X-cell WHIPLASH

Assembly Instructions

Turbine
Helicopter Kit

MA1035-1 / -2

miniature aircraft usa

Step up to excellence with X-Cell

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Version 0.8 - Draft
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Kit Introduction

Thank you for purchasing the X-Cell Whiplash Turbine 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" turbine powered 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 give 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. Always have a ready to use CO2 fire-extinguisher (at least 2kg of CO2) next to the place where you start the Whiplash turbine engine.

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. Fly only if there are other people at the field.
- 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.

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. Synthetic Grease (MA3200-06)
3. 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)
14. 2x Ratchet & Socket M10, M13

15 Dail Gauge resolution of 0.01mm / 0.0004” or better

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: Turbine Solutions 45i Whiplash Edition or Wren 44i.
2. Cyclic servos (Miniature Aircraft recommends high quality digital cyclic servos with no less than 80 oz. in. of torque.)
3. R/C helicopter flybarless system
4. Rudder servo suitable for use with the gyro you choose. Digital servo is recommended.
5. R/C helicopter transmitter and receiver with at least 8 channels, telemetry capabilities are recomm.
6. 700-720mm Main Blades and 105-115mm Tail Blades.
8. R/C helicopter fueling equipment.
9. R/C helicopter engine governor (Futaba GV-1, GY701, CGY 760 or 750) are recommended.
10. CO2 fire-extinguisher for operating the turbine engine

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.

- 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

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	2
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-B	Tail Pitch Control Bellcrank	1
2-A-3	131-131	C/F Bellcrank Bracket	1
2-Hardware	0019	M3 Lock Nut	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	0071	M3x18 Socket Bolt	2
2-Hardware	0107	M3x6 Threaded Steel Ball	2
2-B-1	131-400	TT Ends	2
2-B-1	131-480	TT Bearing Cup	3
2-B-1	131-481	TT Bearing Cup O-Ring	6
2-B-1	131-482	TT Sleeve	3
2-B-1	131-485	TT Bearing	3
2-Hardware	0015	2mm Hex Nut	2
2-Hardware	0049-1	M2x12 Socket Bolt	2

Bag	Part No.	Part Description	Qty
2-B-2	133-458	TT	1
2-B-2	131-62	Tail Boom	1
2-B-2	135-472	T/R Control Rod	1
2-B-2	131-86	Tail Boom Support C/F Rod Assemly	2
2-B-3	0133-1	M3x21.5 Ball Link	2
2-B-3	0868-41	Control Rod Support	2
2-B-3	128-80	Aluminum Front Boom Clamp	2
2-B-3	128-444	T/R Control Rod Guide	2
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	128-400	Push Rod End	2
2-B-3	135-128	C/F Boom Clamp Plate	1
2-Hardware	0016-2	4mm External Serrated Lockwasher	2
2-Hardware	0032	2.9 Philipps Tapping Screw	2
2-Hardware	0053-5	M3x16 Socket Screw	2
2-Hardware	0060-1	M3x6 Socket Bolt	4
2-Hardware	0063	M3x10 Socket Bolt	2
2-Hardware	0065	M3x12 Socket Bolt	3
2-Hardware	0067	M3x14 Socket Bol	2
2-Hardware	0078	M4x12 Socket Bolt	2
2-B-4	133-60	C/F Vertical Tail Fin	1

Bag 3 - Turbine Frame Assembly

Bag	Part No.	Part Description	Qty
3-A	128-57	3mm Tray Mount	6
3-A	131-52	Delrin Tray Mount	2
3-A	131-53	C/F Gyro Plate	2
3-A	135-55	C/F Angled Battery Tray	1
3-A	135-57	Spacer	1
3-A	135-383	Hopper Support 1	1
3-A	135-492	Hopper Support 2	1
3-Hardware	0032-2	M3x8 Tapping Screw	4
3-Hardware	0088-2	M3x6 Tapered Socket Bolt	14
3-Frames	135-487	C/F Left Frame - Turbine	1
3-Frames	135-488	C/F Right Frame - Turbine	1
3-Frames	135-115	C/F Bottom Plate	1
3-Hardware	0004	4mm Washer	10
3-Hardware	0032	2.9x9.5 Tapping Screw	4
3-Hardware	0060-1	M3x6 Socket Bolt	40
3-Hardware	0061	M3x8 Socket Bolt	40
3-Hardware	0063	M3x10 Socket Bolt	6
3-Hardware	0078-4	M4x8 Socket Bolt	6
3-Hardware	2700-01	3mm Blue Washer	35
3-B	128-58	Frame Spacer	6
3-B	128-90	Tank Plate Mounting Stud	4
3-B	131-46	P/A Servo Rail	2
3-B	131-47	C/F Servo Rail Spacer, optional	2
3-B	131-186	C/F Anti-rotation Bracket	1
3-B	131-420	Mid Main Bearing Block	1
3-B	131-421	Upper Main Bearing Block	1
3-B	134-104	T/R Drive Support	2
3-B	135-100	Engine Mount	1
3-B	135-107	Rear Doubler	2
3-B	135-125	Front Canopy Spacer	2
3-B	135-429	C/F X-Brace	1
3-Hardware	0060-1	M3x6 Socket Bolt	4
3-Hardware	0063	M3x10 Socket Bolt	4
3-Hardware	0065	M3x12 Socket Bolt	4
3-C	0215	6mm Retaining Collar	1
3-C	127-86	Washer	2
3-C	131-3	Start Shaft w/Sleeve	1
3-C	131-117	Fan Hub	1
3-C	131-118	Shim Washer	1
3-C	131-119	Clutch	1
3-C	131-120	Fan	1
3-C	131-179	X-Block	1
3-C	131-411	Assembled Clutch Bell	1
3-C	135-101	Engine Support	4
3-C	135-103	Spacer	2
3-C	135-124	Turbine Mount	1
3-Hardware	0009	3mm Washer	4
3-Hardware	0051	M3x3 Socket Set Screw	2
3-Hardware	0064-3	M3x6 Button Head Socket	4
3-Hardware	0065	M3x12 Socket Bolt	2
3-Hardware	0069	M3x16 Socket Bolt	4
3-Hardware	0078-4	M4x8 Socket Bolt	2
Sensor Mount:			
3-Hardware	0001	2mm Washer	4
3-Hardware	0016-2	4mm Safety Washer	4
3-Hardware	0018	2mm Lock Nut	2
3-Hardware	0049	M2x10 Socket Bolt	2
3-Hardware	0080	M4x14 Socket Bolt	2
3-Hardware	0081	M4x16 Socket Bolt	2
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

Bag	Part No.	Part Description	Qty
3-D	128-57	Spacer	1
3-D	128-58	Spacer	1
3-D	131-382	C/F Spacer	1
3-D	131-454	4mm Tray Mount	2
3-D	135-58	Spacer	1
3-D	135-380-1	White Strut II	1
3-D	135-380-2	White Strut II	1
3-D	135-382	C/F Strut Spacer	1
3-D	135-489	Lower Main Frame	2
3-D	135-490	C/F Frame Spacer R + L	2
3-D	135-491	C/F Washer	2
3-D	2500-39	Tuf-Strut II End Cap White	4
3-Hardware	0003	3mm Washer	4
3-Hardware	0058-1	M4x6 Socket Screw	4
3-Hardware	0064-3	M3x6 Button Head	6
3-Hardware	0073	M3x20 Socket Bolt	4
3-Hardware	0078-5	M4x10 Socket Bolt	4
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-Hardware	0021	4mm Lock Nut	1
3-Hardware	0059-2	M2.5x8 Socket Bolt	2
3-Hardware	0088	M3x8 Tapered Socket Bolt	13
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	106-22	Rubber Canopy Grommet	4
3-E-1	120-99	Canopy Knobs	2
3-E-1	128-59	M4 Front Boom Support Brace	1
3-E-1	131-153	C/F Canopy Breakaway Tabs	4
3-E-1	131-451	Rear Canopy Post	2
3-E-1	131-452	Canopy Post Splint	2
3-E-1	135-127	Boom Support Spacer	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	3400-38	Fuel Line 9.5 cm	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	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 Fuel Tank Plate	2
3-F	135-133	Fanshroud R + L	2
3-Hardware	0011-5	Washer	1
3-Hardware	0014F	5mm Hex Nut - Fine Threaded	1
3-Hardware	0060-1	M3x6 Socket Bolt	4
3-Hardware	0061	M3x8 Socket Bolt	2
3-Hardware	0065	M3x12 Socket Bolt	4
3-G	0390	Wire Retainers	5
3-G	3200-30	20” Spiral Band for Wire and Cable	1
3-G	3200-46	1/2” Hook and Loop Tape	1
3-G	3200-48	20” 3/4 Hook and Loop Tape	1
3-G	3200-54	17” Adhesive Hook and Loop	1
BOX	135-252	Whiplash Canopy - Turbine	1
BOX	135-106	Hopper Tank	1
BOX	133-144	Skids	1
BOX	3000-73	MA Towel	1

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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

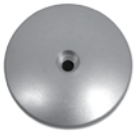
106-06
2x5x1.5 Bearing

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 Blate 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)

