolt

0082-4
M5x32 Shouldered Socket Bolt

0086-1
M5x16 Flanged Bolt

0107
M3x6 Threaded Steel Ball

0109
M3x8 Threaded Steel Ball

0133-1
M3x21.2 Ball Link

0159
3x7x3 Bearing

0217
Swashplate

0447-1
E-Clip

0597-4
M3x4.75x.215 Brass Spacer

0869
3D Washout Link

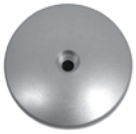
106-06
2x5x1.5 Bearing

120-7-1
M5x15 Safety Washer

121-4
M3x30 Threaded Control Rod

121-7
M3x65 Threaded Control Rod

128-176
M2x.584 Washout Pivot Pin



128-195
Aluminum Head Button

128-314
Swashplate Follower

131-83
Swashplate Pin

131-161
Aluminum Blade Grip

131-163
Aluminum Pitch Arm

131-181
9x17x5 Bearing

131-182
9x17x5 Thrust Bearing

131-183
9x14x.75 Washer

131-187
Head Axle

131-200
M4x33 Shouldered Socket Bolt

131-368
Flybarless Head Block

131-408
Flybarless Main Shaft

131-490
Damper Sleeve

131-491
Damper O-Ring (80D)

Apply a small amount of medium thread lock when threading into metal parts

Hardware for this assembly

0051 x 2
M3x3 Socket Set Screw

0107 x 3
M3x6 Threaded Steel Ball

0109 x 4
M3x8 Threaded Steel Ball

131-83 x 1
Swashplate Pin

Assembly Tip

- **Install MA0051 M3x3 Socket Set Screws only until they bottom out against the lower bearing. Do not overtighten or damage to swashplate bearing will occur. *Note: these are used to adjust the bearing tolerance if it develops play over time.***

1A

Hardware for this assembly

0067 x 1
M3x14 Socket Bolt

0071 x 2
M3x18 Socket Bolt

0447-1 x 2
E-clip

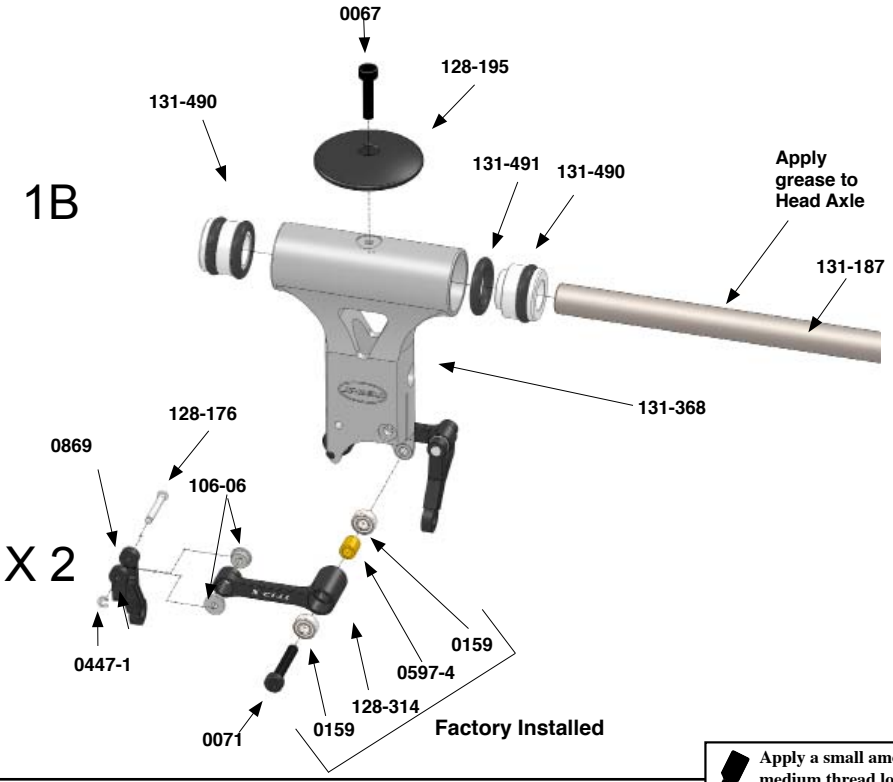
128-176 x 2
M2x.584 Washout
Pivot Pin

Assembly Tip

- The use of a light grease such as MA3200-06 Tri-Flow Synthetic Grease is required for damper/head axle lubrication

New damper system (131-490)

1B



Apply a small amount of medium thread lock when threading into metal parts

Hardware for this assembly

0107 x 2
M3x6 Threaded
Steel Ball

0061 x 4
M3x8 Socket Head
Cap Screw

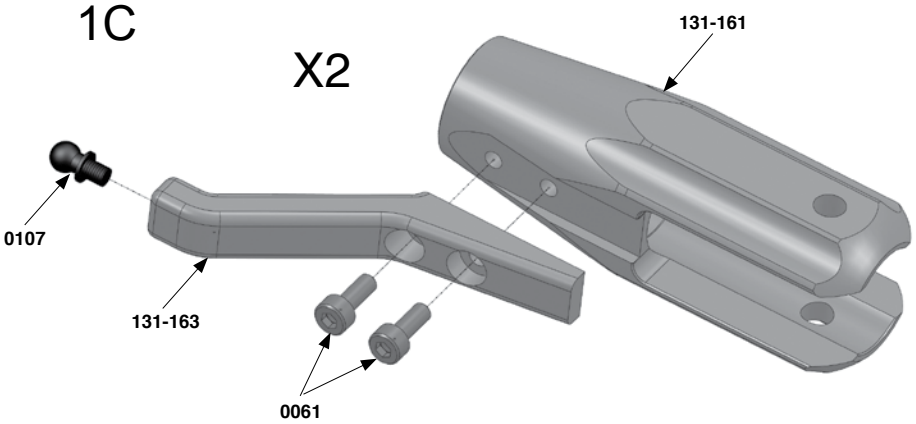
0086-1 x 2
M5x16 Flanged Bolt

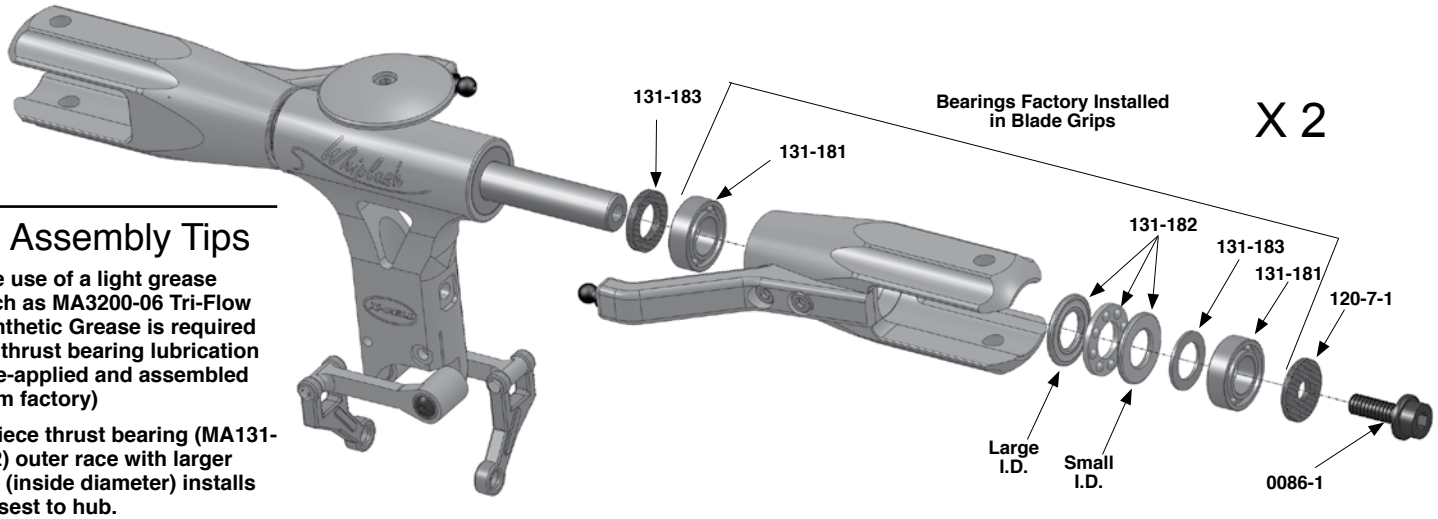
120-7-1 x 2
M5x15 Safety Washer

131-183 x 4
9x14x.75 Washer

1C

X2





Assembly Tips

- The use of a light grease such as MA3200-06 Tri-Flow Synthetic Grease is required for thrust bearing lubrication (pre-applied and assembled from factory)
- 3 piece thrust bearing (MA131-182) outer race with larger I.D. (inside diameter) installs closest to hub.

Hardware for this assembly

0021 x 1
M4 Lock Nut

0023 x 2
M5 Lock Nut

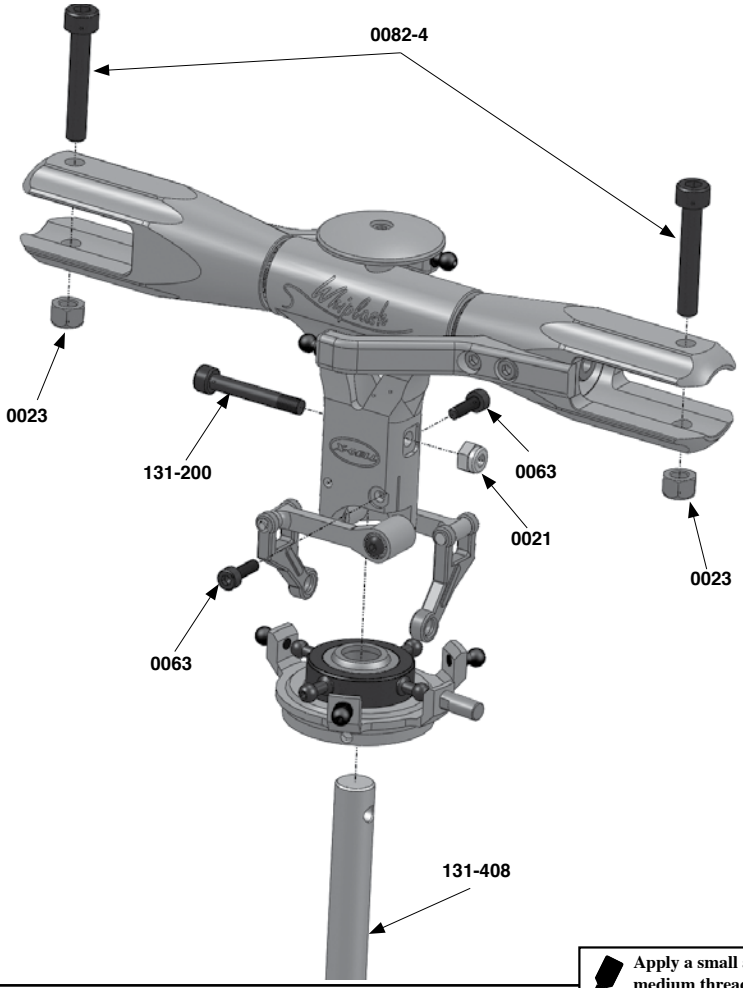
0063 x 2
M3x10 Socket Bolt

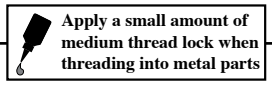
0082-4 x 2
M5x32 Shouldered Socket Bolt

131-200 x 1
M4x33 Shouldered Socket Bolt

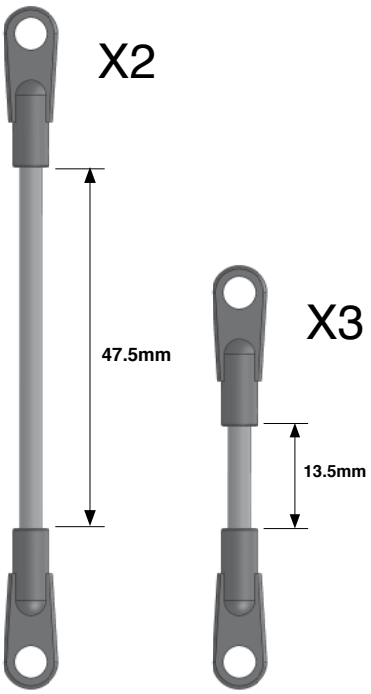
Assembly Tips

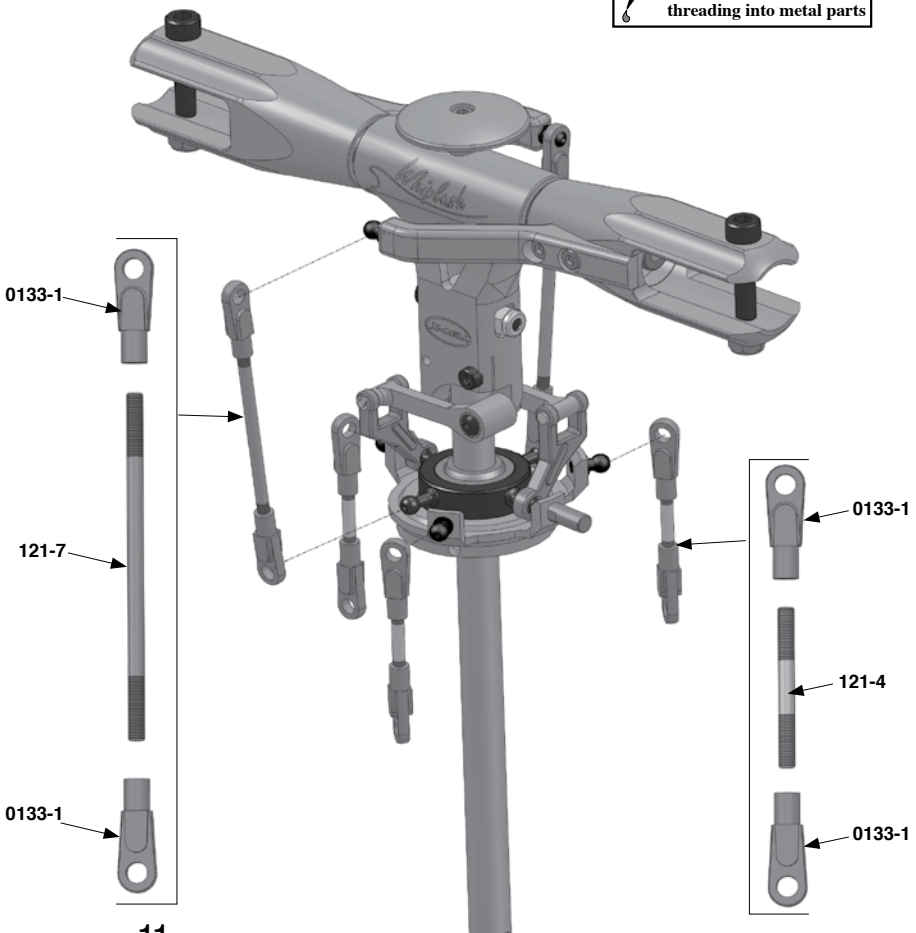
- **Head, Swashplate and Main Shaft can be assembled now, or you can assemble the parts later step by step installing them to the frame.**