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.***

Hardware for this assembly

0067 x 1
M3x14 Socket Bolt

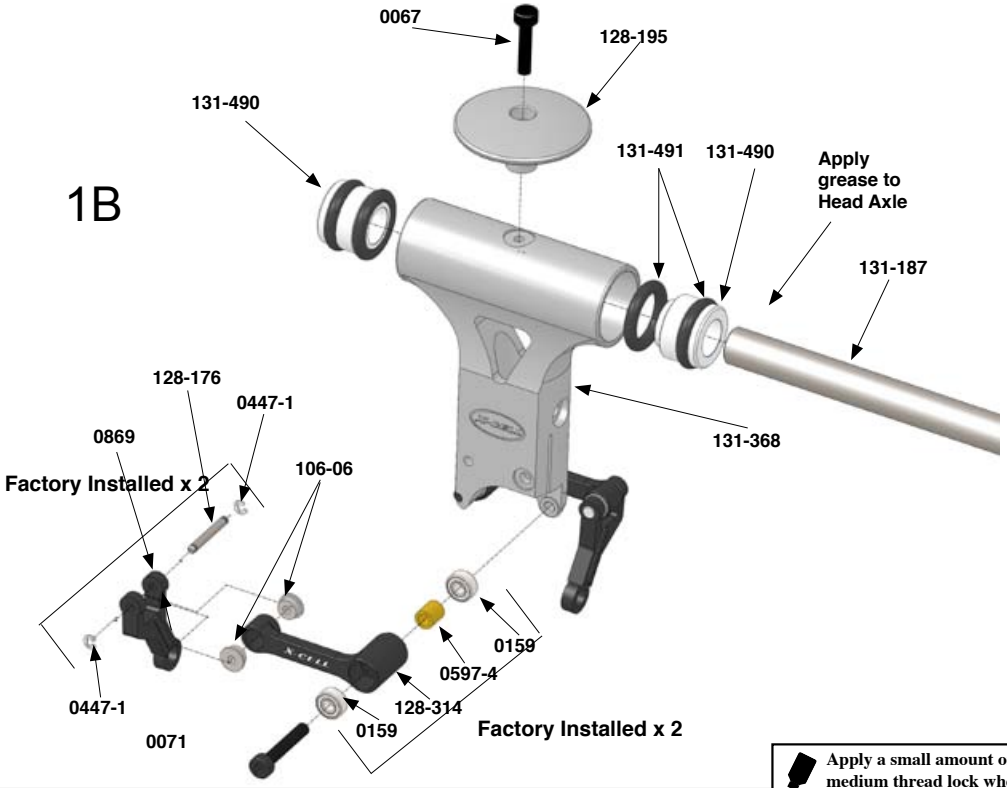
0071 x 2
M3x18 Socket Bolt

Assembly Tip

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

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

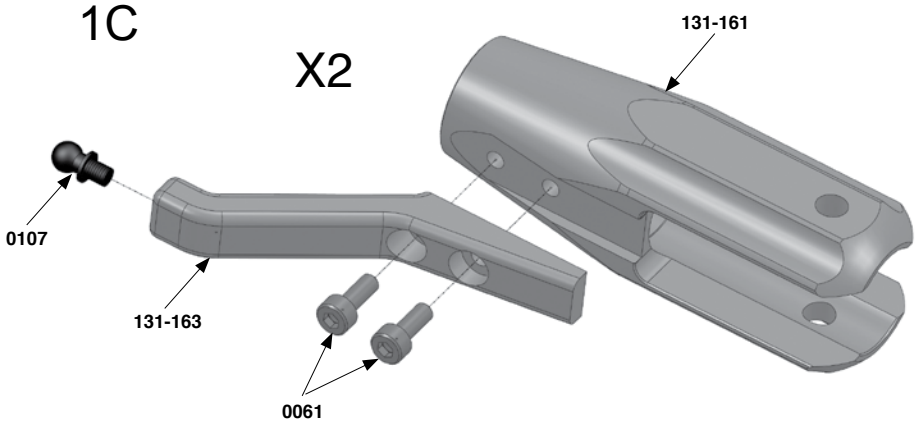
0086-1 x 2
M5x16 Flanged Bolt

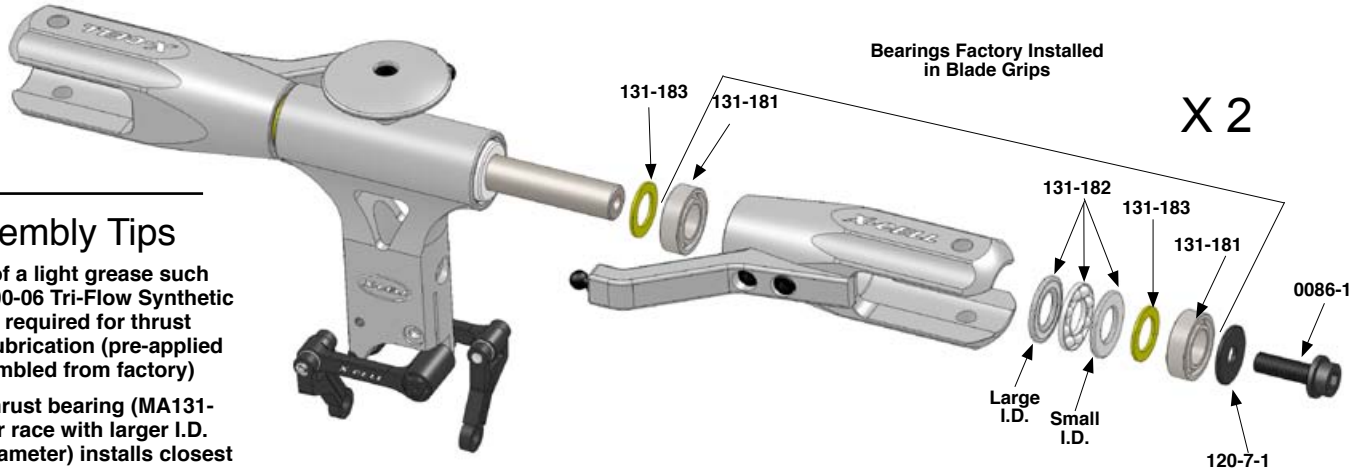
120-7-1 x 2
M5x15 Safety Washer

131-183 x 2
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

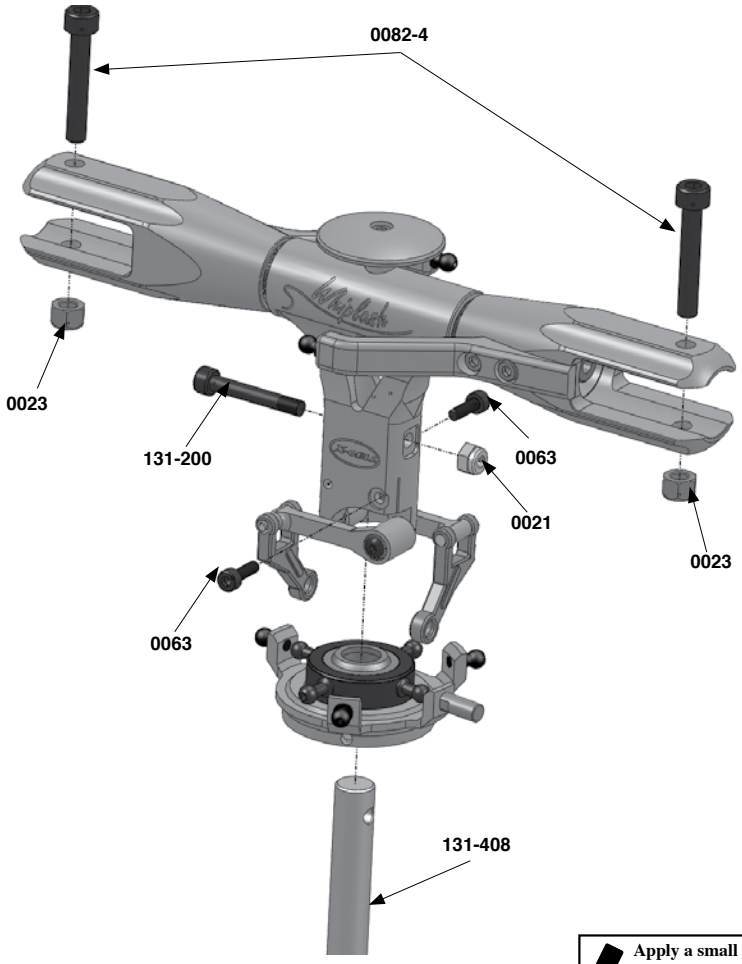
0063 x 2
M3x10 Socket Bolt

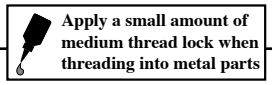
0082-4 x 2
M5x32 Shouldered Socket Bolt

131-200 x 1
M4x33 Shouldered Socket Bolt

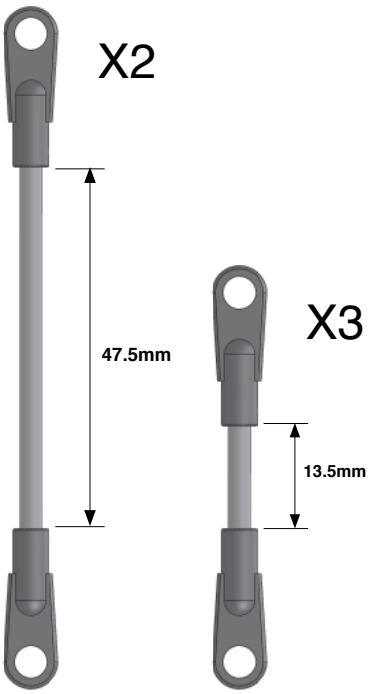
Assembly Tips

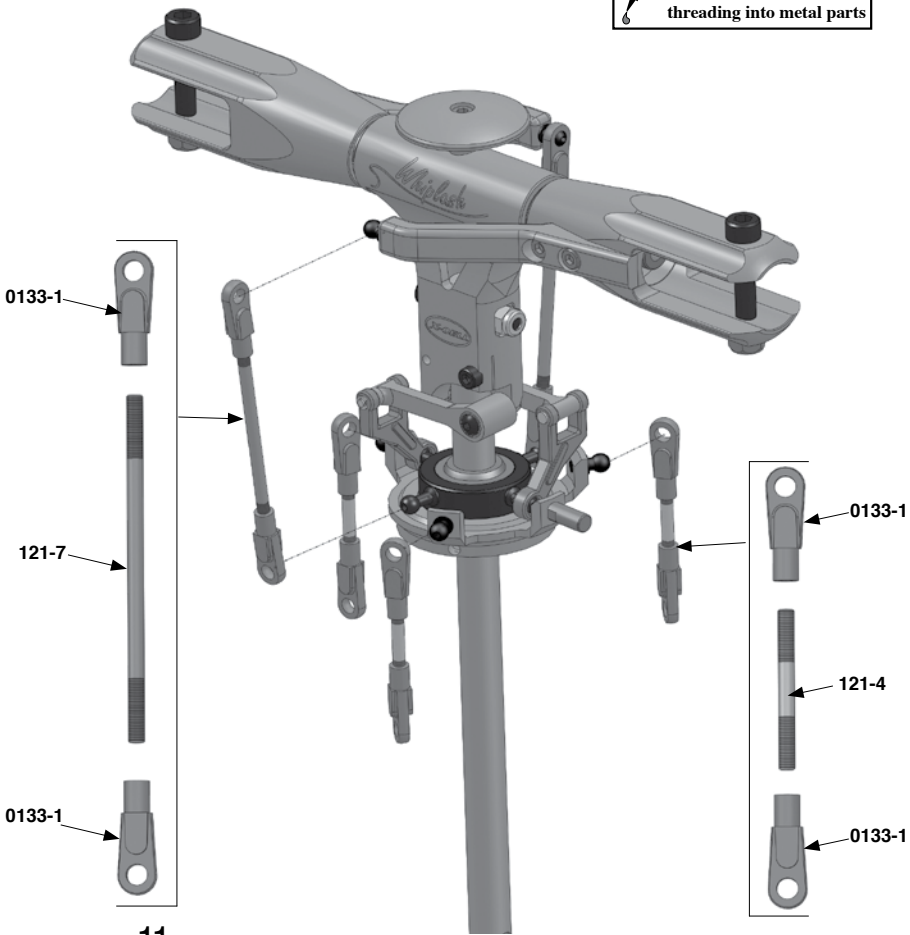
- **Head, Swashplate and Main Shaft can be assembled now, or you can assemble the parts later step by step installing them to the frame (recommended).**





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

0032
2.9 Philipps Tapping Screw

0049-1
M2x12 Socket Bolt

0051
M3x3 Socket Set Screw

0053-5
M3x16 Socket Set Screw

0056
M3x5 Dog Point Socket Screw

0056-3
M3x5 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

0071
M3x18 Socket Bolt

0073
M3x20 Socket Bolt

0078
M4x12 Socket Bolt

0107
M3x6 Threaded Steel Ball

0133-1
M3x21.2 Ball Links

0159
3x7x3 Bearing

0215
Auto Hub Ret. Collar

0225
Pivot Pin For Pitch Links

0273
M6x10x.011" Steel Shim Waasher

0273-1
M6x10x.0.1 Steel Shim Waasher

0442
Pivoting T/R Pitch Link

0868-41
Push Rod Support

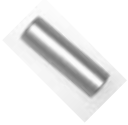
120-39
5x10x4 Bearing

122-70
Washer

128-80
Aluminum Front Boom Clamp

128-146
Aluminum Boom Support Ends

128-149
Rear Boom Support Mount



128-400
CF Rod Ends

128-444
T/R Control Rod Guides

131-17-C
Tail Bevel Gear, Shaft Side

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

131-33
15x21x4 Bearing

131-33-1
15x21x4 Flanged Bearing

131-62
Aluminum Tail Boom

131-64
Tail Hub

131-66
5x10 Thrust Bearing

131-70
Tail Rotor Output Shaft

131-84
Carbon Boom Support Rod

131-86
Tail Boom Support Assembly

131-112
T/R Blade Grip

131-129
Tail Case

131-130-B
Tail Bellcrank

131-131
Carbon Fiber Bellcrank Bracket

131-132-B
Bellcrank Cup

131-180
8x12x3.5 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

133-60
CF Vertical Tail Fin

133-458
Torque Tube

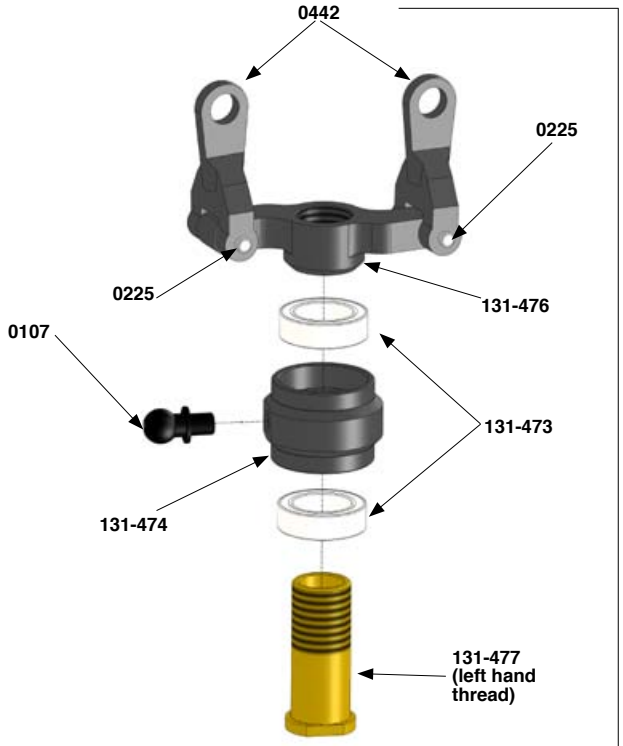
135-128
Carbon Fiber Boom Clamp Plate

135-472
Tail CF Linkage Rod

Hardware for this assembly

0107 x 1
M3x6 Threaded Steel Ball

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 x 2
M3x5 Dog Point Socket Screw

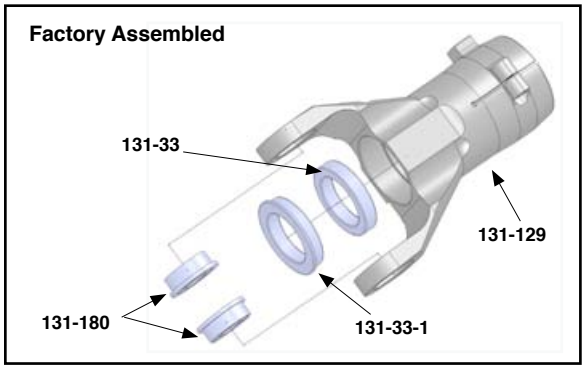
0273 x 1
m6x10x.11" Steel Shim Washer

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

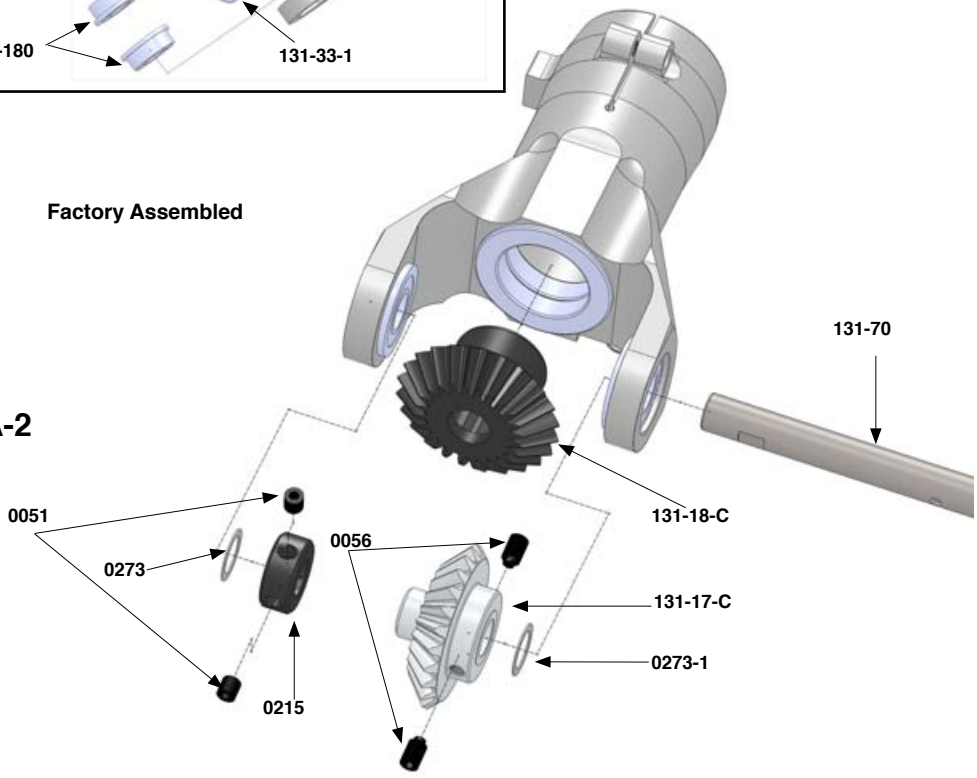
Assembly Tip

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

Factory Assembled



2-A-2



Hardware for this assembly

0019 x 1
3mm Hex Nut

0064-3 x 2
M3x6 Button Head Socket Bolt

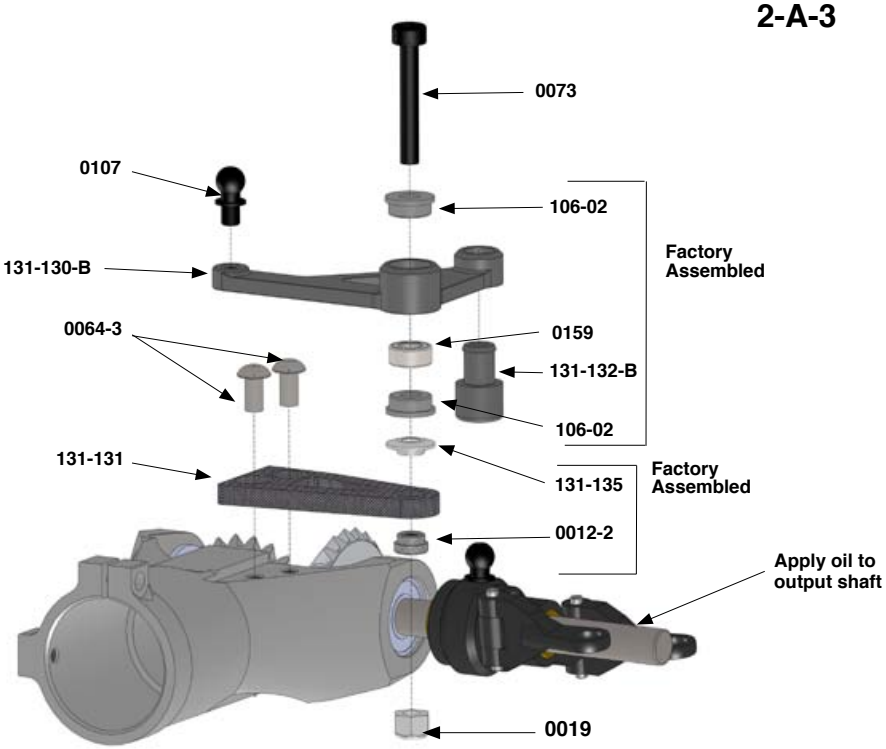
0073 x 1
M3x20 Socket Bolt

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

0071 x 2
M3x18 Socket Bolt

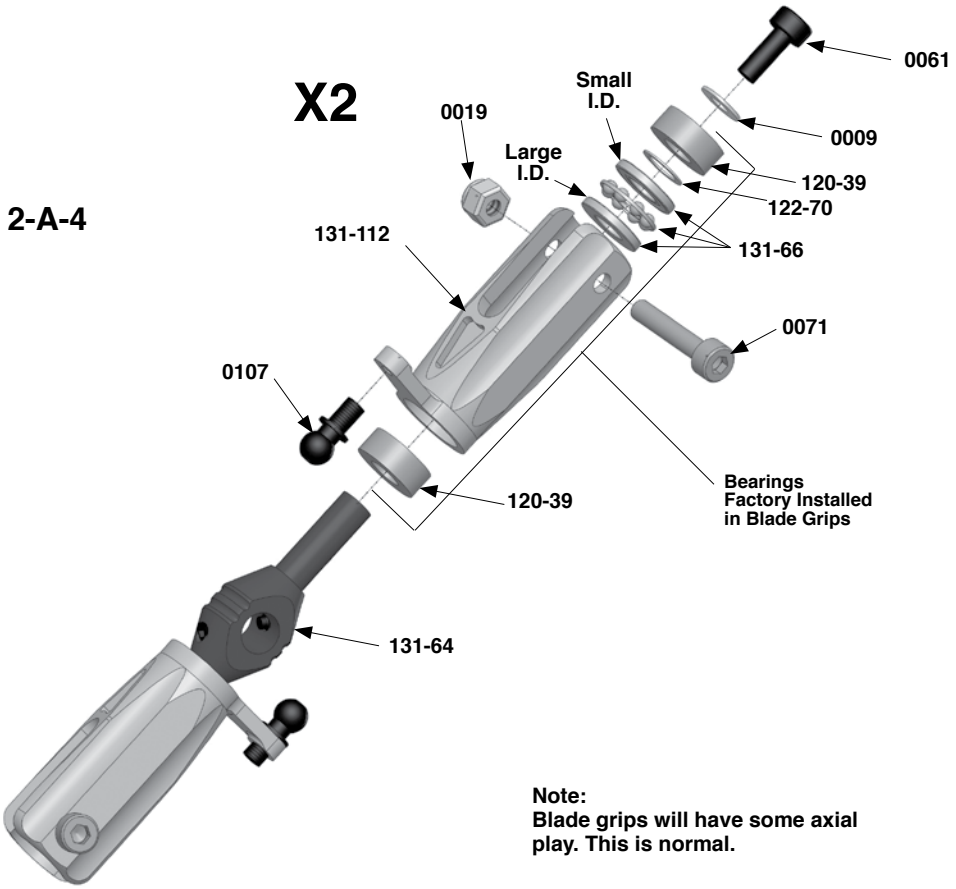
0107 x 2
M3x6 Threaded Steel Ball

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

X2



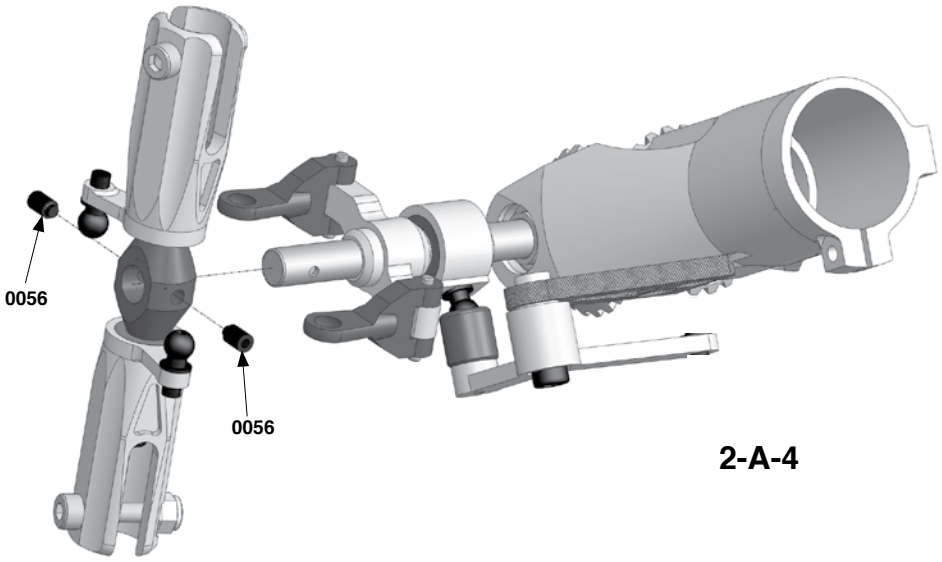
Note:
Blade grips will have some axial play. This is normal.

Hardware for this assembly

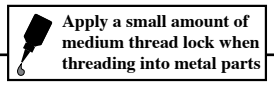
0056 x 2
M3x5 Dog Point Socket Screw

Assembly Tip

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



2-A-4

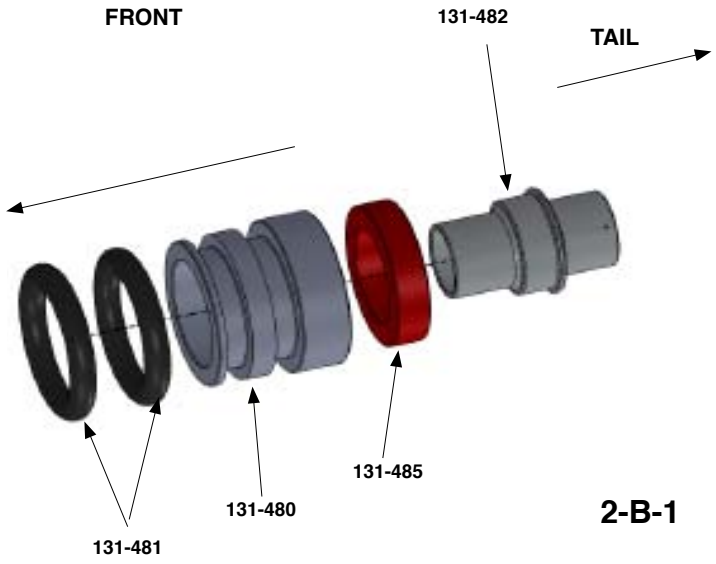


Apply a small amount of medium thread lock when threading into metal parts

Take care about the orientation of guide edge of the sleeves.

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

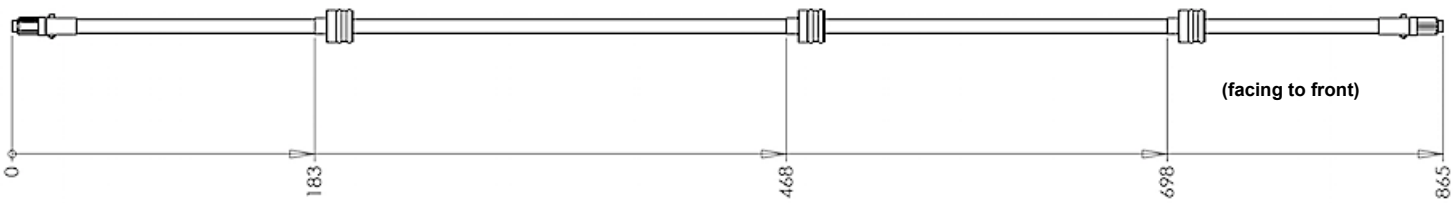
Apply a small amount of green Loctite 648 when mounting the bearing cup assemblies on the torque tube.



X3

2-B-1

Tail **Front**



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.