Link Arm Lengths and Installation





Tail Assembly Parts

0009
3mm Flat Steel Washer

0012-2
M3 Pem Nut

0015
2mm Hex Nut

0016-2
4mm External Serrated Lockwasher

0019
3mm Hex Locknut

0049-1
M2x12 Socket Bolt

0051
M3x3 Socket Set Screw

0056
M3x5 Dog Point Socket Screw

0056-3
M3x8 Dog Point Socket Screw

0059-0
M2.5x4 Socket Bolt

0059-1
M2.5x6 Socket Bolt

0060-1
M3x6 Socket Bolt

0061
M3x8 Socket Bolt

0063
M3x10 Socket Bolt

0064-3
M3x6 Button Head Socket Bolt

0065
M3x12 Socket Bolt

0067
M3x14 Socket Bolt

0069
M3x16 Socket Bolt

0073
M3x20 Socket Bolt

0078
M4x12 Socket Bolt

0107
M3x6 Threaded Steel Ball

0133
M2x21.2 Ball Links

0159
3x7x3 Bearing

0215
Auto Hub Ret. Collar

0225
Pivot Pin For Pitch Links

0273
M6x10x.011" Steel Shim Washer

0273-1
M6x10x.0.1 Steel Shim Washer

0273-2
M6x10x.0.2 Steel Shim Washer

0442
Pivoting T/R Pitch Link

0597-1
3x4.75x.126 Brass Spacer

120-39
5x10x4 Bearing

122-70
Washer

128-80
Aluminum Front Boom Clamp

128-144
T/R Control Rod Guides

128-146
Aluminum Boom Support Ends

128-149
Rear Boom Support Mount

131-17-B Tail Bevel Gear, Shaft Side

131-18-B
Tail Bevel Gear, Torque Tube Side

131-33
15x21x4 Bearing

131-60
Carbon Fiber Vertical Tail Fin

131-62
Aluminum Tail Boom

131-64
Tail Hub

131-66
5x10 Thrust Bearing

131-69-1
Tail Linkage Rod

131-70
Tail Rotor Output Shaft

131-84
Carbon Boom Support Rod

131-86
Tail Boom Support Assembly

131-112
T/R Blade Grip

131-128
Carbon Fiber Boom Clamp Plate

131-129
Tail Case

131-130
Tail Bellcrank

131-131
Carbon Fiber Bellcrank Bracket

131-132
Bellcrank Cup

131-180
6x13x5 Flanged Bearing

131-400
Torque Tube End

131-473
8x12x3.5 Bearing

131-474
Pitch Slider Ring

131-475
Tail Pitch Slider

131-476
Tail Pitch Yoke

131-477
Brass Slider

131-480
Torque Tube Bearing cup

131-481
Torque Tube Bearing cup o-ring

131-482
Torque Tube Sleeve

131-485
12x18x4 Bearing

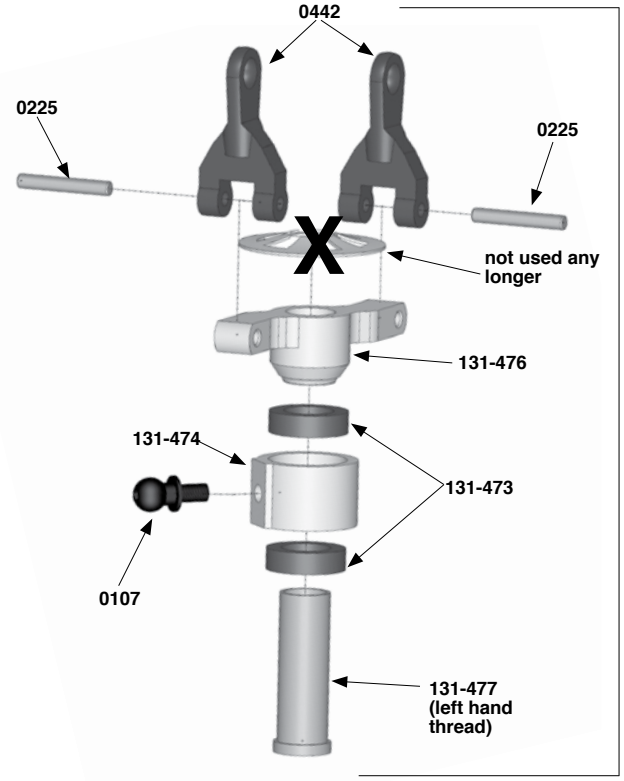
131-558
Torque Tube

Hardware for this assembly

0107 x 1
M3x6 Threaded Steel Ball

0225 x 2
Pivot Pin for Wash-out Arm

2-A-1



Factory Assembled

Apply a small amount of medium thread lock when threading into metal parts

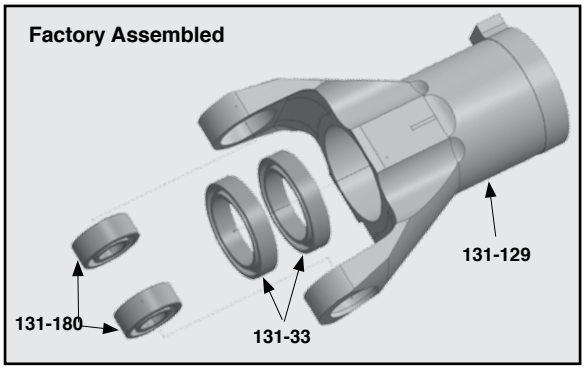
Hardware for this assembly

0051 x 2
M3x3 Socket Set Screw

0056-3 x 2
M3x8 Dog Point Socket Screw

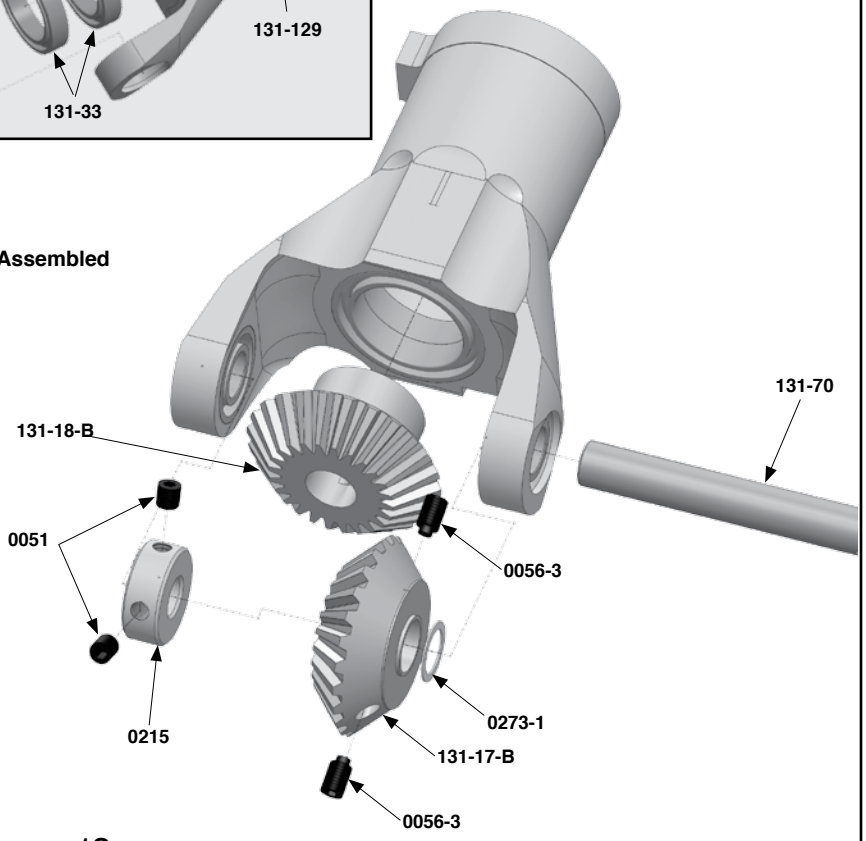
0273 x 1
m6x10x.11" Steel Shim Washer

0273-1 x 1
m6x10x.004" Steel Shim Washer



Factory Assembled

2-A-2



Assembly Tip

- **Make sure to include MA0273-1 Shim Washer between MA131-17-B Output Gear and transmission case bearing.**

Hardware for this assembly

0019 x 1
3mm Hex Nut

0059-1 x 1
M2.5x6 Socket Bolt

0064-3 x 2
M3x6 Button Head Socket Bolt

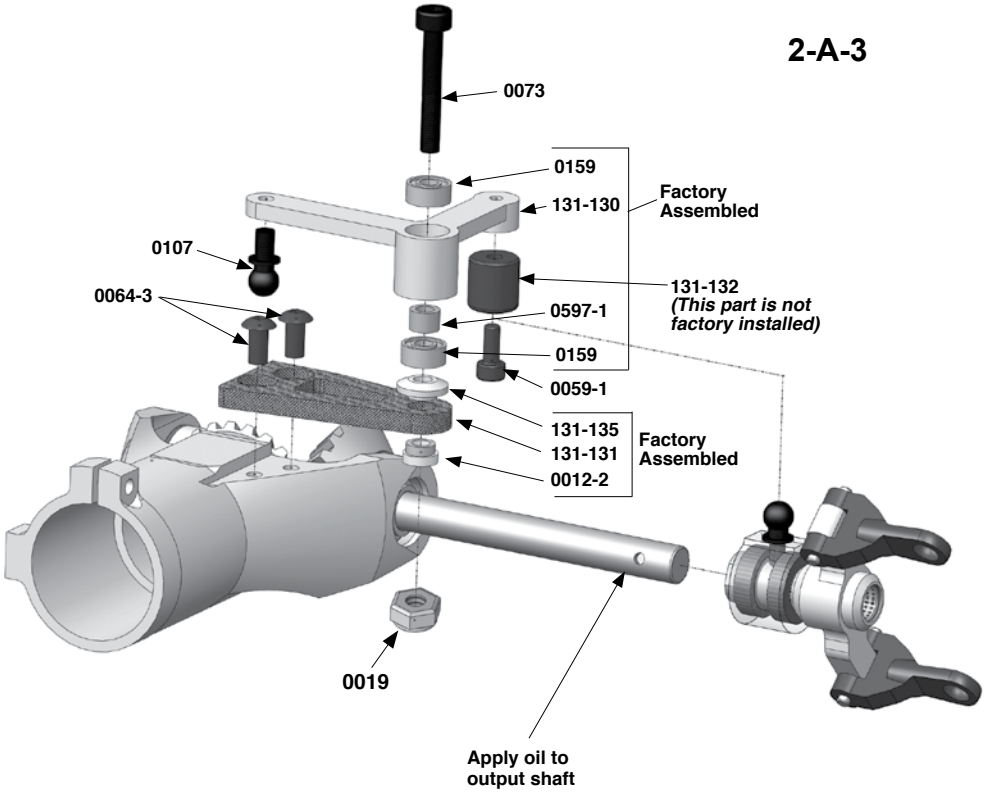
0073 x 1
M3x20 Socket Bolt

0107 x 1
M3x6 Threaded Steel Ball

Assembly Tip

- The use of a light oil such as MA3200-02 Tri-Flow Oil is required for tail rotor output shaft/pitch slider lubrication

2-A-3



Apply a small amount of medium thread lock when threading into metal parts

Hardware for this assembly

0009 x 2
3mm Flat Steel Washer

0019 x 2
3mm Hex Nut

0061 x 2
M3x8 Socket Bolt

0069 x 2
M3x16 Socket Bolt

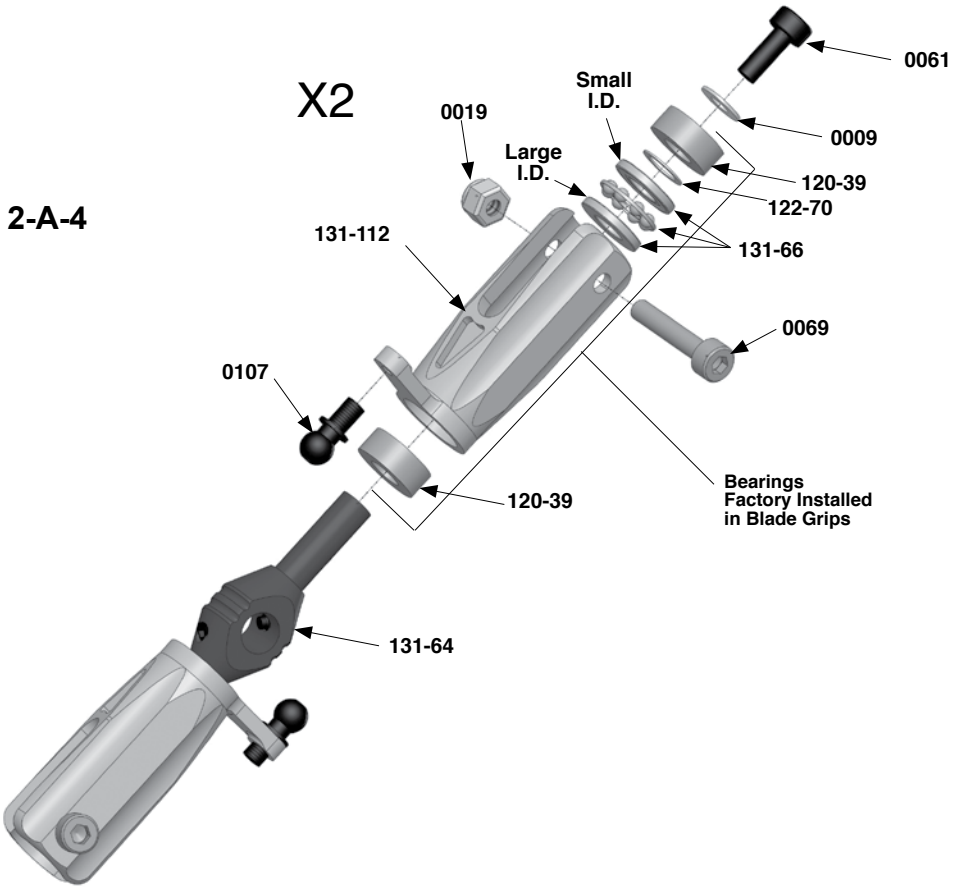
0107 x 2
M3x6 Threaded Steel Ball

122-70 x 2
M.5x.25 Shim

Assembly Tips

- 3 piece thrust bearing (MA131-66) outer race with larger I.D. (inside diameter) installs closest to hub.
- Grease the center ball cage of the thrust bearing. We recommend using MA3200-06 Tri-Flow synthetic grease.
- Only hand tighten MA0061 Socket Bolt until it is moderately tight. Do not overtighten bolt or it may result in fatigue to bolt. Use green thread lock on these bolts.

2-A-4

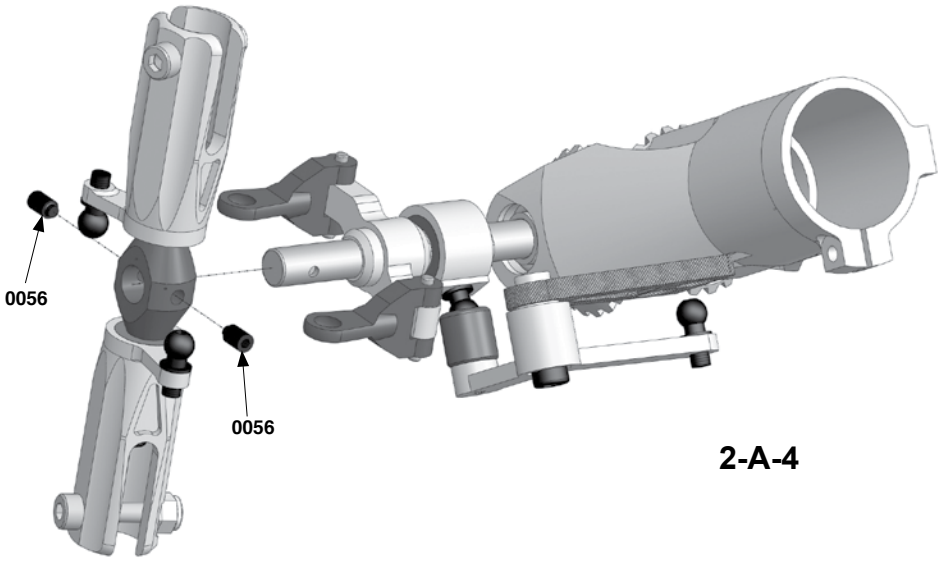


Hardware for this assembly

0056 x 2
M3x5 Dog Point Socket Screw

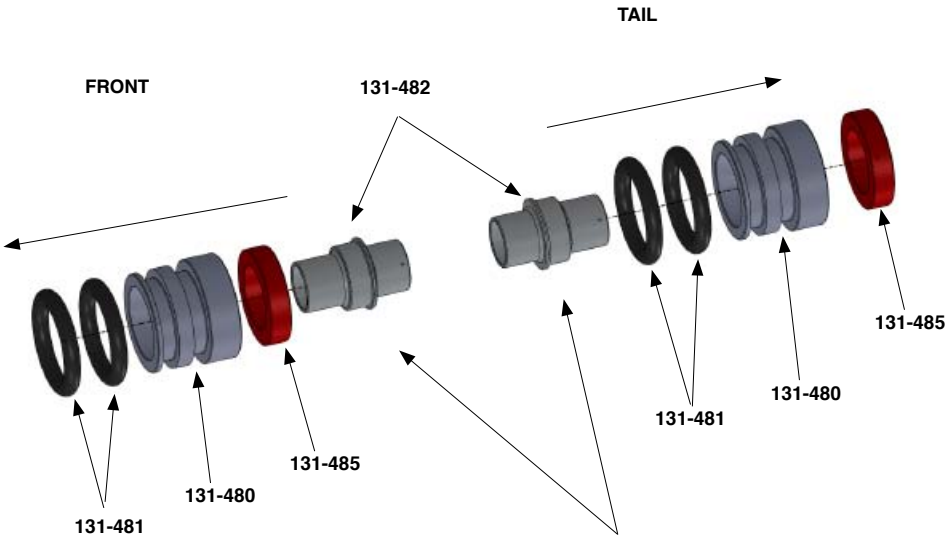
Assembly Tip

- **Ensure the dog point tip is seated into the dimples on the tail rotor shaft.**



2-A-4

Apply a small amount of medium thread lock when threading into metal parts



Take care about the orientation of guide edge of the sleeves, one facing to the front, one one facing to the tail.

Install both bearing cup assemblies facing the same direction on torque tube.

Apply a small amount of green Loctite 648 when mounting the bearing cup assemblies on the torque tube.

2-B-1

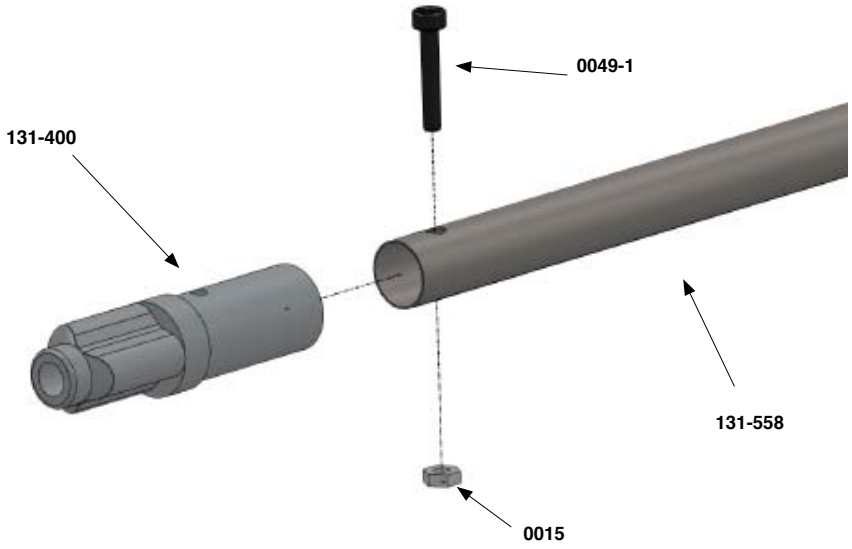
Hardware for this assembly

0015 2 x
2mm Hex Nut

0049-1 x 2
M2x12 Socket Bolt

Assembly Tips

- **Use only Loctite green #648 to glue TT ends to tube.**
- **Do not overtighten 0049-1 socket bolts as it is possible to crush torque tube.**



2-B-2

NOTE: Carefully glue bearing assemblies to torque tube making sure bearing locations are NOT equal distances from torque tub ends. Allow Loctite 648 to dry (about 2 hours) before installing into tail boom.

Apply a small amount of medium thread lock when threading into metal parts

Hardware for this assembly

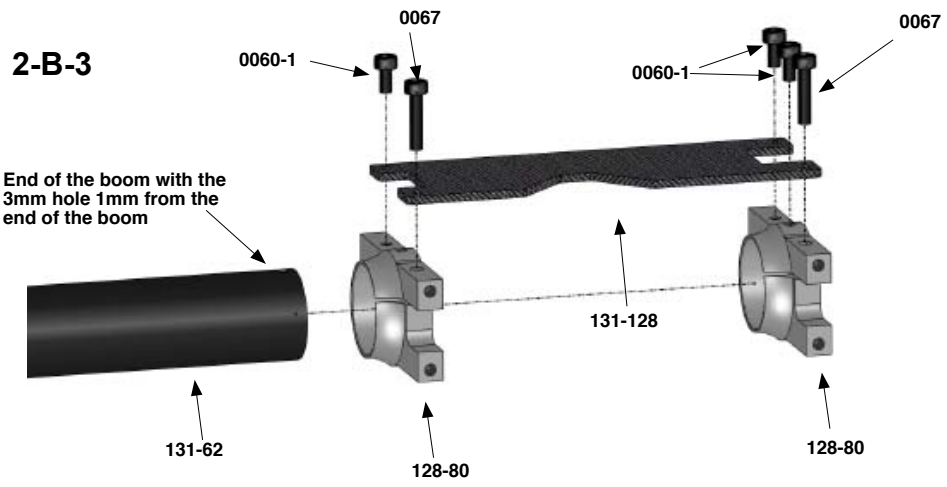
0060-1 x 3
M3x6 Socket Bolt

0067 x 2
M3x14 Socket Bolt

Assembly Tips

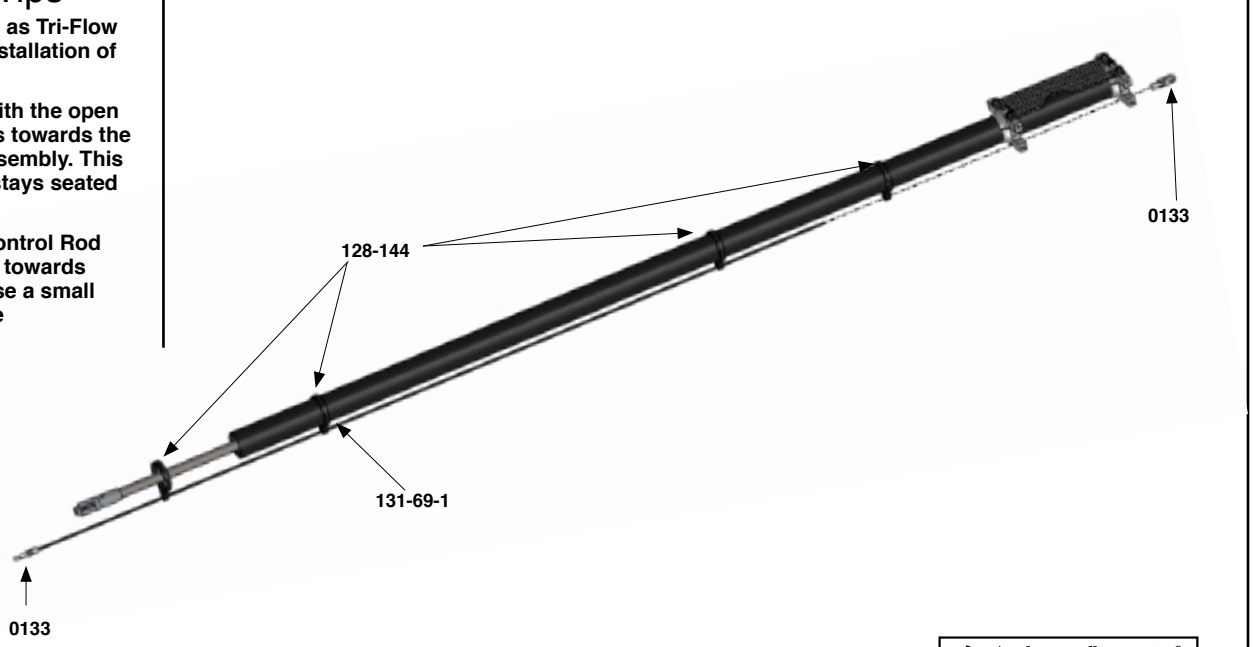
- **Ensure that the boom is full inserted through boom clamps.**
- **Do not overtighten MA0067 Socket Bolts as it is possible to crush tail boom.**

2-B-3



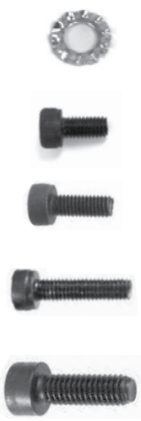
Assembly Tips

- Pour some light oil such as Tri-Flow into tail boom to ease installation of torque tube assembly.
- Install the torque tube with the open ends of the bearing cups towards the back of the tail boom assembly. This will ensure the bearing stays seated in the bearing cup.
- Install MA128-144 T/R Control Rod Guides with the dimples towards front of tail assembly. Use a small amount of cyanoacrylate glue to ensure each guide stays in position.



Apply a small amount of medium thread lock when threading into metal parts

Hardware for this assembly



0016-2 x 2
4mm External Serrated Lockwasher

0060-1 x 1
M3x6 Socket Bolt

0063 x 1
M3x10 Socket Bolt

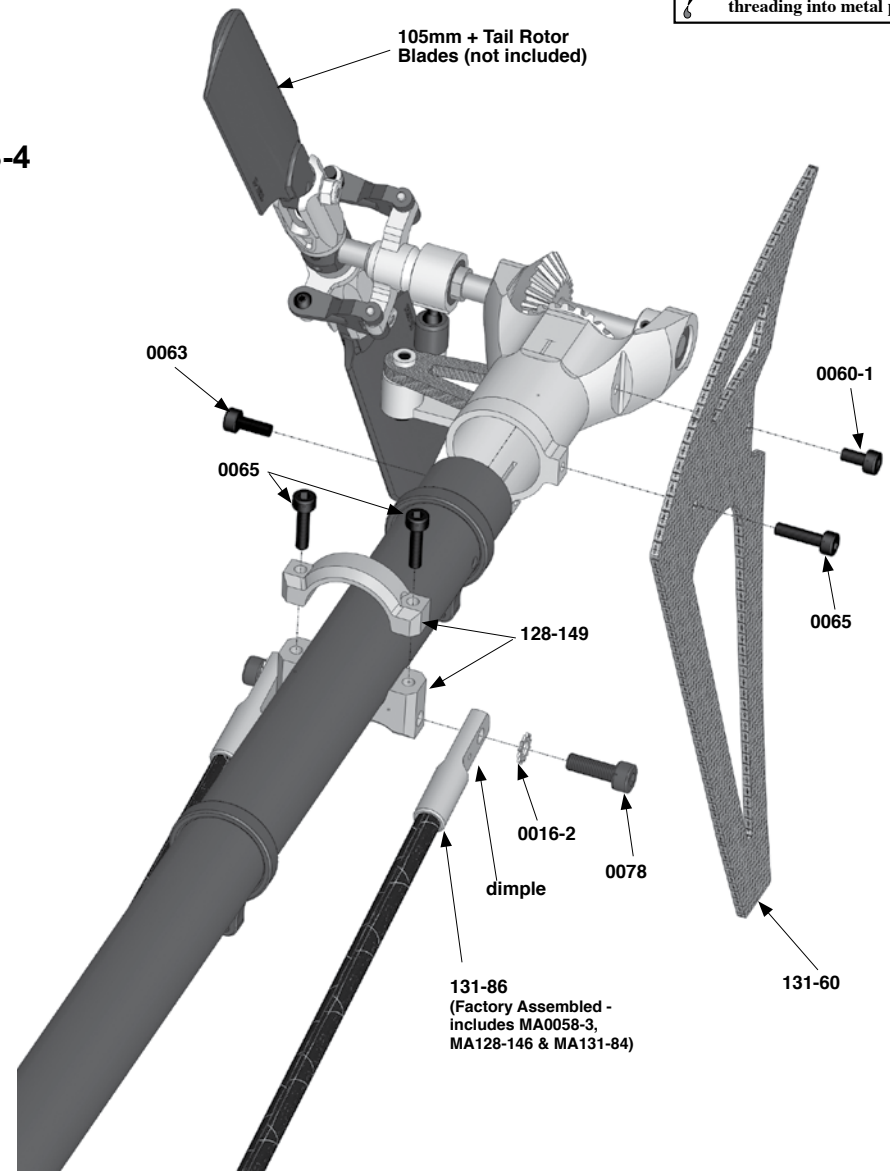
0065 x 3
M3x12 Socket Bolt

0078 x 2
M4x12 Socket Bolt

Assembly Tips

- The use of "243 blue" thread lock such as MA3200-20 (loctite blue #243) is recommended on MA0078 Socket Bolts.
- Do not overtighten MA0065 Socket Bolts on the Rear Boom Support Mounts.
- Aluminum boom support ends have a dimple on one side. The dimple indicates a slight angle built in to this part. On the Boom support assembly side that attaches to the main frame, the dimple will be facing "in."