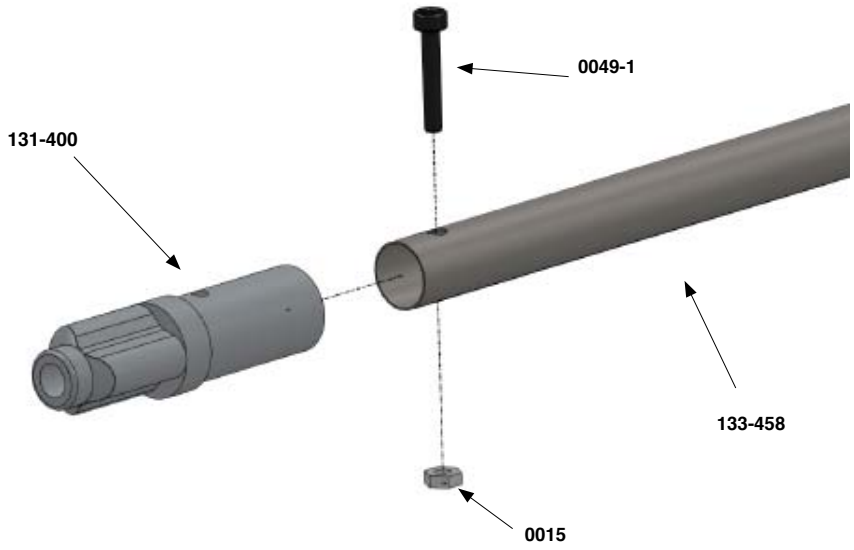
Hardware for this assembly

0015 2 x
2mm Hex Nut

0049-1 x 2
M2x12 Socket Bolt

Assembly Tips

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

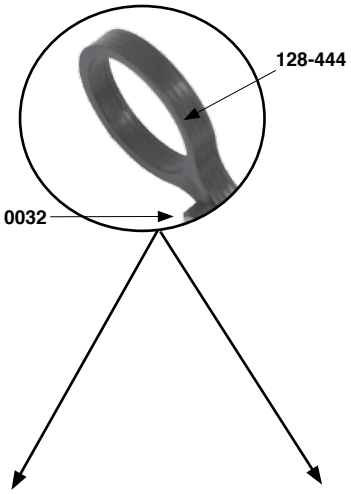


2-B-2

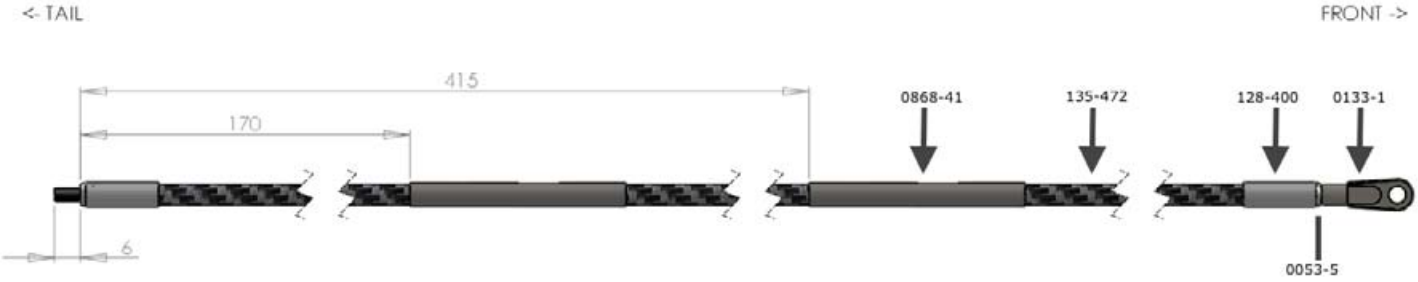
Hardware for this assembly

0032 x 2
2.9 Philipps Tapping Screw

0053-5 x 2
3 x 16mm Inbuss-chrauben



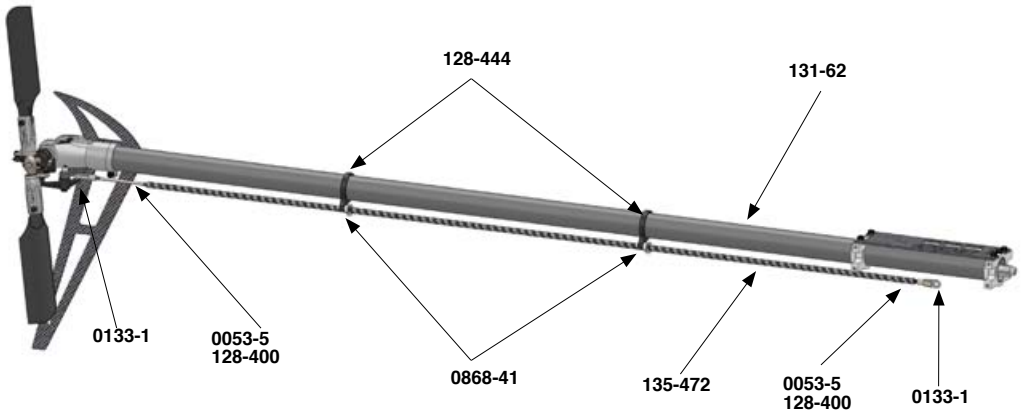
Check length before assembling the push rod. Shorten to fit



0868-41

Assembly Tips: Torque Tube

- **Please use some grease or vaseline or tallow to grease the tail boom from the inner side and the o-rings of the torque tube. So the tube will slide in smooth. If it stops before it is at the correct position so remove the torque tube again and apply some more grease.**
- **Install torque tube from the tail side into the boom. It is normally that the tube goes in strong into the boom.**
- **The torque tube is at the correct position inside the boom if at the tail side the end of the boom 'cuts' the head of the m2 socketbolt in half (top view at the socket bolt) .**



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 2
M3x10 Socket Bolt

0065 x 3
M3x12 Socket Bolt

0078 x 2
M4x12 Socket Bolt

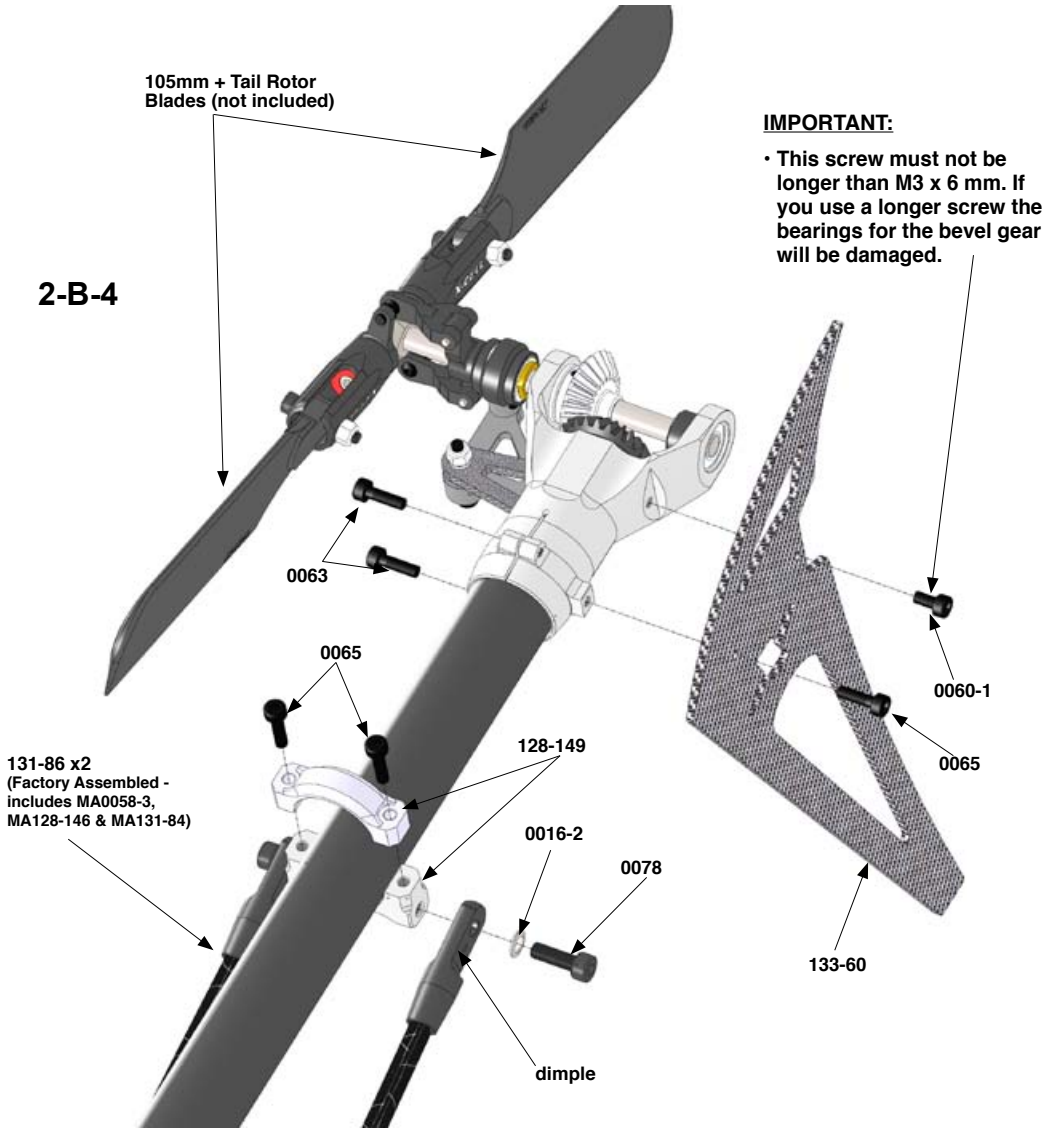
Assembly Tips

- **The use of thread lock MA3200-20 (loctite #243) is recommended on MA0078 Socket Bolts.**
- **Do not overtighten MA0065 Socket Bolts on the Rear Boom Support Mounts.**

IMPORTANT:

- **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



Turbine Frame Assembly Parts

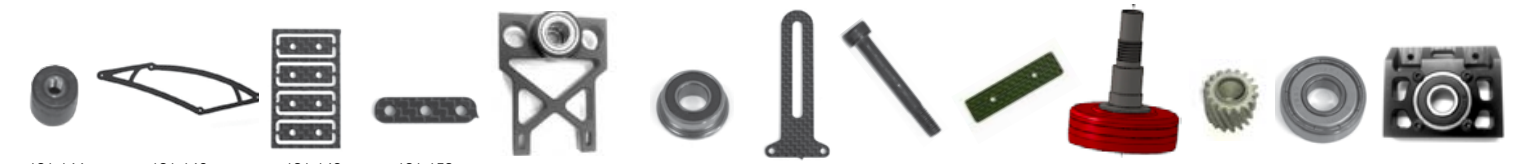
0001 2mm Washer | 0003 2mm Washer | 0004 4mm Washer | 0009 3mm Flat Steel Washer | 0011-CF Carbon Washer | 0012-1 2.5mm Pem Nut | 0012-2 3mm Pem Nut | 0014F 5mm Hex Nut Fine Thread | 0016-2 4mm Safety Washer | 0017-2 2.5mm Hex Nut | 0018 M2 Hex Locknut | 0021 M4 Hex Locknut | 0032 M2.9x9.5 Self Tapping Screw | 0032-2 M3x8 Self Tapping Screw | 0049 M2x10 Socket Bolt | 0051 M3x3 Socket Set Screw | 0058-1 M4x6 Socket Set Screw

0059-1 M2.5x6 Socket Bolt | 0059-2 M2.5x8 Socket Bolt | 0059-4 M2.5x12 Socket Bolt | 0059-4 M2.5x12 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 | 0073 M3x20 Socket Bolt | 0078-4 M4x8 Socket Bolt | 0078-5 M4x10 Socket Bolt | 0080 M4x14 Socket Bolt | 0081 M4x16 Socket Bolt

0087 M4x20 Socket Bolt | 0088 M3x8 Tapered Socket Bolt | 0088-2 M3x6 Tapered Socket Bolt | 0088-3 M3x7 Tapered Socket Bolt | 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 | 0215 6mm Collar | 0390 Large Wire Lead Retainer | 0597-1 3x4.75x.126 Brass Spacer | 0620-01 -02, -03 Shim Washer | 0818-3 Mounting Block

0875-1 Collar | 105-70 6x15x6 Bearing | 106-22 Rubber Canopy Grommets | 3400-38 Fuel Line | 120-99 Thumb Screw | 122-47 10x22x6 Bearing | 125-24 Fuel Pick-up Magnet | 127-86 Washer | 128-57 Tray Mount | 128-58 Main Frame Spacer | 128-59 Front Boom Support Spacer | 128-92 Tank Plate Stud | 128-92 Fuel Tank Plug | 128-94 Fuel Nipple

131-3 Start Shaft | 131-10 Clutch Liner | 131-19 10x26x8 Bearing | 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 | 131-117 Fan Hub | 131-119 Clutch w/Torrington Bearing | 131-120 Fan with magnets | 131-138 Whiplash Fuel Tank



131-144 Rubber Fuel Tank Mount | 131-146 Carbon Fiber Fuel Tank Plate | 131-148 Carbon Fiber Servo Plate | 131-153 Carbon Fiber Breakaway Tab | 131-179 X-Block | 131-180 6x13x5 Flanged Bearing | 131-186 Anti Rotation Bracket | 131-202 M4 Jesus bolt OWB V2 | 131-382 C/F Strut Spacer | 131-411 Clutch Bell Assembly | 131-413 Pinion Gear | 131-419 15x24x4 Bearing | 131-420 Middle Main Shaft Bearing Block

131-421 Upper Main Shaft Bearing Block | 131-424 Main Gear Hub | 131-426 Sprague Bearing | 131-428 Clutch Bearing Block | 131-442 Bottom Main Shaft Bearing Block | 131-451 Rear Canopy Post | 131-452 Canopy Post Splint | 131-454 M4 Tray Mount | 131-466 Crown Gear Mounting Base | 131-469-1 Crown Gear Plate | 131-470 70T Crown Gear | 132-117-B 117T Main Gear

133-144 Skid Tube | 134-104 Drive support | 135-55 C/F Angled Battery Tray | 135-57 Spacer | 135-58 Spacer | 135-100 Engine Mount | 135-101 Engine Support | 135-103 Spacer | 135-104 Rubber Grommet | 135-106 Hopper Tank | 135-107 C/F Rear Frame Doubler Turbine | 135-115 C/F Bottom Plate | 135-124 Turbine Mount | 135-125 Front Canopy Spacer

135-127 Boom Support Spacer | 135-133 R Right Fan Shroud | 135-133 L Left Fan Shroud | 135-252 Whiplash Canopy Turbine | 135-382 C/F Strut Spacer | 135-383 C/F Hopper Mount Bottom | 135-429 Carbon Fiber X-brace | 135-487 Whiplash C/F Frame Right | 135-488 Whiplash C/F Frame Left | 135-489 main frame support | 135-490 R + L | 135-491 C/F Washer | 135-492 C/F Hopper Mount