2-B-4



Nitro Frame Assembly Parts


0004
M4 Washer


0009
3mm Flat Steel Washer


0011-5
5.3x20x.08 Washer


0012-1
2.5mm Pem Nut


0012-2
3mm Pem Nut


0014F
5mm Hex Nut Fine Thread


0016-2
4mm Extrnal errated Lockwasher


0017-2
2.5mm Hex Nut


0021
M4 Hex Locknut


0032
M2.9x9.5 Self Tapping Screw


0032-2
M3x8 Self Tapping Screw


0053-5
M3x16 Socket Set Screw


0057
M4x4 Set Screw


0059-2
M2.5x8 Socket Bolt


0059-3
M2.5x10 Socket Bolt


0060-1
M3x6 Socket Bolt


0061
M3x8 Socket Bolt


0063
M3x10 Socket Bolt


0064-3
M3x6 Button Head Socket Bolt


0065
M3x12 Socket Bolt


0069
M3x16 Socket Bolt


0078-3
M4x6 Socket Bolt


0081
M4x16 Socket Bolt


0088
M3x8 Tapered Socket Bolt


0088-3
M3x7 Tapered Socket Bolt


0107
M3x6 Threaded Steel Ball


0116
M2.5 Threaded Steel Ball


0133
M2x21.2 Plastic Ball Link


0133-1
M3x21.2 Plastic Ball Link


0159
3x7x3 Bearing


0183
10x19x5 Bearing


0208
10x12 One-Way Torrington Bearing


0390
Large Wire Lead Retainer


0597-1
3x4.75x.126 Brass Spacer


0875-1
Collar


105-70
6x15x6 Bearing


106-22
Rubber Canopy Grommets

115-65
High-Flex Fuel Line


122-47
10x22x6 Bearing


122-48
22mm C-clip

122-94
M3x97 Threaded Control Rod

125-24
Fuel Pick-up Magnet

128-57
Tray Mount

128-58
Main Frame Spacer

128-59
Front Boom Support Spacer

128-92
Fuel Tank Plug

128-94
Fuel Nipple

128-118
6mm Hex Starting Adaptor

131-3
Start Shaft

131-10
Clutch Liner

131-19
10x26x8 Bearing

131-21
Upper Main Shaft Bearing Block

131-46
Pitch/Aileron Servo Rail

131-47
Carbon Fiber Servo Rail Spacer

131-50
Elevator Servo Mount

131-52
Delrin Tray Mount

131-53
C/F Gyro Plate

131-55
C/F Angled Battery Tray

131-69
M2x315 Linkage Rod

131-85
Carbon Tube

131-107
Swing Arm

131-109
Swing Arm Pivot Mount

131-115
C/F Bottom Plate - Nitro

131-117
Fan Hub

131-119
Clutch w/Torrington Bearing

131-120
Engine Fan w/magnets

131-122
Left Motor Mount

131-123
Right Motor Mount

131-133
Left Fan Shroud

131-134
Right Fan Shroud

131-136
Landing Strut

131-137
C/F Rear Frame Doubler - Nitro

131-138
Whiplash Nitro Fuel Tank

131-139
Skid Tube

131-144
Rubber Fuel Tank Mount

131-145
Fuel Tank Standoff

131-146
Carbon Fiber Fuel Tank Plate

131-148
Carbon Fiber Servo Plate

131-150
Front Canopy Post

131-151
Rear Canopy Post

131-252
Whiplash Canopy

131-153
Carbon Fiber Breakaway Tab

131-154
Thumb Screw

131-179
X-Block - Nitro

131-180
6x13x5 Flanged Bearing

131-186
Anti Rotation Bracket

131-202
M4 Jesus bolt OWB V2

131-411
Clutch Bell Assembly

131-414
14T Pinion Gear

131-419
15x24x4 Bearing

131-420
Middle Main Shaft Bearing Block

131-424
Main Gear Hub

131-429
Carbon Fiber X-brace

131-442
Bottom Main Shaft Bearing Block

131-454
M4 Tray Mount

131-487
Whiplash C/F Frame Right - Nitro

131-488
Whiplash C/F Frame Left - Nitro

132-117-B
117T Main Gear

131-466
Auto Hub Crown Gear Mounting Base

131-469-1
Crown Gear Plate

131-470
70T Crown Gear

132-59
C/F Front Frame Doubler

3200-30
40" Spiral Band for Wire

3200-48
3/4" Hook and Loop Tape

3200-54
17" Adhesive Hook and Loop

Hardware for this assembly

0011-4 x 1
5x15x.08 Washer

0014F x 1
5mm Hex Nut
Fine Thread

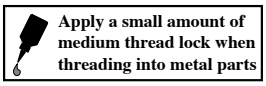
0032-2 x 4
M3x8 tapping screw

0061 x 4
M3x8 Socket Bolt

0064-3 x 6
M3x6 Button Head
Socket Bolt

Assembly Tips

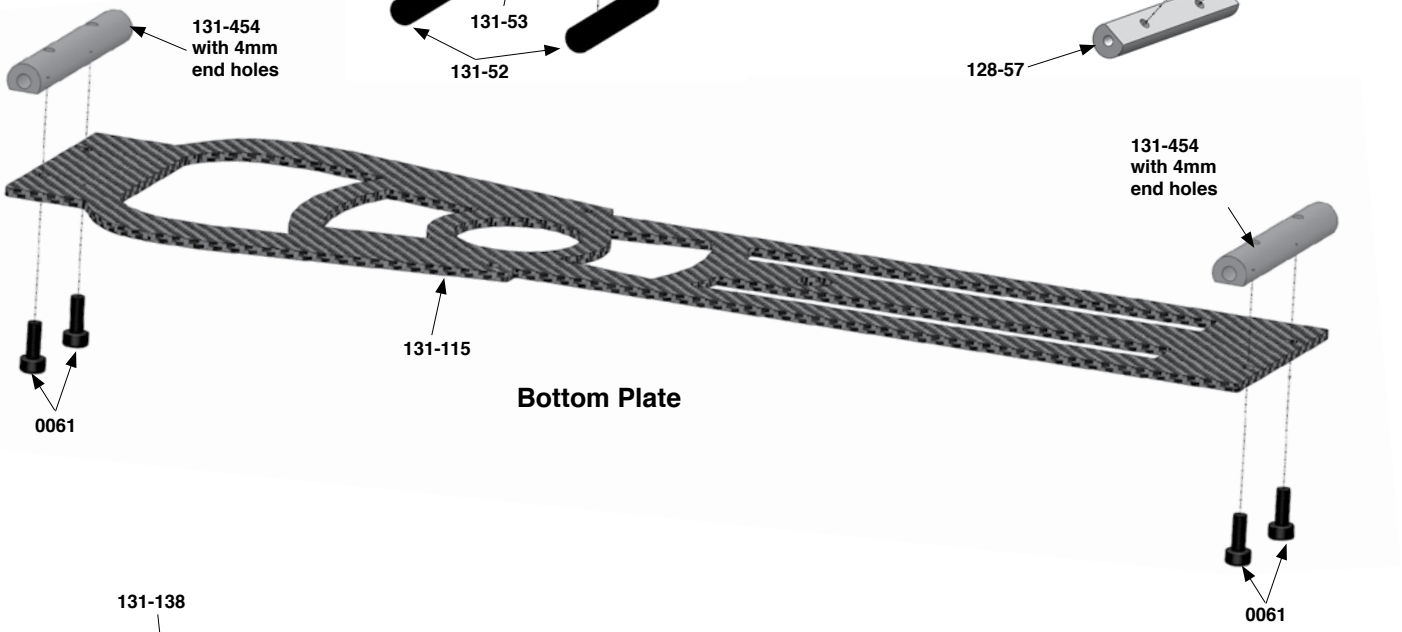
- Do not overtighten MA0032-2 Self Tapping Screw into MA131-52 Delrin Tray Mount.
- Ensure the MA131-454 M4 Tray Mounts are used in the correct locations on the ends of MA132-58 Bottom Plate.



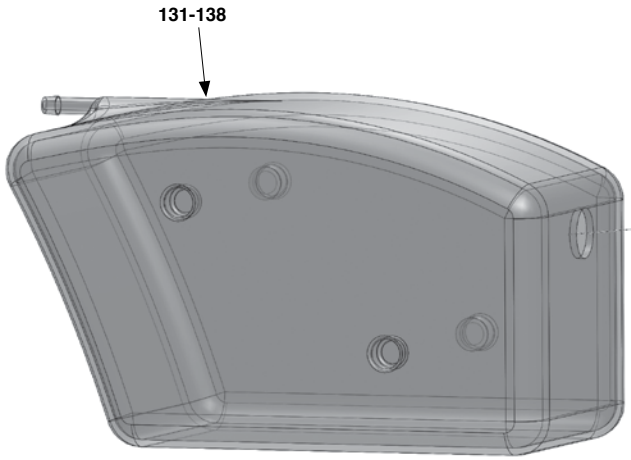
Front Battery Tray

3-A

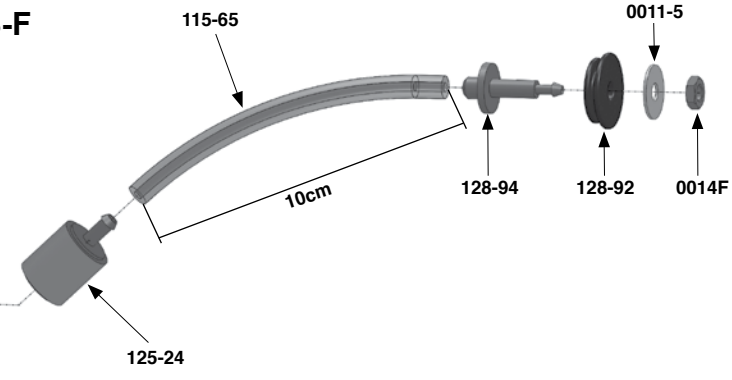
Gyro Plate



Bottom Plate



3-F



Hardware for this assembly

0032 x 2
M3 Self Tapping Screw

0060-1 x 4
M3x6 Socket Bolt

0061 x 9
M3x8 Socket Bolt

0069 x 1
M3x16 Socket Bolt

0107 x 2
M3x6 Threaded Steel Ball

Apply a small amount of medium thread lock when threading into metal parts

Hardware for these assemblies

0003 x 3
M3 Washer

0060-1 x 10
M3x6 Socket Bolt

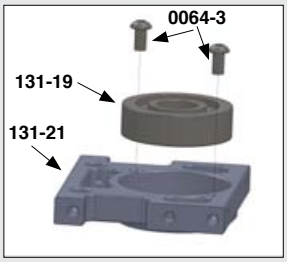
0063 x 5
M3x10 Socket Bolt

0065 x 2
M3x12 Socket Bolt

Assembly Tip

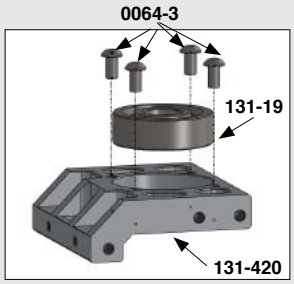
- **If using JR brand servos or other "tall" servos, MA131-47 Servo Rail Spacers are included for proper servo linkage alignment, if required.**
- **Do not tigthen the three screws for the bottom bearing block now.**

Upper Main Shaft Bearing Block (Factory Assembled)



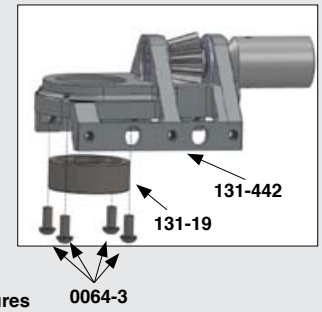
NOTE: Upper bearing block features smooth, wrench access holes

Middle Main Shaft Bearing Block (Factory Assembled)

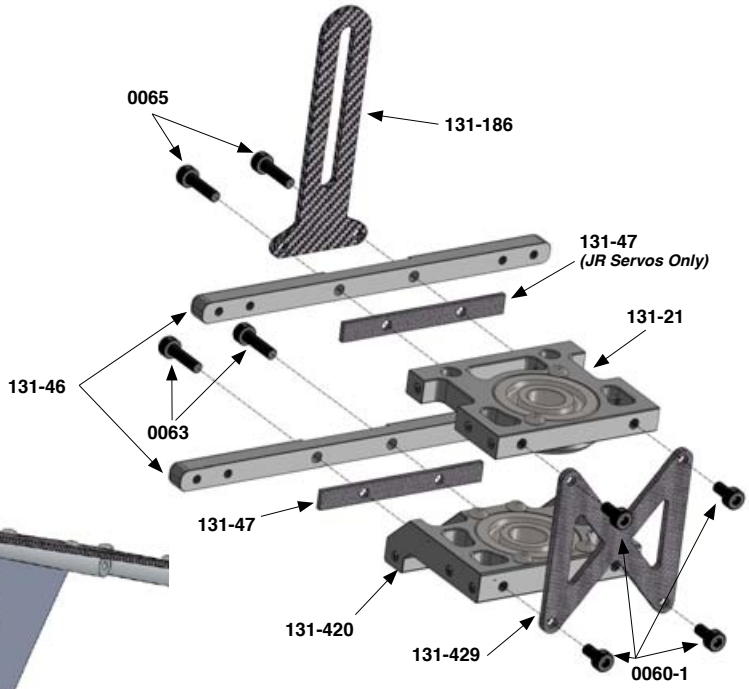


NOTE: Middle bearing block features threaded holes.

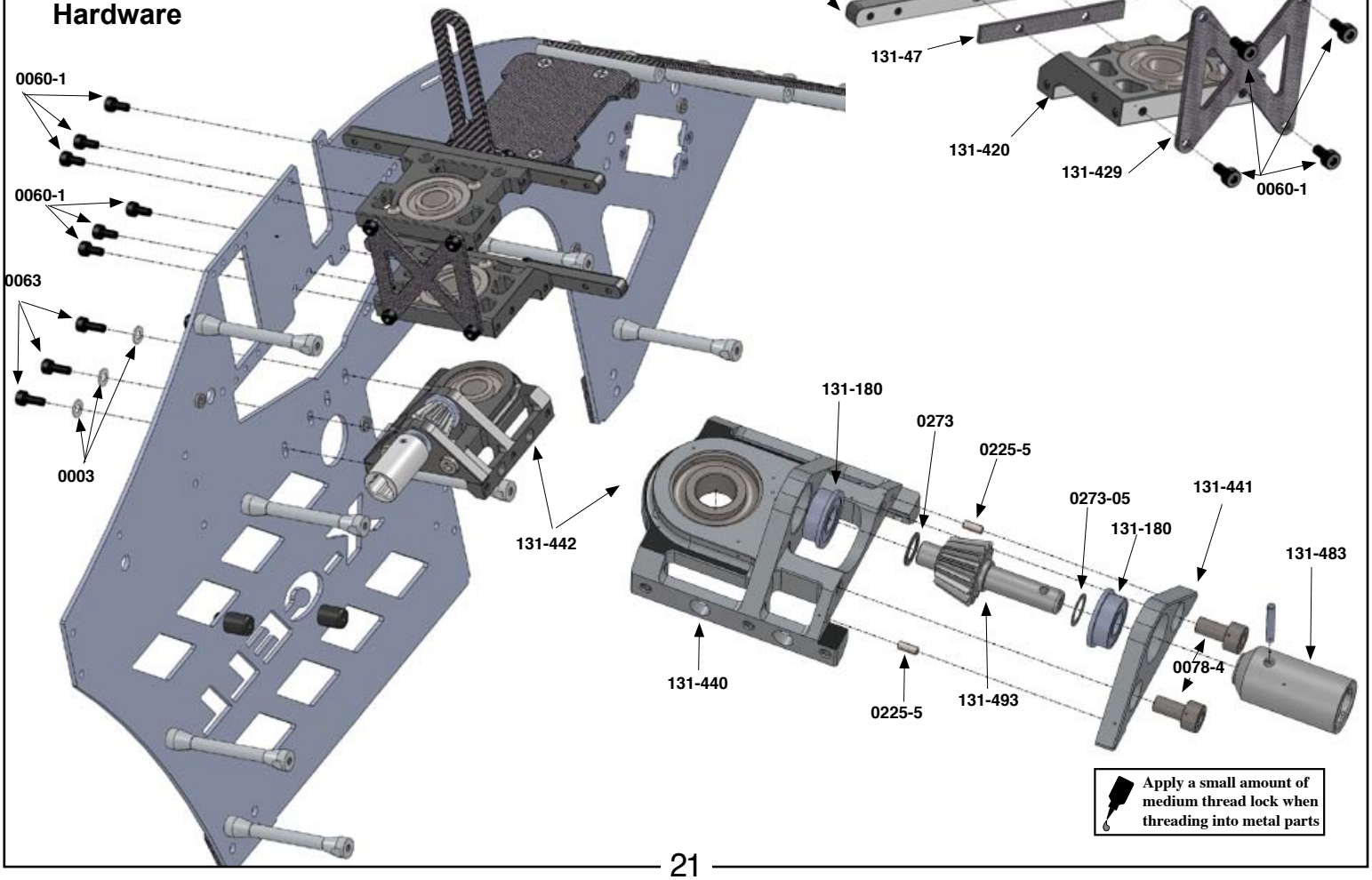
Bottom Main Shaft Bearing Block (Factory Assembled)



3-B



Hardware



Apply a small amount of medium thread lock when threading into metal parts

Hardware for these assemblies

0004 x 4
M4 Washer

0057 x 2
M4x4 Socket Set Screw

0063 x 2
M3x10 Socket Bolt

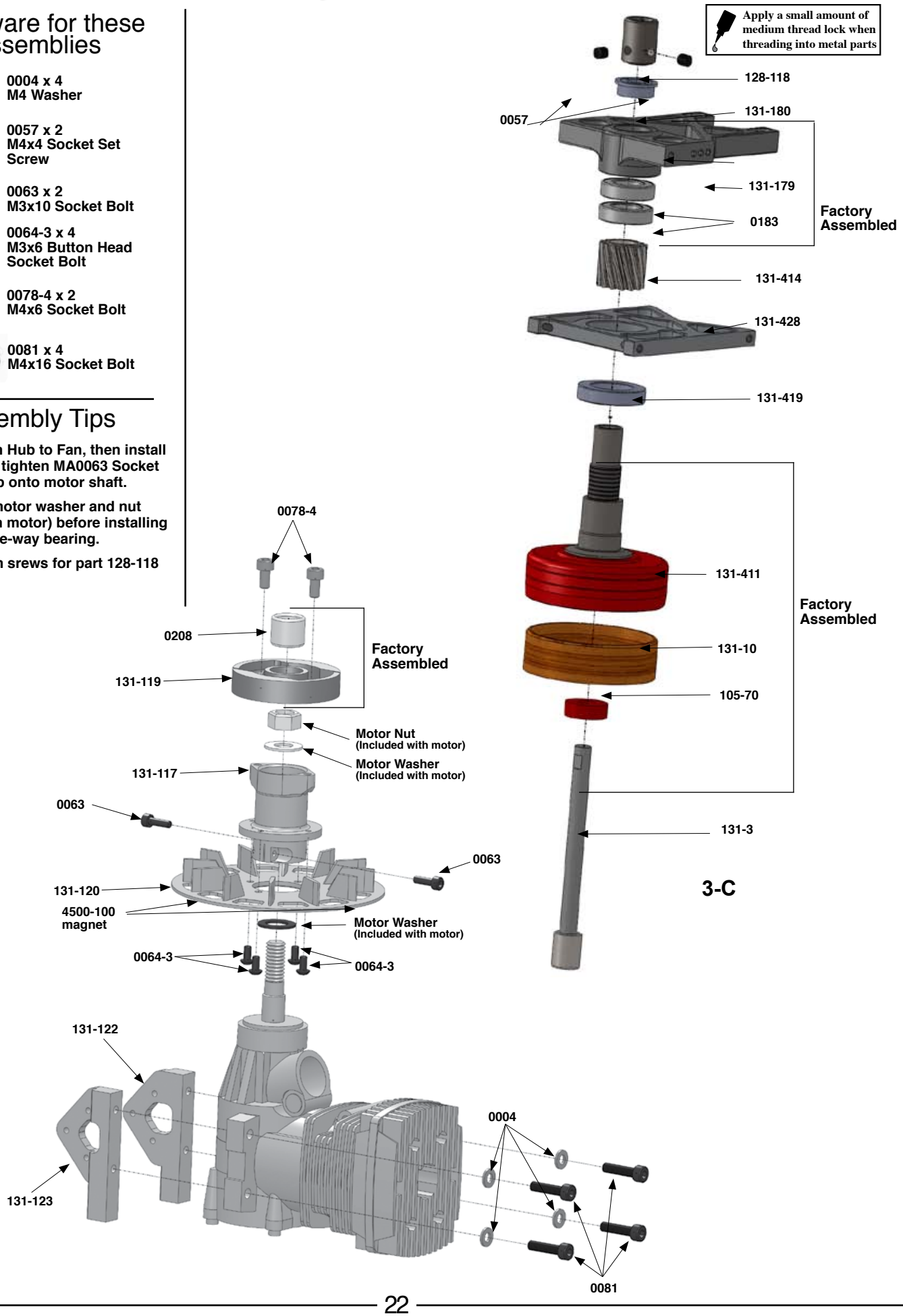
0064-3 x 4
M3x6 Button Head Socket Bolt

0078-4 x 2
M4x6 Socket Bolt

0081 x 4
M4x16 Socket Bolt

Assembly Tips

- **Assemble Fan Hub to Fan, then install on motor and tighten MA0063 Socket Bolts to clamp onto motor shaft.**
- **Next, install motor washer and nut (included with motor) before installing clutch and one-way bearing.**
- **Do not tigthen srews for part 128-118 now.**



Hardware for these assemblies

0003 x 6
3mm Flat Steel Washer

0032 x 2
M3 Self Tapping Screw

0053-5 x 2
M3x16 Socket Set Screw

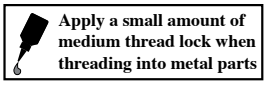
0060-1 x 6
M3x6 Socket Bolt

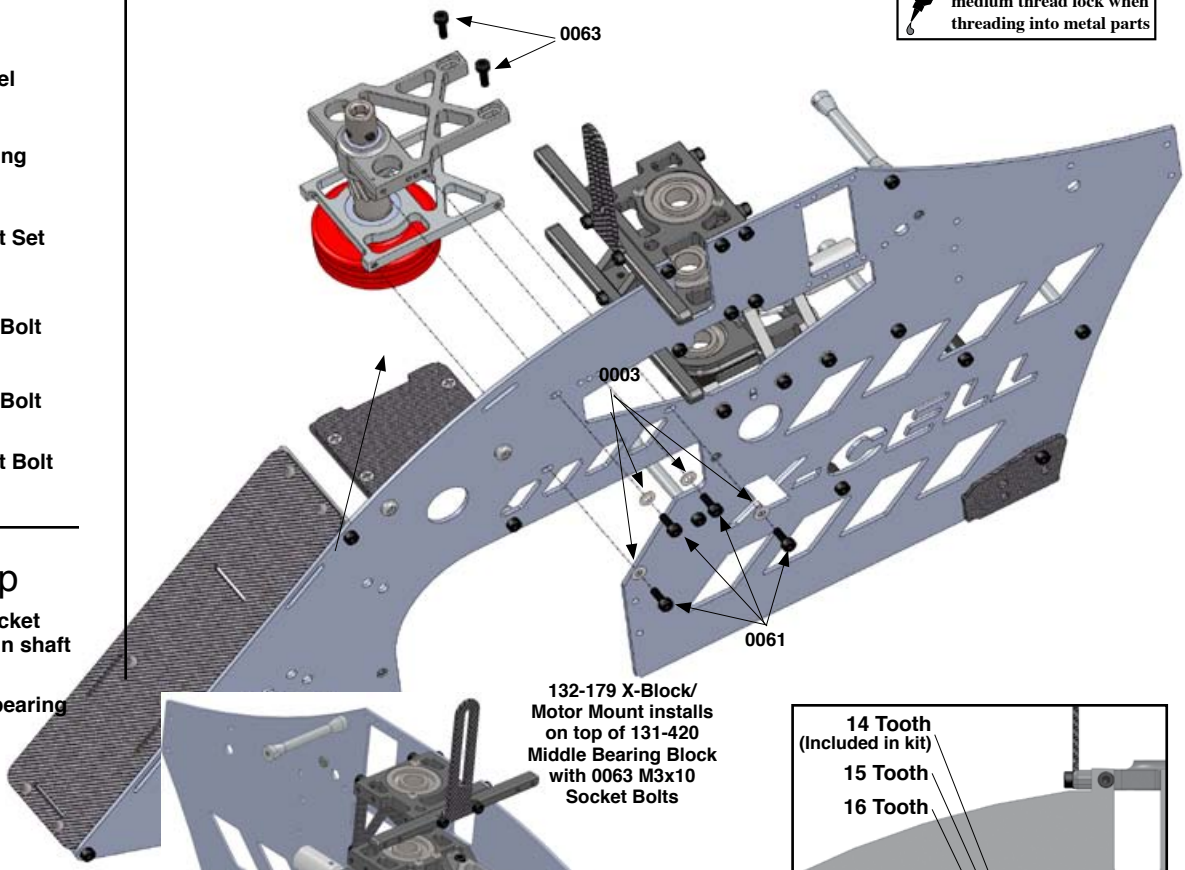
0061 x 15
M3x8 Socket Bolt

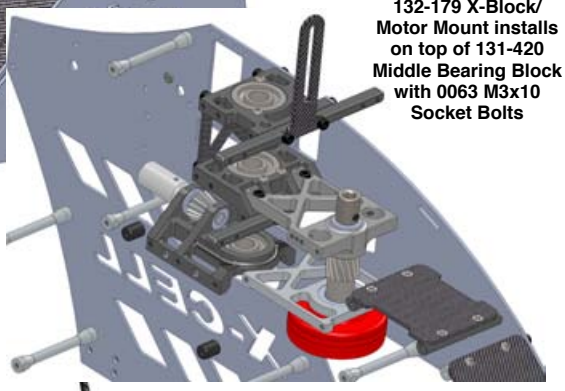
0063 x 5
M3x10 Socket Bolt

Assembly Tip

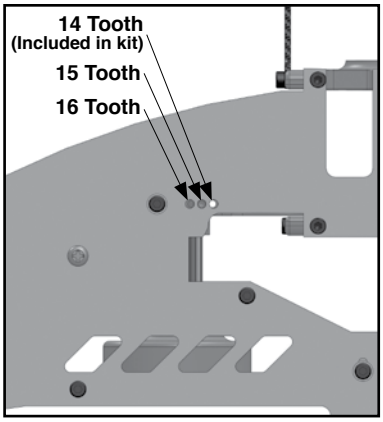
- **Note - MA0060-1 M3x6 Socket Bolts are used for the main shaft bearing blocks.**
- **Do not tigthen srews for bearing block 131-428 now.**



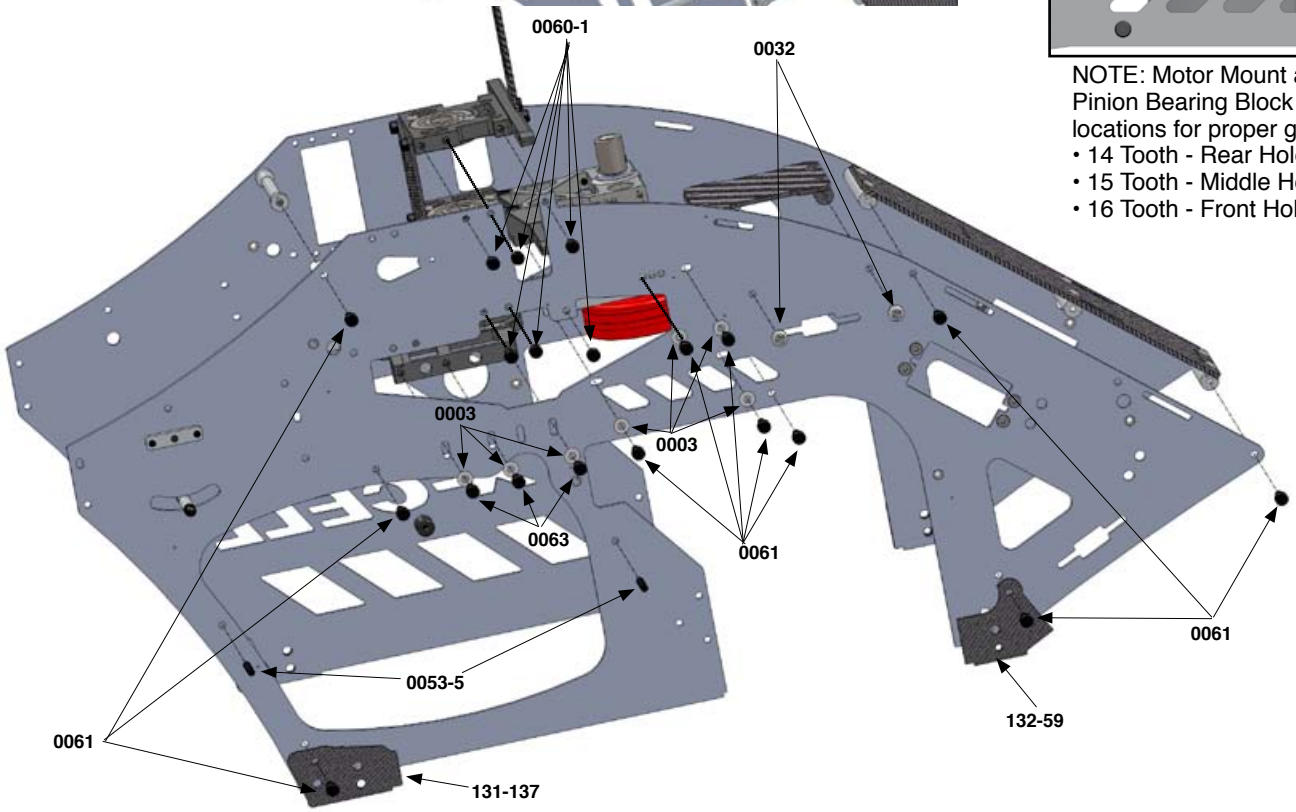




132-179 X-Block/ Motor Mount installs on top of 131-420 Middle Bearing Block with 0063 M3x10 Socket Bolts



NOTE: Motor Mount and Lower Pinion Bearing Block bolt locations for proper gear mesh.
- 14 Tooth - Rear Holes
- 15 Tooth - Middle Holes
- 16 Tooth - Front Holes



Hardware for these assemblies

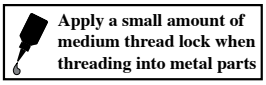
0057 x 4
M4x4 Set Screw

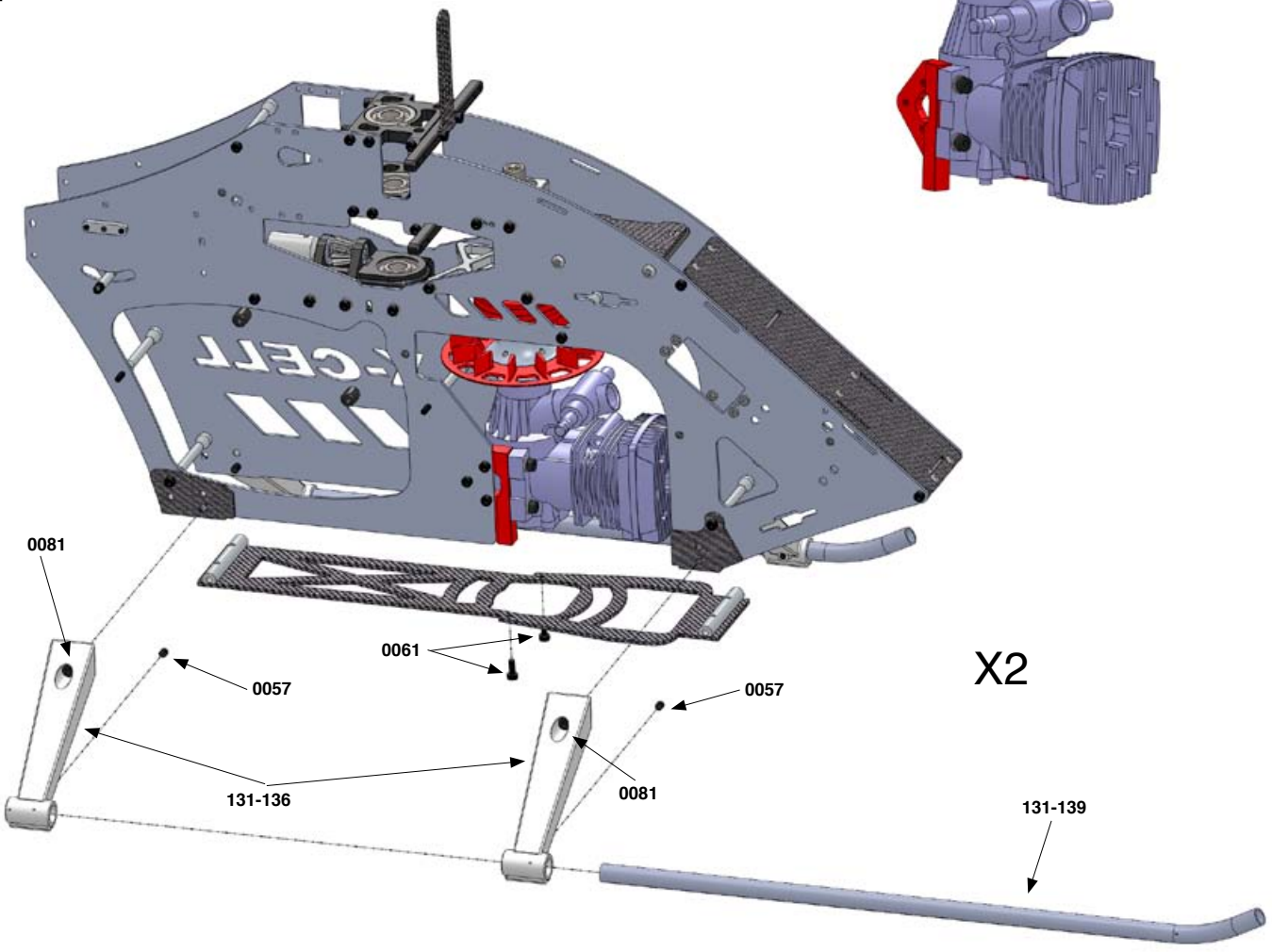
0061 x 8
M3x8 Socket Bolt

0081 x 4
M4x16 Socket Bolt

Assembly Tip

- **Tighten the MA0057 M4x4 Set Screw securely against the landing gear tube using thick cyanoacrylate glue.**
- **Press startshaft 131-3 to the top and tighten screws at part 128-118**
- **Install engine and take care that it is aligned properly (start shaft can be rotated easy clockwise)**
- **Tighten screws of bearingblick 131-428 now (use loctite blue #243)**