Hardware for this assembly

0011-CF Carbon Washer

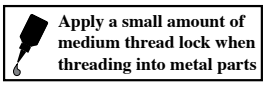
0014F x 1
5mm Hex Nut
Fine Thread

0032-2 x 4
M3x8 tapping screw

0088-2 x 14
M3x6 Tappered Socket Bolt

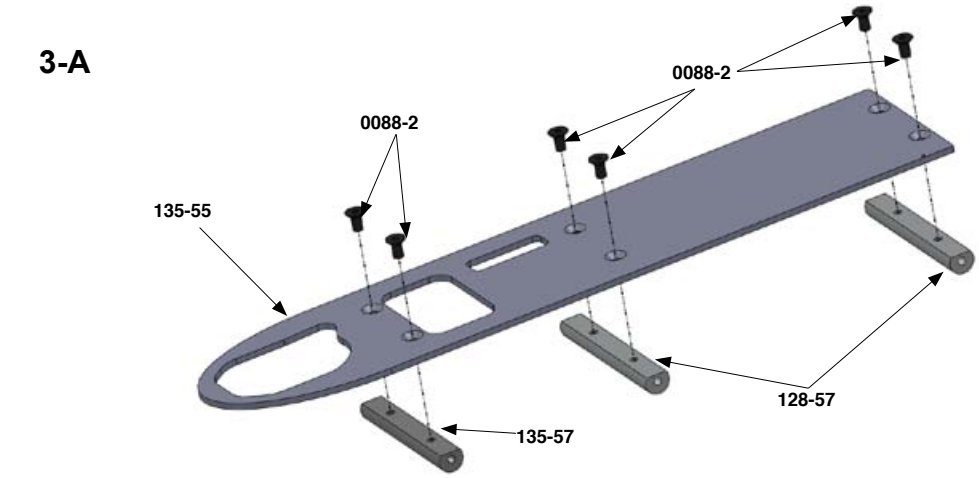
Assembly Tips

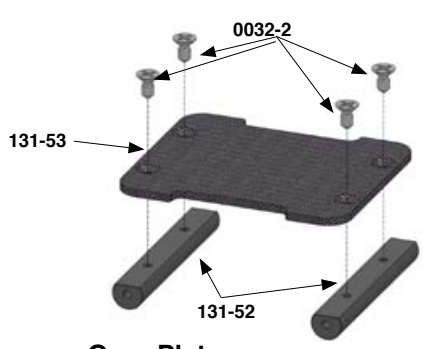
- Do not overtighten MA0032-2 Self Tapping Screw into MA131-52 Delrin Tray Mount.



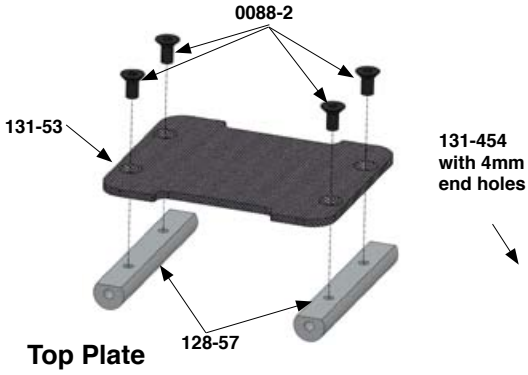
Front Battery Tray

3-A

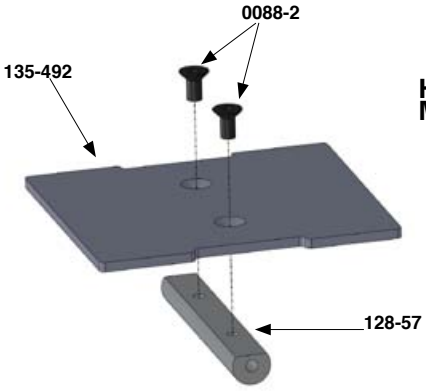




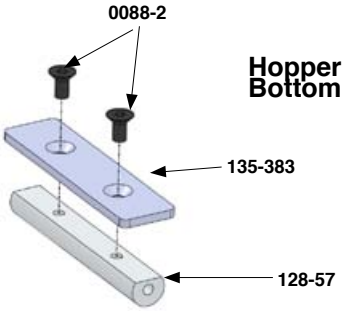
Gyro Plate



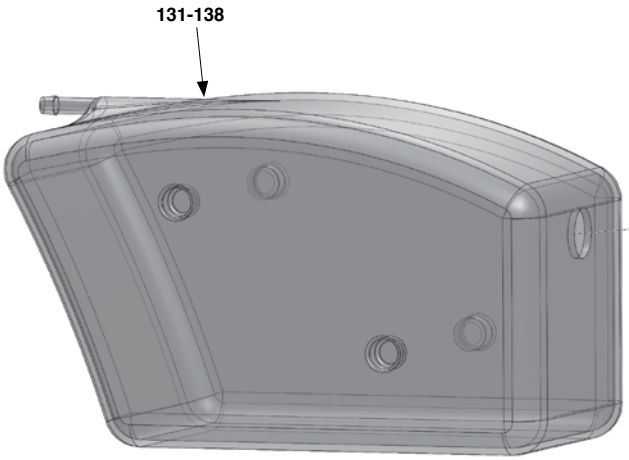
Top Plate



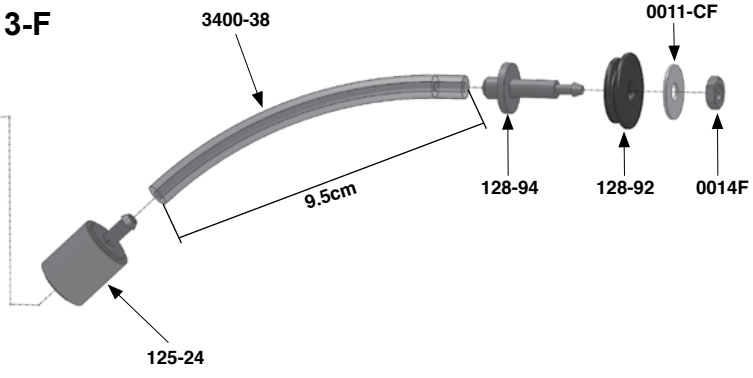
Hopper Mount



Hopper Mount Bottom



3-F



Hardware for this assembly

2700-01 x 4
Blue M3 Washer

0004 x 2
4mm Washer

0032 x 2
M3 Self Tapping Screw

0060-1 x 11
M3x6 Socket Bolt

0061 x 8
M3x8 Socket Bolt

0063 x 7
M3x10 Socket Bolt

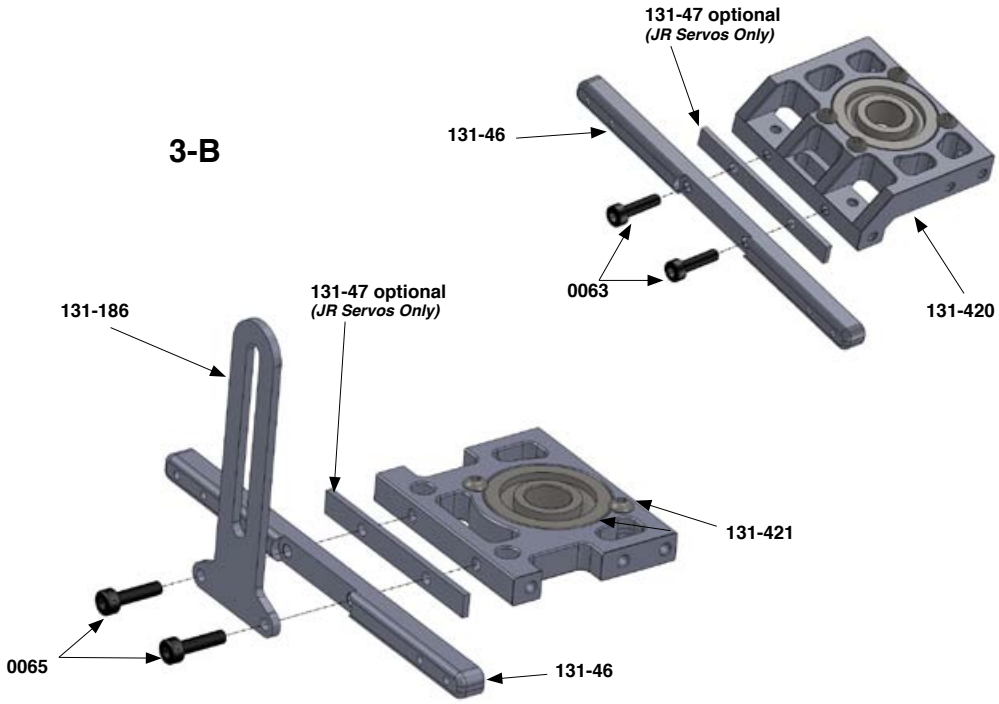
0065 x 4 - optional
M3x12 Socket Bolt

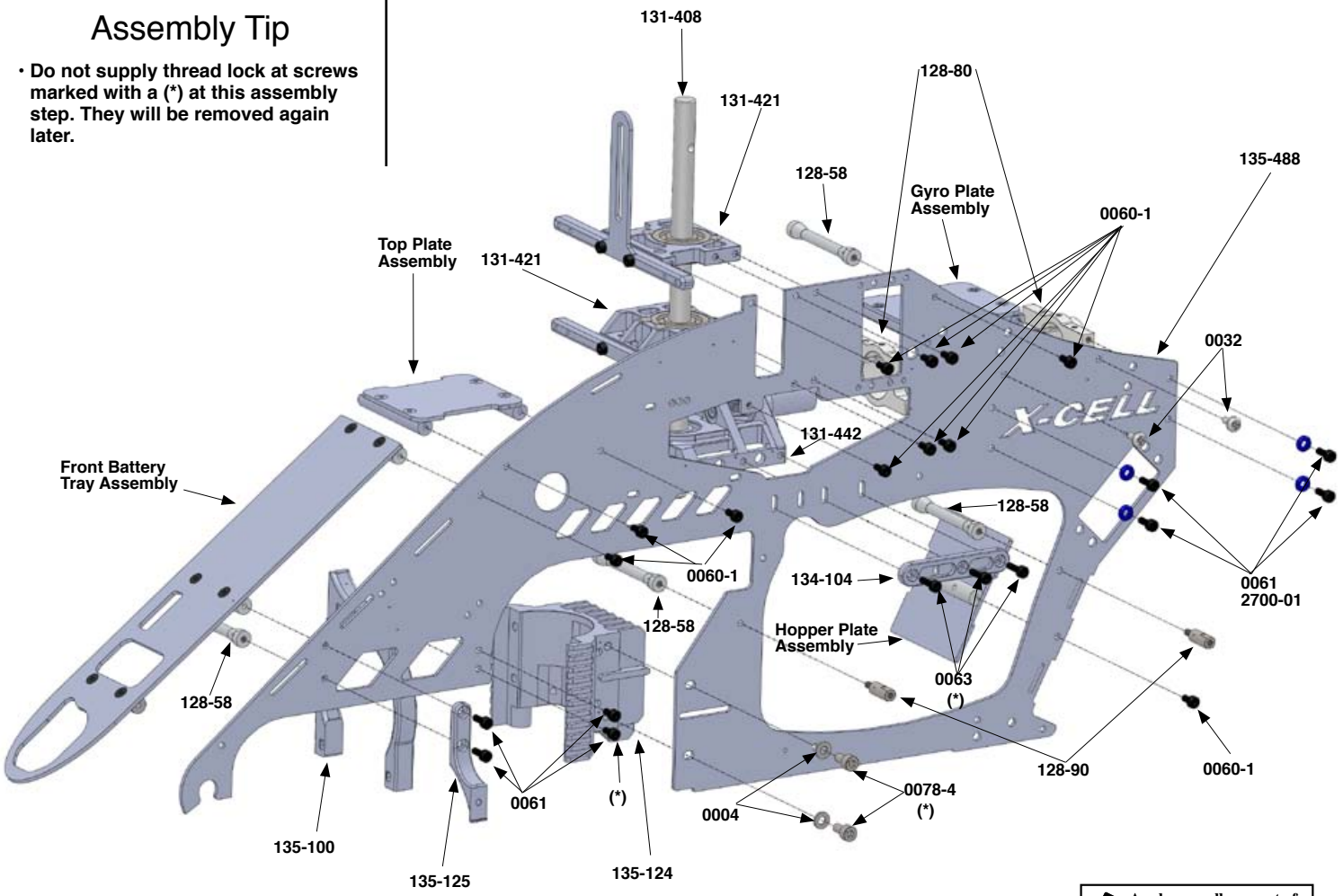
0078-4 x 2
M4x8 Socket Bolt

Assembly Tip

- **Do not supply thread lock at screws marked with a (*) at this assembly step. They will be removed again later.**

3-B





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

Hardware for these assemblies

2700-01 x 4
Blue M3 Washer

0004 x 2
4mm Washer

0032 x 2
M3 Self Tapping Screw

0060-1 x 11
M3x6 Socket Bolt

0061 x 8
M3x8 Socket Bolt

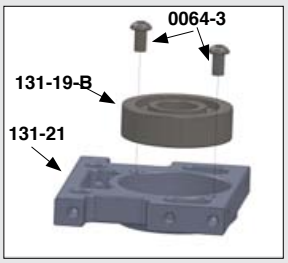
0063 x 3
M3x10 Socket Bolt

0078-4 x 2
M4x8 Socket Bolt

Assembly Tip

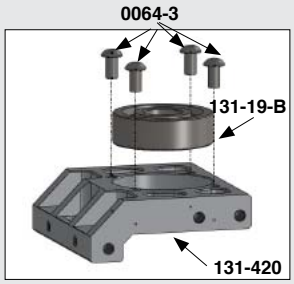
- **If using JR brand servos or other "tall" servos, MA131-47 Servo Rail Spacers are included for proper servo linkage alignment, if required.**
- **Do not supply thread lock at screws marked with a (*) at this assembly step. They will be removed again later.**