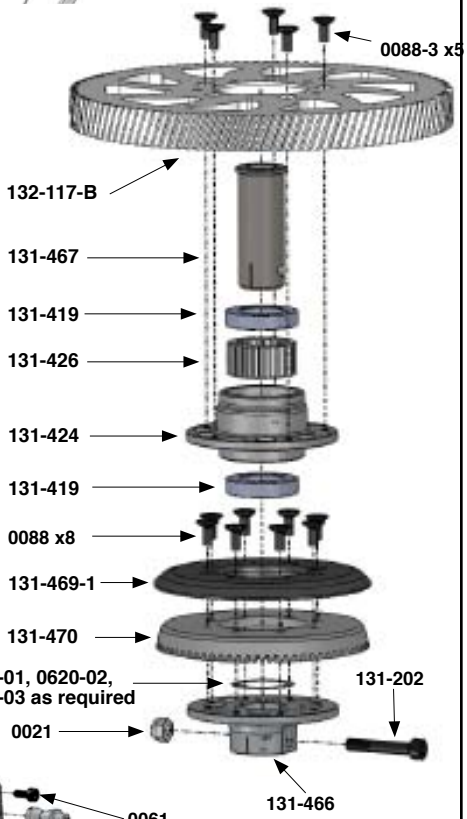


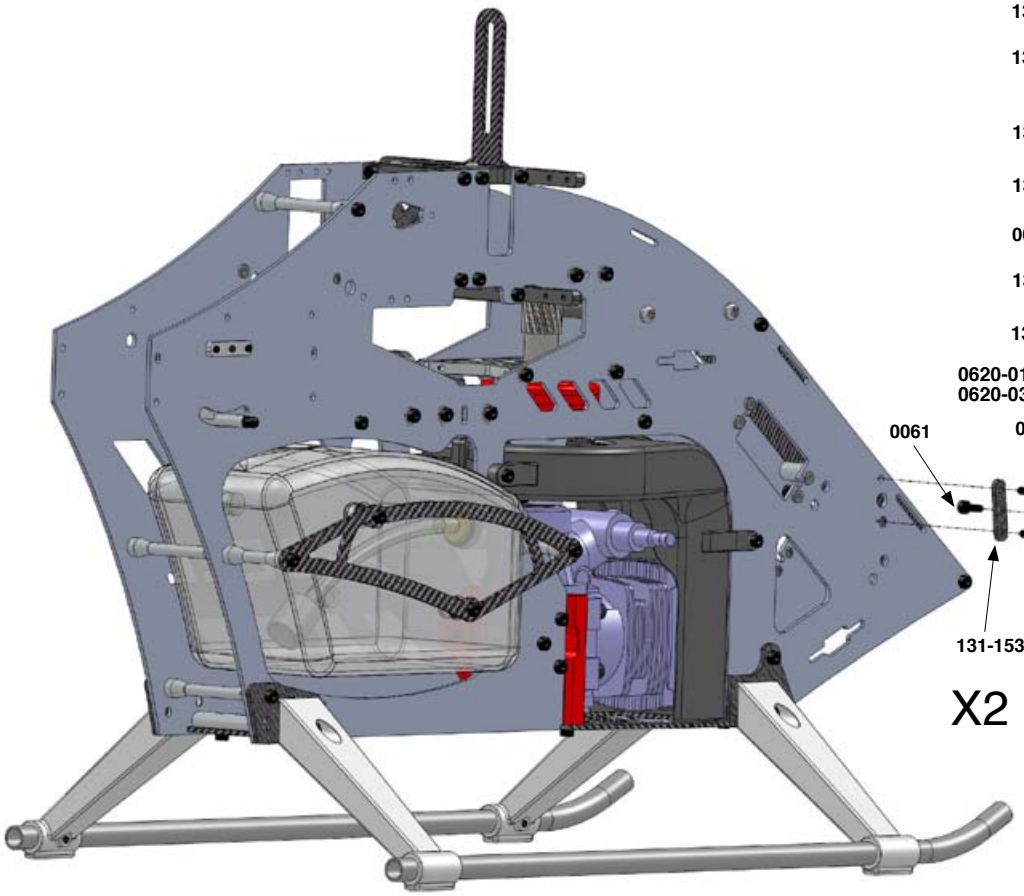
Hardware for these assemblies

- 0021 x 1 M4 Lock Nut
- 0060-1 x 2 M3x6 Socket Bolt
- 0061 x 4 M3x8 Socket Bolt
- 0063 x 6 M3x10 Socket Bolt
- 0088 x 8 M3x8 Tapered Bolt
- 0088-3 x 5 M3x7 Tapered Bolt
- 131-202 x 1 Jesus Bolt OWB

Apply a small amount of medium thread lock when threading into metal parts

3-F





X2

Lower canopy mounting bolt MA0061 installed into PEM nut in frame is optional. Installing bolt will decrease canopy vibration, but increase chance of damage to canopy in a crash.

Hardware for these assemblies

0017-2 x 4
2.5mm Hex Nut

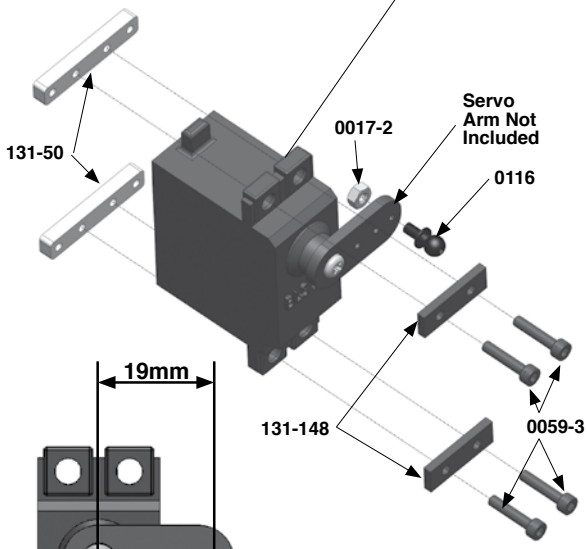
0059-1 x 4
M2.5x6 Socket Bolt

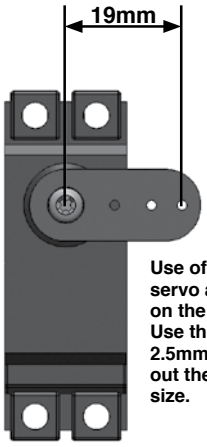
0059-3 x 16
M2.5x10 Socket Bolt

0116 x 4
M2.5 Threaded Steel Ball

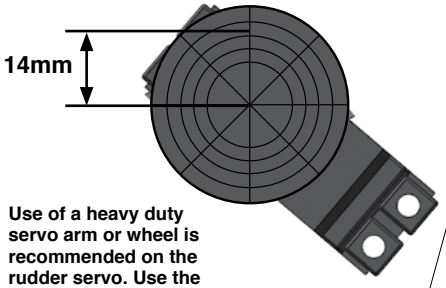
Assembly Tip

- **MA131-148 Servo Spacers are included for proper servo linkage alignment, if required.**

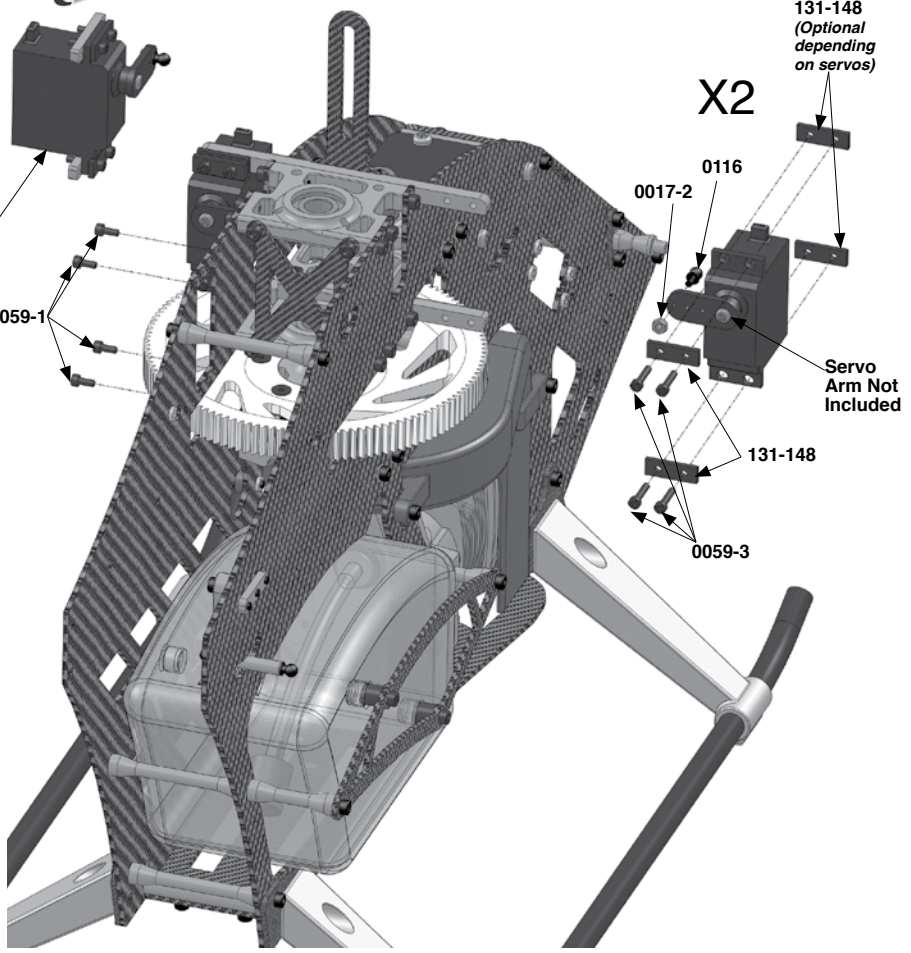


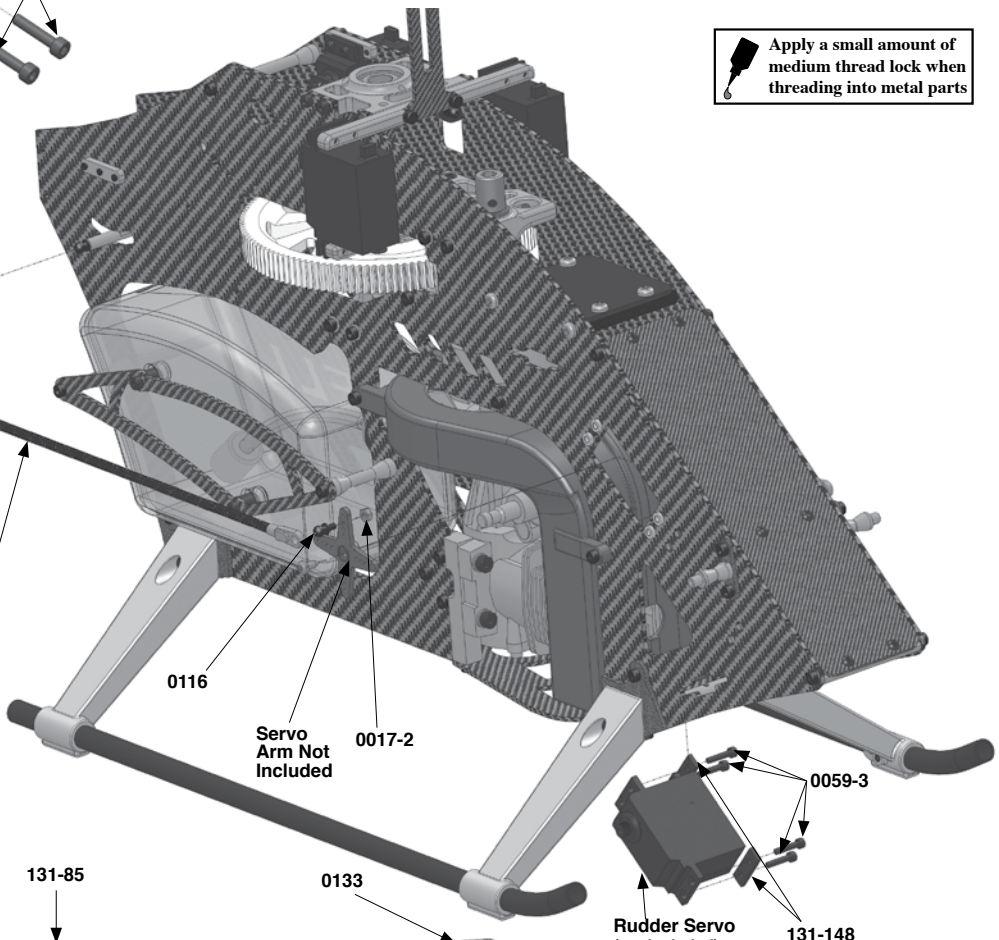


Use of heavy duty servo arms is required on the cyclic servos. Use the included 2.5mm Drill Bit to drill out the proper hole size.



Use of a heavy duty servo arm or wheel is recommended on the rudder servo. Use the included Drill Bit to drill out the proper hole size.





Hardware for these assemblies

0017-2 x 2
2.5mm Hex Nut

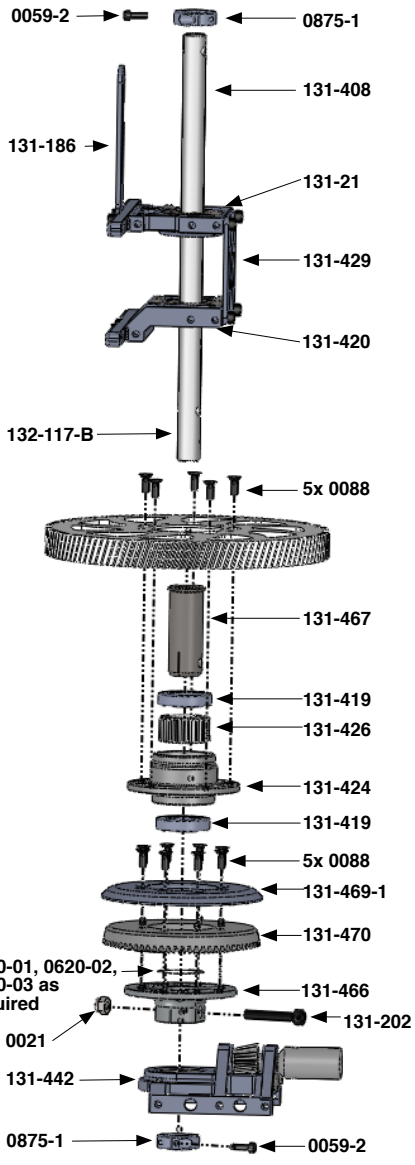
0059-3 x 4
M2.5x10 Socket Bolt

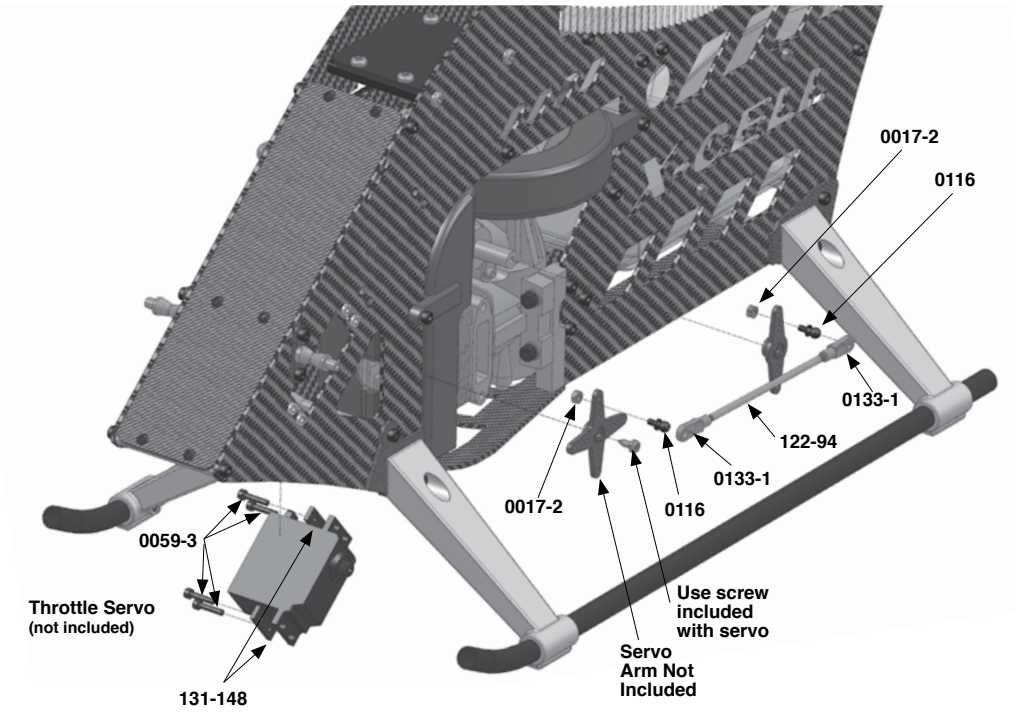
0061 x 6
M3x8 Socket Bolt

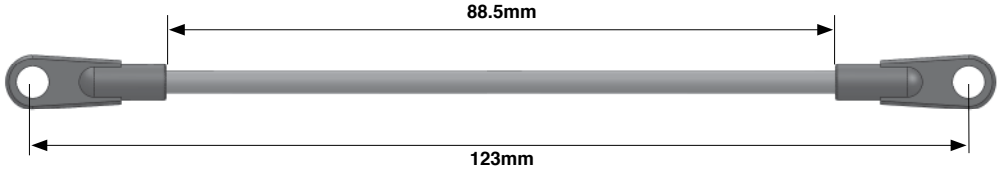
0116 x 2
M2.5 Threaded Steel Ball

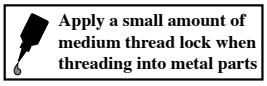
Assembly Tip

- **Throttle linkage length is only an estimate. Linkage lengths will very depending on motor and servo brand.**

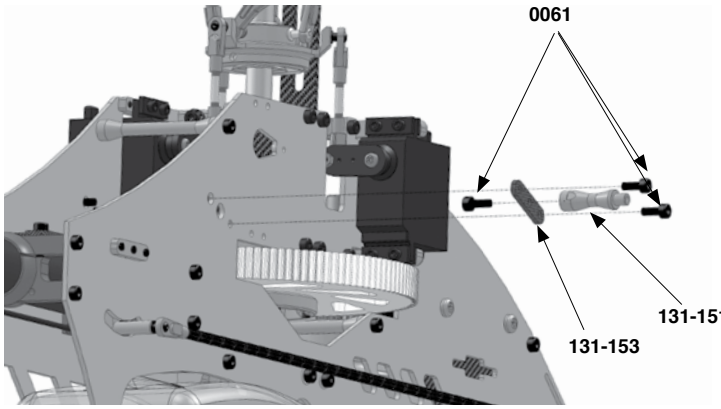








Rear canopy mounting bolt MA0061 installed into PEM nut in frame is optional. Installing bolt will decrease canopy vibration, but increase chance of damage to canopy in a crash.



X2

Hardware for these assemblies

0003 x 2
M3 Washer

0016-2 x 2
4mm External Serrated Lockwasher

0021 x 1
M4 Hex Locknut

0059-2 x 2
M2.5x8 Socket Bolt

0061 x 8
M3x8 Socket Bolt

0081 x 2
M4x16 Socket Bolt

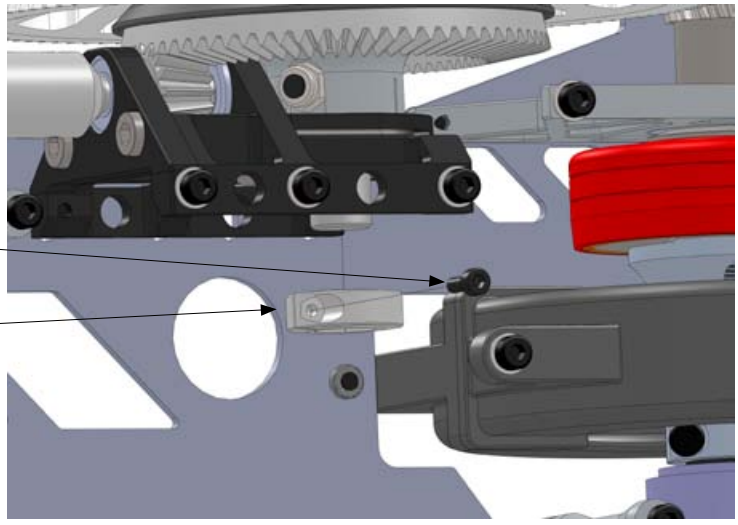
131-202 x 1
M4 Jesus Bolt OWB V2

Assembly Tips

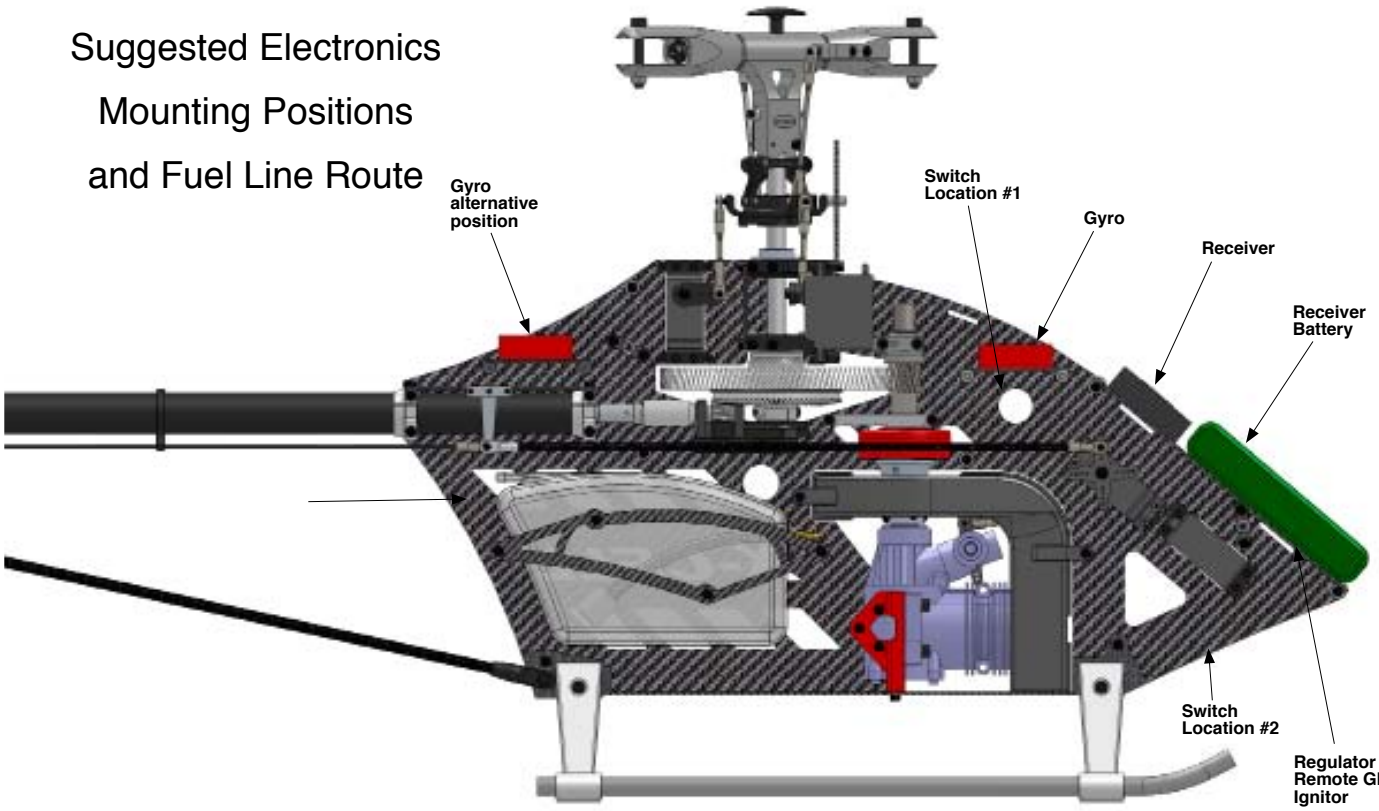
- **One collar 0875 is installed on top of the Middle Bearing Block and one on bottom of the Bottom Bearing Block.**
- **Don't forget to use some Loctite blue #243 at screws 0059-1. Do not overtighten.**

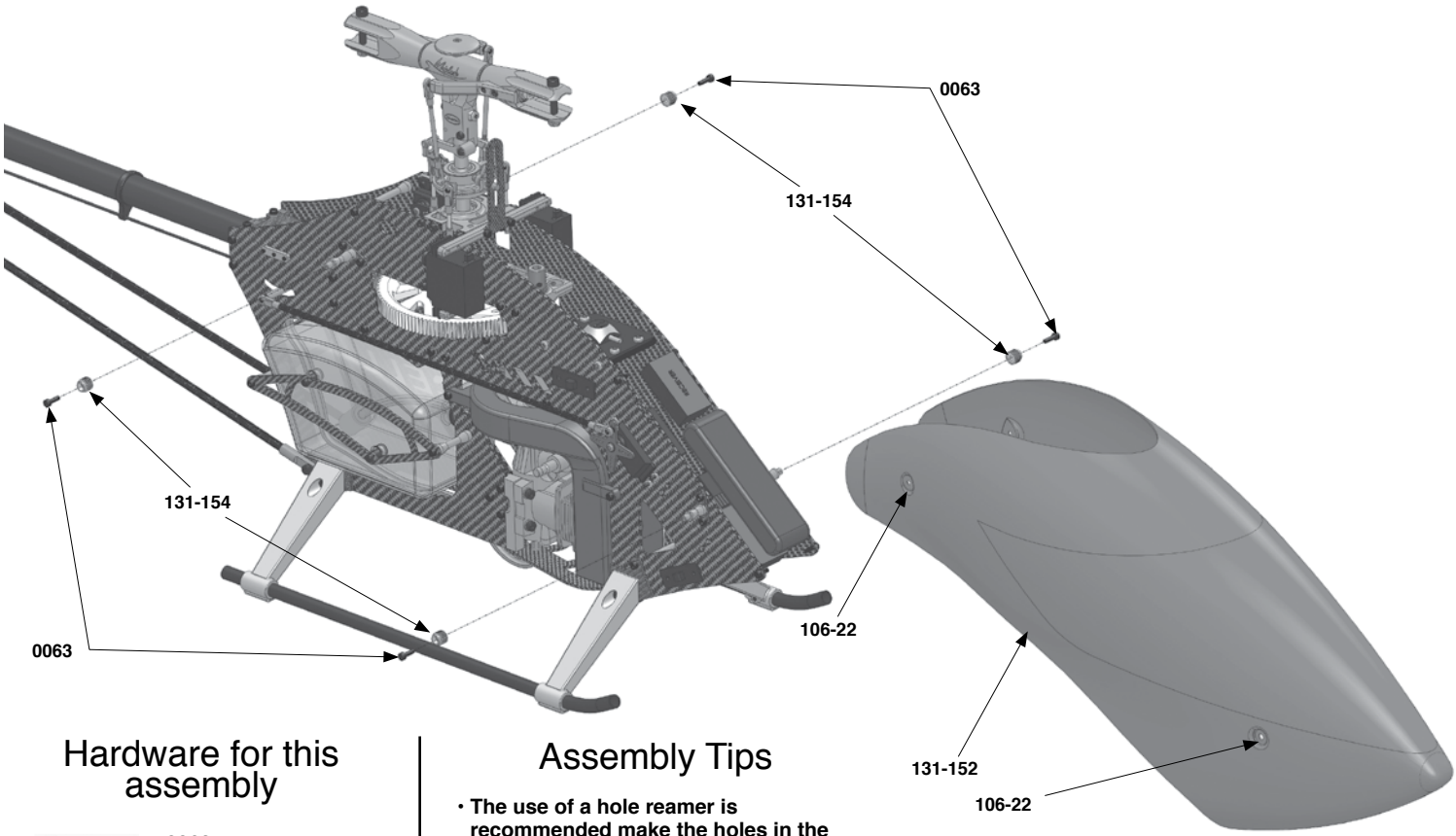
Apply a small amount of medium thread lock when threading into metal parts

After Main Shaft is bolted to the Main Gear, adjust Bottom Main Shaft Bearing Block to eliminate any vertical play. Tighten Bottom Bearing Block bolts.



Suggested Electronics Mounting Positions and Fuel Line Route





Hardware for this assembly

0063 x 4
M3x10 Socket Bolt

106-22 x 4
Rubber Canopy Grommet

Assembly Tips

- **The use of a hole reamer is recommended make the holes in the canopy for the canopy mounts. Final hole size should be 0.300" or 7.6mm**
- **Use CA glue to secure the grommets into the canopy. Be careful no to get it on the outside of the canopy as it will damage the finish.**

Basic Model/Radio set up

The X-Cell Whiplash is an eCCPM model. This means that the servos that are connected to the swashplate move together to achieve the function requested from the transmitter input. The transmitter mixes the channels required to achieve the correct movement of the swashplate. The X-Cell Whiplash uses a very simple “direct” servo to swashplate system that decreases the overall parts count and complexity of the model.

The very first thing to do, is center the swashplate servos. Simply align the servo horns so they are 90 degrees to the servo, and the linkage is 90 degrees to the servo horn. Ideally, you rotate the servo horn until the servo is centered, eliminating the the need for using sub-trim.

For the pitch, aileron, and elevator servos:

In your radio

- ATV (servo endpoints) should be at 100%.
- Set all trims and sub-trims to center or zero.
- Set an initial linear pitch curve as a straight line (sample points: 0%, 25%, 50%, 75%, and 100%).
- Make sure there is no mixing enabled for cyclic channels at this point.
- Center the collective stick and make sure all the cyclic channels are centered.

On your model

- Mount each ball into a servo arm hole approximately 19-20mm from the center of each arm.
- Slide the servo horns for each channel onto each servo exactly in the middle of its travel.
- Failing to get them set at center will create interaction in your swash plate travel.
- If possible, center the horns on the servos without using any sub trim. As a last resort, use the sub trim function to precisely center each servo.
- Make sure you install hex nuts on the ball retainer bolts using thread locking compound.
- Make sure you install servo arm retainer screws.

For the rudder servo:

In your radio

- Make sure the gyro is in non-heading hold mode. Refer to your gyro manufacturer as to how to enable this.
- Rudder servo endpoints (ATV) should be at 100%.
- Make sure there is no mixing enabled for rudder channel at this point (some radios mix throttle to rudder by default).

On your model

- The ball should go into a hole approx 13-15mm from the center of the servo wheel.
- With your rudder stick centered, rotate the servo wheel until you find a spot that aligns properly and then slide the servo wheel onto the servo exactly in the middle of its travel. Do not use any sub-trim.
- Now make sure that the T/R bell crank is aligned. The 90 degree pitch slider on the tail case should be in the center of its travel. Adjust the links as necessary to ensure this is correct.
- Make sure you install hex nuts on the ball retainer bolts using thread lock.
- Make sure you install servo arm retainer screws.
- Set up the gyro according to the manufacturers specification in the manual included with the gyro.

Swashplate eCCPM Set Up:

Now that you've built your new Whiplash helicopter, you have to make the servos work together. The Whiplash is an eCCPM model, and requires a specific radio program for the servos that control the swashplate. eCCPM is a mix that is already programmed in your transmitter, you just have to fine tune it to your Whiplash and here's how:

The very first thing you need to do is tell your radio that a 120 degree eCCPM mix must be used. All modern transmitters should have 120 degree eCCPM built programmed from the factory. Consult the manual that came with your radio! Before you turn on your Transmitter and power up your servos, you need to make sure they are centered. With your transmitter and receiver powered on, put collective stick in the exact center with all three swashplate servo horns removed. Then put the horns on so they are 90 degrees to the linkage. This centers the servo horn on the servo and assures that there will be equal travel on either side of the servo's center point. If you find that you cannot get the servo horn exactly at center, you have two choices. You can flip the horn 180 degrees, sometimes the splines will line up perfect, this is the preferred method. You can also use a bit of "sub-trim" to center the servo. You really want to avoid using subtrim because it makes leveling the swashplate a little more involved.

Now you need to make sure that your servos are all working together. What we mean is the three collective servos need to be plugged into the appropriate channels, i.e. the elevator (which is the servo that controls the center ball on the swash) needs to be plugged in to channel 3, the aileron and pitch servo (the ones that control the sides of the swashplate) need to be plugged into channels 2 and 6 (it doesn't matter which channel just either servo, into either 2 or 6 on the RX).

The channel assignments for ail, elev, rudder, throttle and pitch may vary depending upon the brand and model of your radio. Consult the transmitter manual or use the TX servo monitor (if it has one) to ensure that the correct servo is receiving its signal from the correct channel. Note: the position of the pitch and aileron servos in relationship to the elevator as indicated in your radios setup manual are important. Make sure you connect them exactly as the radio manual shows when the swashplate is viewed from above.

Then, using the servo reverse screen, you need to make sure that the servos are doing the proper function. All the servos need to move up (or down) when the collective stick is moved up or down (it doesn't matter if the collective is reversed, we'll fix that later). If it doesn't, you need to (one at a time) reverse the channels on the servo reverse screen until all the servos move in the same direction when the collective stick is moved.

Now the aileron and elevator functions need to be sorted out. When you move the right stick right and left, the swashplate should tilt to the right and left (it doesn't matter if it moves right when you push the stick left, we'll fix that later). Also, when you move the right stick forwards and aft, the elevator should tilt forward or back (at this point it doesn't matter if the function is reversed, proper direction will be addressed in the next step).

Now that the SERVOS are all moving in together, we need to be sure that the SWASHPLATE is moving correctly for a given command. Pull up the Swash Mix screen. Futaba calls it "Swash AFR" There should be 3 functions and they'll look like this:

Aileron: 60%
Elevator: 60%
Pitch: 60%

So, if the the swashplate tilts left when you move the cyclic (right) stick TO the right, make the value of 60% for Aileron NEGATIVE or -60%, and likewise for the elevator. If the swash tilts forward when you pull the cyclic stick BACK, make the value of 60% NEGATIVE or -60% to correct it.