Upper Main Shaft Bearing Block (Factory Assembled)



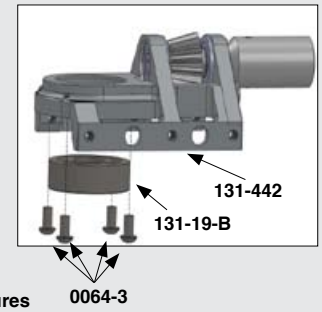
NOTE: Upper bearing block features smooth, wrench access holes

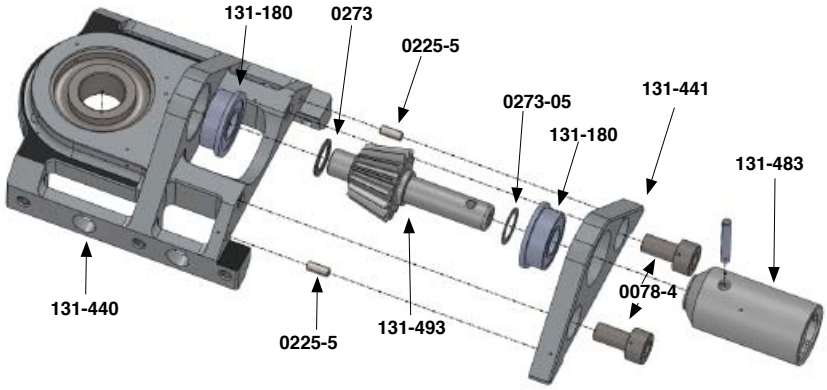
Middle Main Shaft Bearing Block (Factory Assembled)

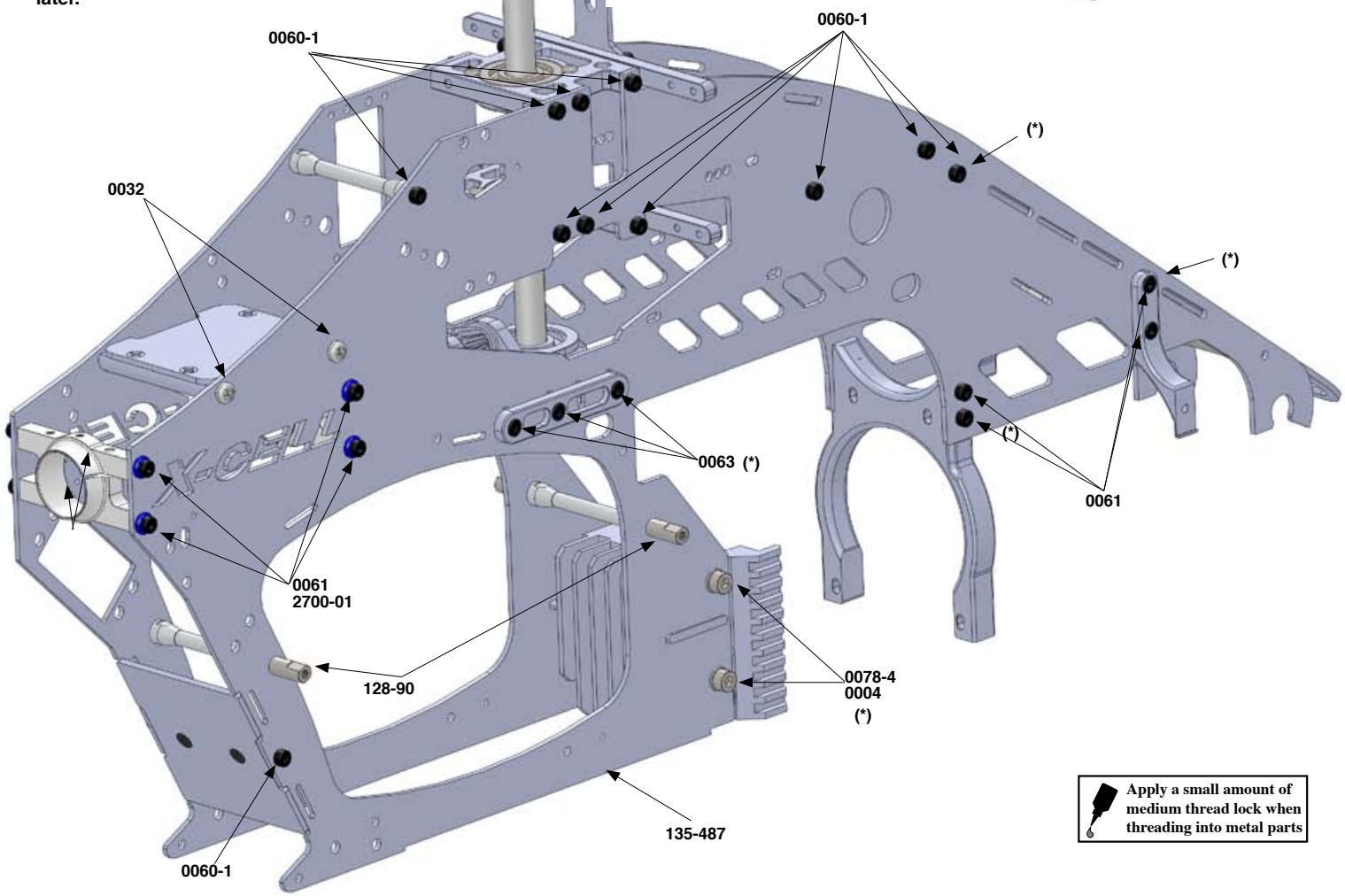


NOTE: Middle bearing block features threaded holes.

Bottom Main Shaft Bearing Block (Factory Assembled)







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

Hardware for these assemblies

2700-01 x 2
Blue M3 Washer

0004 x 4
4mm Washer

0060-1 x 4
M3x6 Socket Bolt

0061 x 3
M3x8 Socket Bolt

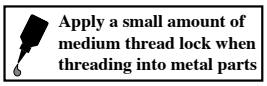
0063 x 2
M3x10 Socket Bolt

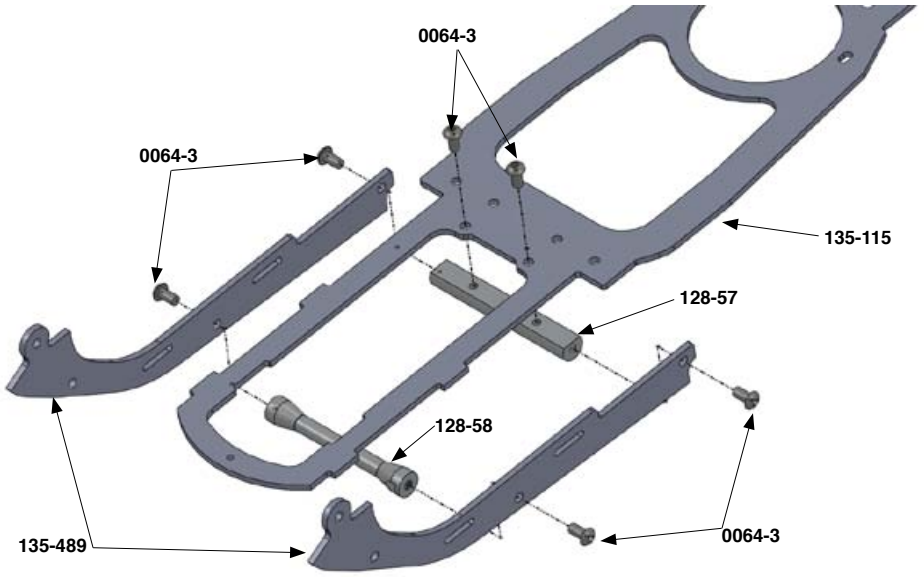
0064-3 x 6
M3x6 Button Head

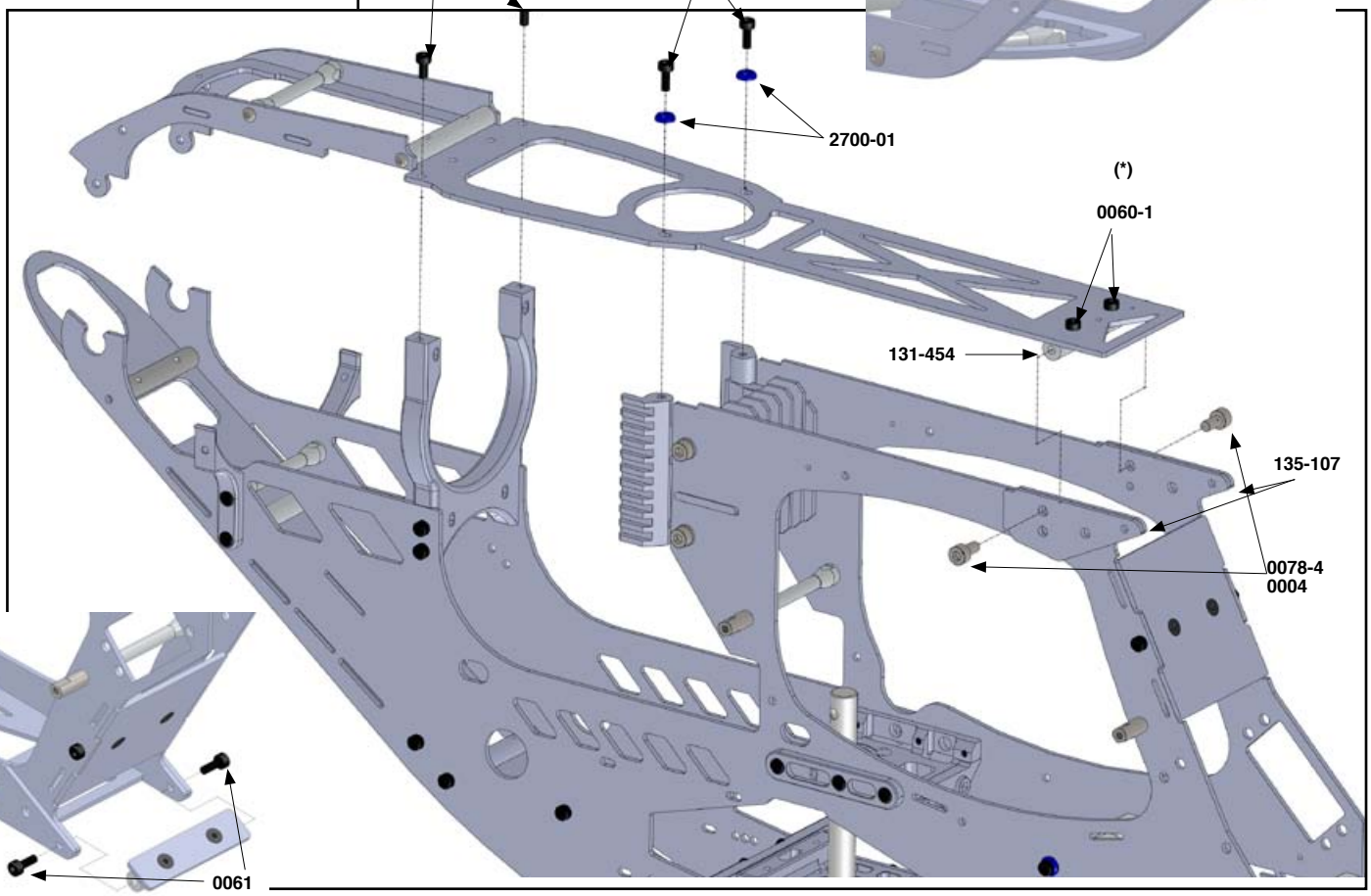
0078-4 x 2
M4x8 Socket Bolt

Assembly Tips

- **Do not supply thread lock at screws marked with a (*) at this assembly step. They will be removed again later.**
- **Assemble the bottom frame section to ensure that the frame is straight and rectangular. The front section of bottom frame and main frame shall fall in line (see picture at the right). If they don't so open some screws of the main frame bearing blocks and spacers and align the complete frame. Don't forget to refresh thread lock.**







Hardware for these assemblies

0021 x 1
M4 Lock Nut

0059-2.5 x 8
M3x16 Socket Set Screw

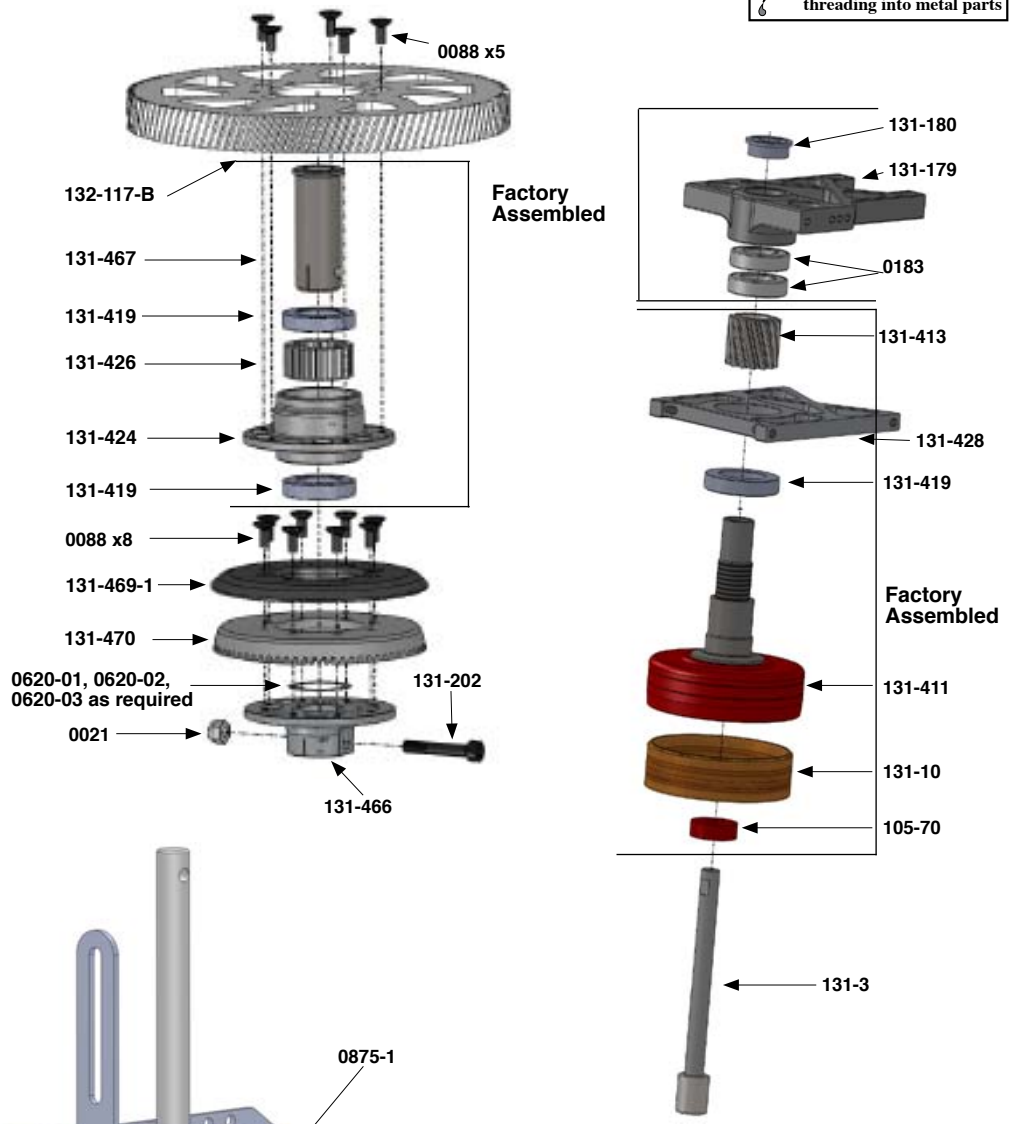
0088 x 13
M3x8 Tappered Bolt

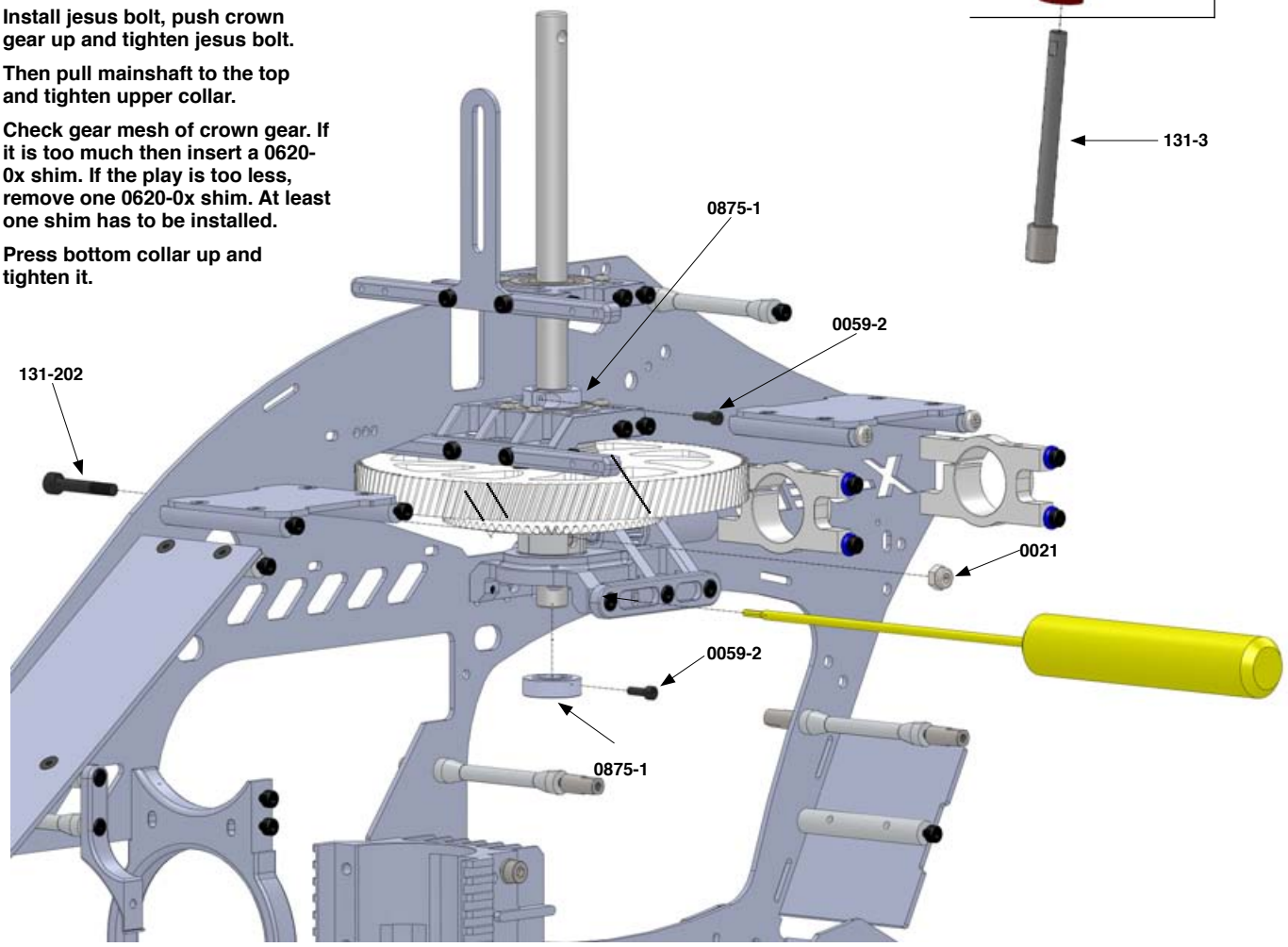
131-202 x 1
Jesus Bolt OWB

Assembly Tip

- **Assemble main gear and crown gear at the corresponding hubs.**
- **Install front drive assembly and one way hub with main gear at the frame and insert mainshaft with collars.**
- **Push bottom bearing block up and tighten screws. Take care that it is aligned horizontal.**
- **Install jesus bolt, push crown gear up and tighten jesus bolt.**
- **Then pull mainshaft to the top and tighten upper collar.**
- **Check gear mesh of crown gear. If it is too much then insert a 0620-0x shim. If the play is too less, remove one 0620-0x shim. At least one shim has to be installed.**
- **Press bottom collar up and tighten it.**

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





Hardware for these assemblies

2700-01 x 8
Blue M3 Washer

0051 x 2
M3x3 Set Screw

0060-1 x 4
M3x6 Socket Bolt

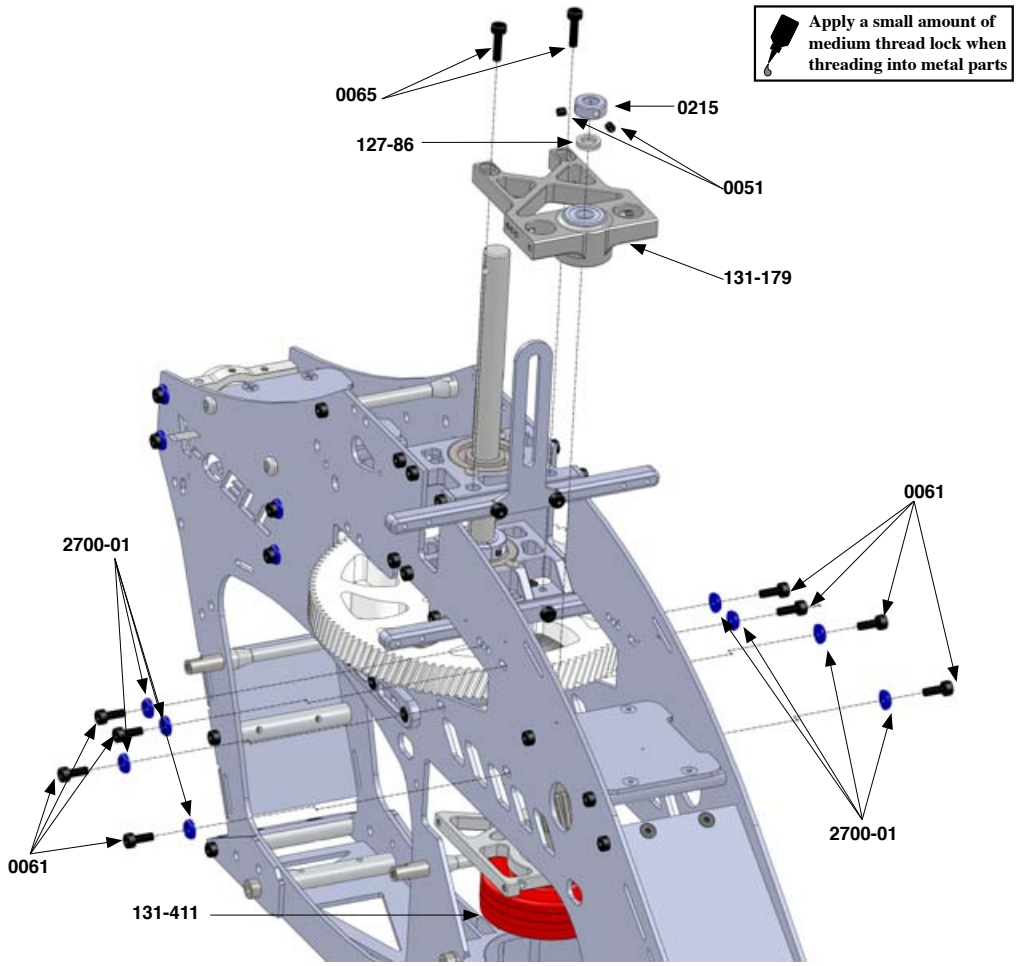
0061 x 8
M3x8 Socket Bolt

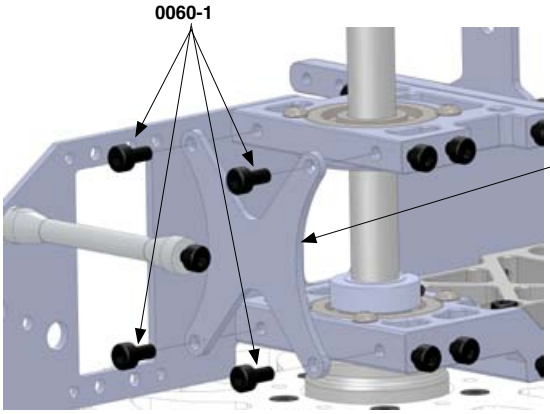
0065 x 2
M3x12 Socket Bolt

127-86 x 1-2
Washer

Assembly Tip

- **Install 131-179 but do not tighten bolts 0065 and 0061 now. Install clutch bell assembly and check gear mesh of main gear. 131-179 can be moved 0.2mm back and forward to adjust gear mesh. Tighten bolts if gear mesh is okay.**
- **Tighten bolts 0061 of the clutch bell assembly.**
- **Pull shaft 131-3 up and install 0215 and shims as needed.**
- **Remove bottom frame section as shown**