The swashplate should move up and down with the collective stick, and if you RAISE the collective stick, the blades should show POSITIVE PITCH. And if you LOWER the collective stick, the blades should show NEGATIVE pitch. IF that function is reversed, again, make the value of 60%, NEGATIVE 60% or -60%.

To ensure that your Whiplash is set up as precise as possible, it is very important that you follow the pitch curve set up guide and properly level the swashplate. There are several different tools for determining if your swashplate is level. We recommend the MA3000-10 Swashplate Leveling Tool.

Place the swashplate leveler on the swashplate and ensure that it is level. The collective stick should be at the center with zero degrees pitch on the blades. At this same time as described in the pitch curve set up guide, the swashplate should then be in the center of its travel, and the midpoint of the pitch curve should read 50%. If the swashplate is not level, you can use subtrim to level it, but the preferred method would be adjusting the linkages that connect the swashplate to the servos! If you find that you have to use more than a couple of clicks of subtrim on any channel, you should put it back to zero, and adjust mechanically by adjusting the linkages to the swashplate. After the swashplate is perfectly level at center stick, you need to level it at the extreme pitch range, i.e. full positive pitch and full negative pitch.

Place the Collective stick at full positive stick with the swash leveling tool attached. If the swashplate is not level, you will use the End Point screen or Travel Adjust screen. For instance, if the swashplate tilts slightly to the right at full positive pitch, then you will need to increase the travel for the servo that controls that swashplate ball. Now put the collective stick at full negative and repeat the same procedure with the end points. You do have to be careful that you don't create any binding at the extremes of the swashplate's travel.

Pitch Curve Set Up:

It is important that you build your model exactly the way we describe in this manual. Make sure all your linkage rods are exactly the length determined in the manual included with your helicopter kit.

First, go to the pitch curve menu in your radio for Idle up 1, or Stunt mode 1. You'll see numbers, a graph, or both. There will generally be 5 points you can adjust. You'll have to imagine the points (1,2,3,4,5) as representing points on the collective stick, where point 1 represents full bottom stick, and 5 represents full top stick. Obviously that makes point 3 center stick and that's where we start.

Ensure that point 3 on the pitch curve (center stick) to equal 50% of the swashplate's up and down travel, meaning the in the middle of it's available travel. So, turn on your transmitter, and receiver, flip the flight mode switch to idle-up 1 or Stunt mode, and scroll to the pitch curve menu. Now place the left stick in the center.

Use a pitch gauge, (we recommend the Mavrikk 3802) ensure that there is 0 degrees pitch on both rotor blades and that the mixing arms, and washout arms are perpendicular to the mainshaft. If any of this is untrue, you'll need to make it so, by adjusting slightly the length of the pushrods.

Now that you've got 0 degrees at center stick, and point 3 on the pitch curve has a value of 50% (don't deviate here!) We can adjust the pitch at full top and bottom collective stick positions. Generally we want to have the same amount of pitch on the bottom stick position as we do on the top stick position in idle up or stunt mode. That means positive 10 degrees on top stick, and negative 10 degrees on bottom stick (some pilots are now using more pitch 12, 13 or even 14 degrees, but most people find 10 degrees to be an acceptable initial setting to learn 3D flying).

With the transmitter still in idle up, or stunt mode place the collective stick at the top of it's travel, and take a reading of the pitch gauge and remember that number. It should be a positive pitch value and 10 degrees is a good place to start. Now place the collective stick at the full bottom of it's travel. It should be a negative pitch value and again -10 degrees is a good place to start. If the value is not close to 10 degrees then making it so is a simple adjustment of the swash mix function in your transmitter. In this menu, "swash mix" or "swash AFR", there are three options. Elevator, Aileron, and Pitch. Adjusting the pitch value, adjusts the total up and down travel of the swashplate. Making the number higher gives you a greater pitch range, and making the number lower gives you a smaller pitch range.

If you find that at full top stick, you get a negative pitch value, and at bottom stick you get a positive pitch value, you would go back to that "swash mix" menu, and make the value the opposite, Meaning if it was 60%, make the number –60%. That will change the direction of the swash travel.

Now, You'll notice that your pitch "curve" isn't really a curve at all, it's a straight line. You can adjust this if you wish by changing points 2 and 4. Right now, point 2 is 25%, and point 4 is 75%. You can change those values and it will affect how "jumpy" or responsive the collective is. Usually leaving it a straight line is best until you really get the "feel" for 3D flying.

If you're a beginner chances are you'll want to fly your model around in "normal" mode. Normal mode means that at full bottom stick the engine is at idle and the blades are not turning. You also don't have any need for there to be negative 10 degrees of pitch, usually more like -4 degrees is best.

This can easily be achieved by raising points 1 and 2. Scroll in the transmitter menu to pitch curve for normal mode, and increase point 1 from 0% to about 35%, and then you can usually inhibit point 2, so it makes a straight line from point 1 to point 3, which should still be 50%.

The Pitch Curve for throttle should usually look real similar to stunt mode. Throttle hold is generally used for performing autorotations.

Throttle Curve Set Up:

Build the throttle linkage as shown previously. This linkage length may change but ideally, you'll want the servo linkage 90 degrees to the servo horn. This ensures equal travel in both directions.

Turn on your transmitter. Scroll to the "throttle curve" screen and notice that there are points, usually 5, that all have an assignable percentage. For example point 1 is 0% and point 5 is 100% (of the servo's travel). Ensure that when the throttle/collective stick is at the mid point (point 3) that the engine's carburetor is exactly ½ or 50% open (or otherwise stated in the manual included with the engine). This is crucial to easy set up. You may have to loosen the throttle arm on the carburetor for this to happen. Place the throttle stick to ½ and see where the carburetor opens to. On most popular engines today there is a mark that shows the halfway point. If it is not quite ½ way open you can use sub trim to make it so, but you don't want to use too much. Too much sub trim can make further set up more difficult.

Move the throttle stick to full throttle. The servo should open the carburetor to full open. If it opens less you can increase the end point in your radio so that it opens further, and if the servo binds (servo keeps wanting to move but the carburetor is fully open,) you can decrease the endpoint. Ideally you want the endpoints as close to 100% and 100% as possible.

If you are experiencing the need for more servo movement, try moving the ball link out one hole on the servo arm. Conversely, if you need much less servo movement, you can move the ball link one hole in.

Once you have this set up in normal mode you'll have to start and fly the helicopter to determine whether you need further throttle adjustment. From what we've found this is a good starting point.

Setting up for Idle up or stunt mode is a little different, as you'll want full throttle on either end of the collective/throttle stick travel. Scroll to the idle up menu in your radio, and you'll again find points such as 1,2,3,4,5. If you do not have a governor you have to set up a fixed throttle curve that controls the throttle. If you have a governor, please follow the set up instructions from the manufacturer of the governor. Without a governor you'll rely on the throttle curve to control the engine rpm while you're managing the collective stick. Make points 1 and 5 100%. Make point 3 50% Then you'll want a friend with an optical tachometer (we recommend MA3000-50 Optical Heli Tachometer) to observe the head speed of your helicopter. Make sure to follow the rotor speed recommendations given by the manufacturer of the rotor blades you are using. If the head speed is too low, then increase the value of point 3 by 5% increments until you get the head speed you desire.

Flybarless Stabilization Electronics:

If you have chosen a Flybarless model, it is possible to fly your model without additional stabilization electronics, but Miniature Aircraft highly recommends using Flybarless Stabilization Electronics. There are several that are commercially available, and while they all generally accomplish the same thing, they all are set up and programmed differently. Contact your favorite R/C helicopter retailer and/or talk to your friends to decide which one will be the best for you.

Whiplash Kit Parts & Hardware

0003	M3 Washer
0004	M4 Washer
0009	M3 Washer Small
0011-5	M5.3x20 Washer
0012-1	2.5mm Pem Nut
0012-2	3mm Pem Nut
0014F	5mn Hex Nut - Fine Thread
0016-2	M4 External Serrated Lock Washer
0017-2	M2.5 Hex Nut
0019	M3 Lock Nut
0021	M4 Lock Nut
0023	M5 Nut
0032	M3 Self Tapping Screw
0050-1	M2.5 Set Screw
0051	M3x3 Set Screw
0053-5	M3x16 Set Screw
0056	M3x5 Dog-Point Set Screw
0057	M4x4 Set Screw
0058-3	M4x16 Set Screw
0059-0	M2.5x4 Socket Bolt
0059-1	M2.5x6 Socket Bolt
0059-3	M2.5x10 Socket Bolt
0060-1	M3x6 Socket Bolt
0061	M3x8 Socket Bolt
0063	M3x10 Socket Bolt
0064-3	M3x6 Button Head Socket Bolt
0064-4	M3x16 Button Head Socket Bolt
0065	M3x12 Socket Bolt
0067	M3x14 Socket Bolt
0069	M3x16 Socket Bolt
0071	M3x18 Socket Bolt
0073	M3x20 Socket Bolt
0078	M4x12 Socket Bolt
0078-3	M4x6 Socket Bolt
0081	M4x16 Socket Bolt
0082-4	M5x32 Shouldered Socket Bolt
0086-1	M5x16 Flanged Socket Bolt
0088	M3x8 Tapered Socket Bolt
0088-3	M3x7 Tapered Socket Bolt
0107	M3x6 Threaded Steel Ball
0109	M3x8 Threaded Steel Ball
0116	M2.5 Threaded Steel Ball
0133	M2x21.2 Ball Link
0133-1	M3x21.2 Ball Link
0159	3x7x3 Bearing
0183	10x19x5 Bearing
0208	10x12 One-Way Torrington
0214	Upper Swash Ring
0214-1	Lower Swash Ring
0215	M6 Tail Shaft Collar
0216	Heim Ball
0217	Swash Plate Assembled
0218	20x32x7 Swash Bearing
0219	Washout Center Hub
0225	Link Pin
0225-5	Link Pin
0273	6x10x.011" Steel Washer
0273-05	6x10 Steel Washer
0283	6x10x3 Flanged Bearing
0319	8x16x5 Bearing
0390	Large Wire Lead Retainer
0442	T/R Pitch Link
0447-1	M2 E Clip
0597-1	M3x4.75x.126" Brass Spacer
0597-4	Brass Spacer
0620-01	.10 Washer
0620-02	.20 Washer
0620-03	.30 Washer
0869	Washout Link
105-70	6x15x5 Bearing
106-02	3x7x3 Flanged Bearing
106-06	2x5x1.5 Flanged Bearing
106-22	5x11 Grommet
115-65	High Flex Fuel Line
120-7	5x15 C/F Safety Washer
120-25	Swash To Mixer Linkage Rod
120-39	5x10x4 Ball Bearing
121-4	Servo To Swash Linkage Rod
121-7	Swash To PA Linkage Rod
122-47	10x22x6 Bearing
122-48	22mm Circlip
122-70	M5x.25 S/S Shim Washer
122-94	M3x97 Threaded Control Rod
125-24	Fuel Filtered Pick-up Magnet
127-86	M6x9.7x1.0 Shim Washer
128-57	Tray Mount
128-58	Main Frame Spacer
128-59	M4 Frame Spacer
128-80	Front Boom Clamp
128-92	Fuel Tank Plug
128-94	Fuel Nipple
128-118	6mm Hex Adaptor
128-144	T/R Control Rod Guide
128-146	Boom Support End
128-149a	Upper Rear Boom Support Mount
128-149b	Lower Rear Boom Support Mount
128-176	Washout Pin
128-195	Head Button
128-196	Aluminum Bell Mixer
128-314	Swashplate Follower Arm
131-3	Start Shaft
131-10	Clutch Liner
131-17-B	Bevel Gear Shaft Side
131-18-B	Tail Bevel Gear TT Side
131-19	10x26x8 Main Shaft Bearing
131-21	Upper Main Shaft Bearing Block
131-23	6x13x5 Flanged Bearing - Tail Shaft
131-33	15x21x4 Bearing - Tail Gear
131-40	Bottom Main Shaft Bearing Block
131-46	P/A Servo Rail
131-47	C/F Servo Rail Spacer
131-50	Elevator Servo Mount
131-52	Delrin Tray Mount
131-53	Gyro Plate
131-54	M4 Tray Mount
131-55	C/F Angled Battery Tray
131-60	C/F Tail Fin
131-62	Tail Boom
131-64	Tail Hub
131-66	4x10 Thrust Bearings - Tail Grips
131-69	M2x315 Linkage Rod
131-69-1	T/R Push Rod
131-70	Tail Output Shaft
131-83	Anti Rotation Pin
131-84	Boom Support Rod
131-85	Carbon Pushrod Sleeve
131-86	Assembled Boom Support
131-107	T/R Bellcrank Swing Arm
131-109	Swing Arm Pivot Mount
131-112	T/R Blade Grip
131-115	C/F Bottom Plate - Nitro
131-117	Nitro Fan Hub
131-119	Nitro Clutch
131-120	Engine Fan
131-122	Left Motor Mount
131-123	Right Motor Mount
131-128	C/F Boom Clamp Plate
131-129	Tail Box
131-130	Tail Pitch Control Bellcrank
131-131	C/F Tail Bellcrank Bracket
131-132	Bellcrank Slider Cup
131-133	Whiplash Fan Shroud - Left
131-134	Whiplash Fan Shroud - Right
131-135	Bracket Washer
131-136	Strut
131-137	C/F Rear Doubler - Nitro
131-138	Whiplash Nitro Fuel Tank
131-139	Skid Tube
131-144	Rubber Fuel Tank Mount
131-145	Fuel Tank Standoff
131-146	C/F Fuel Tank Plate
131-148	C/F Servo Plates
131-150	Front Canopy Post
131-151	Rear Canopy Post
131-153	C/F Breakaway Tab
131-154	Thumb Screw
131-161	Main Blade Grip
131-163	FBL Pitch Arm
131-166	4x8x3 Flanged Bearing
131-179	Whiplash Nitro X-Block
131-180	6x13x5 Flanged Bearing
131-181	9x17x5 Radial Bearing
131-182	9x17x5 Thrust Bearing (F9-17)
131-183	9x14x.030 Washer
131-184	9x14x.080 C/F Damper Washer
131-186	Anti Rotation Bracket
131-187	Head Axle
131-200	M4x33 Shouldered Socket Bolt
131-202	M4 Jesus Bolt OWB V2
131-252	Whiplash Canopy
131-368	FBL Head Block
131-400	Torque Tube End
131-408	FBL Main Shaft
131-411	Clutch Bell
131-420	Middle Main Shaft Bearing Block
131-424	Main Gear Hub
131-429	C/F X-Brace
131-440	Bearing Block Mount A
131-441	Bearing Block Mount B
131-442	Bearing Block
131-473	7x11x3 Bearing - Control Ring
131-474	Control Ring
131-475	T/R Pitch Slider Assembly
131-476	Tail Pitch Yoke
131-477	Brass Slider
131-480	Delrin TT Bearing Cup
131-481	TT Bearing Cup O Ring
131-482	Sleeve
131-483	Tail Drive Hub
131-485	12x18x4 Ball Bearing
131-487	C/F Right Frame - Nitro
131-488	C/F Left Frame - Nitro
131-490	Damper Sleeve
131-491	Damper 80D O-ring
131-558	Torque Tube
132-117-B	Main Gear 117T
132-59	C/F Front Doubler Electric
3000-73	Towel
3200-30	Spiral Band For Wire And Cable
3200-48	3/4" Hook & Loop Tape
3200-54	3/4"Adhesive Hook & Loop
3700-160	Foam Blade Guard
4500-100	Magnet

Warranty

The warranty covers defects in material, workmanship, or missing components to the original purchaser for 30 days from the date of purchase. Miniature Aircraft will replace or repair, at our discretion, the defective or missing component. Defective components MUST BE returned to us prior to replacement.

Any part which has been improperly installed, abused, crashed, or altered by unauthorized agencies, is not covered. Under no circumstances will the buyer be entitled to consequential or incidental damages. The components used in this kit are made from special materials designed for special applications and design strengths. We recommend that all replacement parts be original parts manufactured by Miniature Aircraft to ensure proper and safe operation of your model. Any part used which was manufactured by any firm other than Miniature Aircraft VOIDS all warranties of this product by Miniature Aircraft.

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Moser-Saege 5 • Gaissach • 83674 • GERMANY
Phone: +49.8042.507.9239
Website: http://www.miniatureaircraftusa.com
Email: minair@miniatureaircraftusa.com