Hardware for these assemblies


0001 x 4
2mm Washer


0016-2 x 2
4mm Saftey Washer


0018 x 2
M2 Lock Nut


0049 x 2
M2x10 Socket Bolt


0064-3 x 4
M3x6 Button Head


0078-4 x 2
M4x6 Socket Bolt

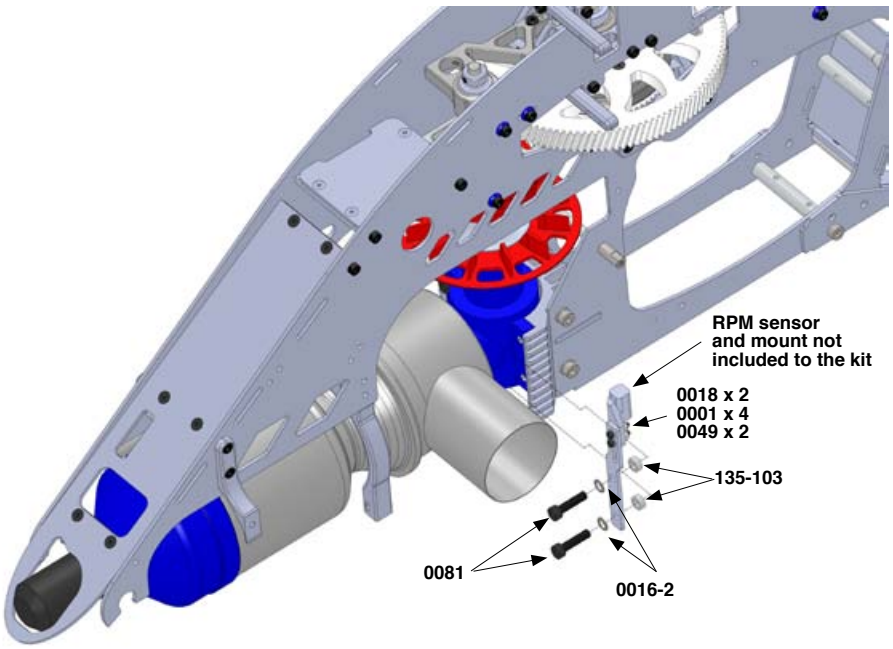

0080 x 2
M4x14 Socket Bolt

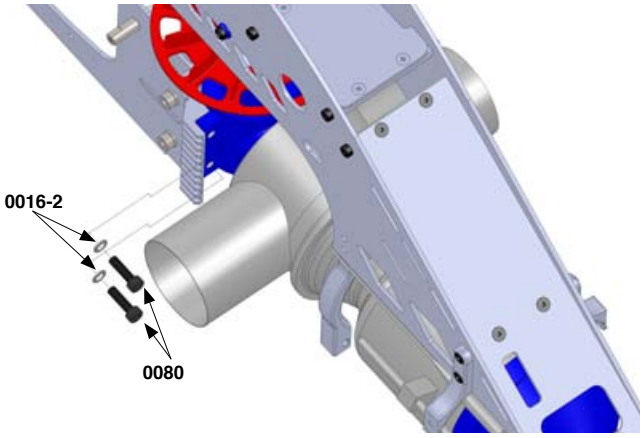

0081 x 2
M4x16 Socket Bolt

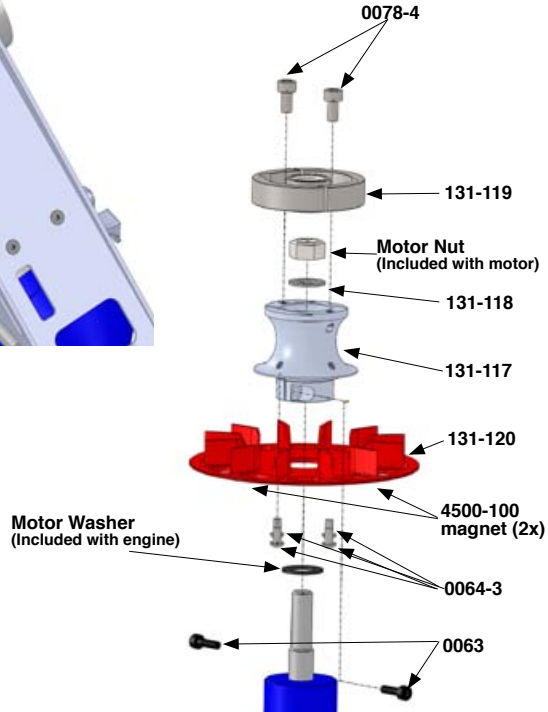
Assembly Tip

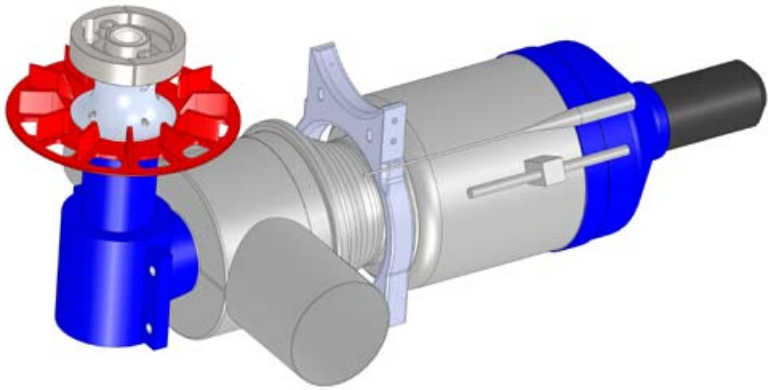
- Install the magnets at the fan using epoxy like UHU 300. Follow instructions of the glue. One mangent has to face by 'N' to the top of the fan the other by 'S' (north and south pole of magnet)
- Assemble fan hub to fan, then install motor washer and hub on engine and tighten MA0063 socket bolts a little to clamp onto engine shaft.
- Next, install 131-118 washer and nut (included with engine). Follow manual of turbine engine. Now tighten bolts 0063.Use a dial indicator to verify runout of the hub at the inner surface. It should be less than +/- 0.015mm. If runout is too big, repeat install procedure and rotate hub by 90°.
- Install clutch (one-way bearing is factory installed).

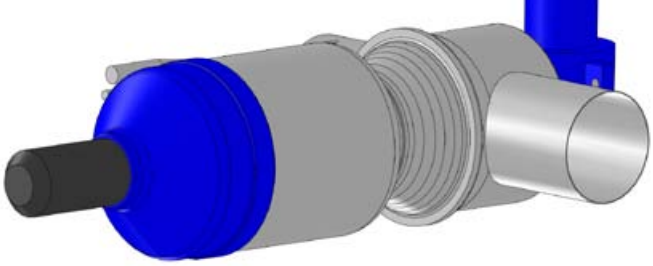
Apply a small amount of medium thread lock when threading into metal parts











At youtube you can find a tutorial about how to setup and align the turbine engine to correct position at the helicopter frame

https://www.youtube.com/watch?v=0mAdLoaoXks&t=102s

Hardware for these assemblies

0003 x 3
3mm Washer

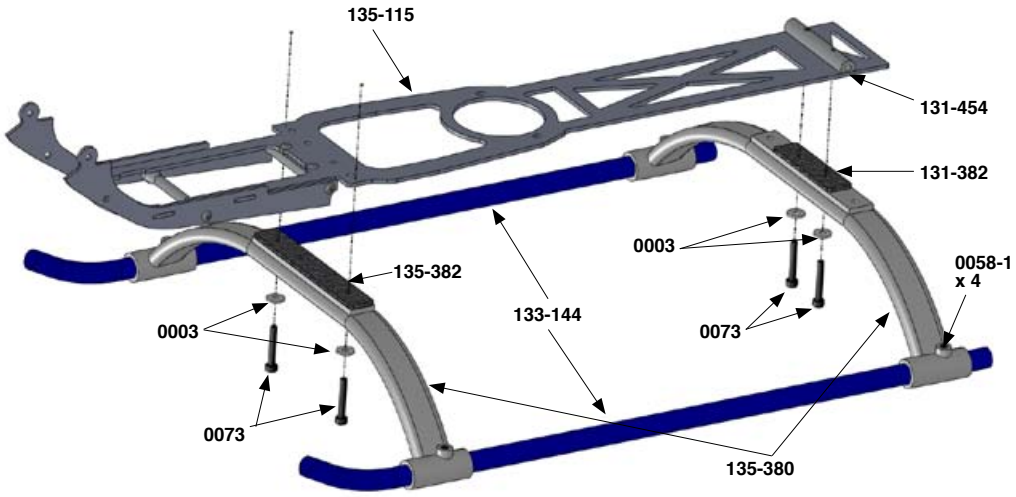
0058-1 x 4
M4x6 Socket Set Screw

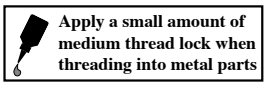
0061 x 8
M3x8 Socket Bolt

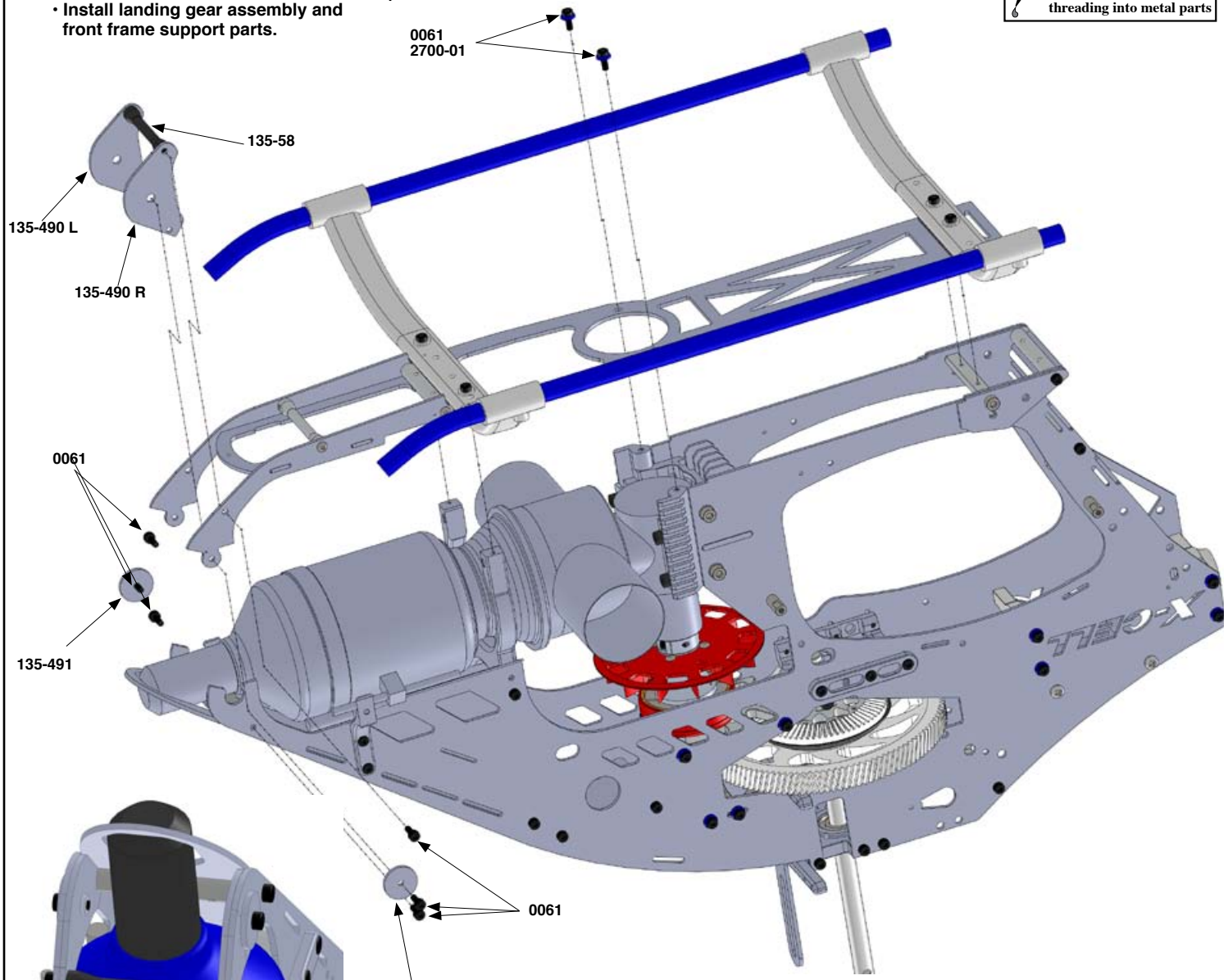
0073 x 1
M3x20 Socket Bolt

Assembly Tip

- **Install bottom frame assembly at the landing gear.**
- **Install landing gear assembly and front frame support parts.**







Hardware for these assemblies

0017-2 x 2
2.5mm Hex Nut

0059-1 x 4
M2.5x6 Socket Bolt

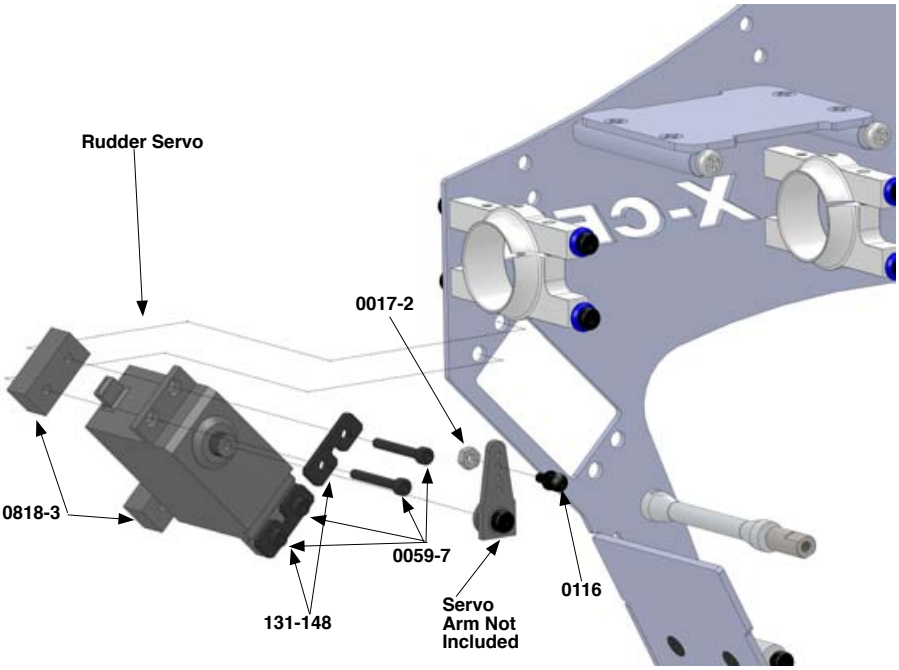
0059-4 x 4
M2.5x12 Socket Bolt

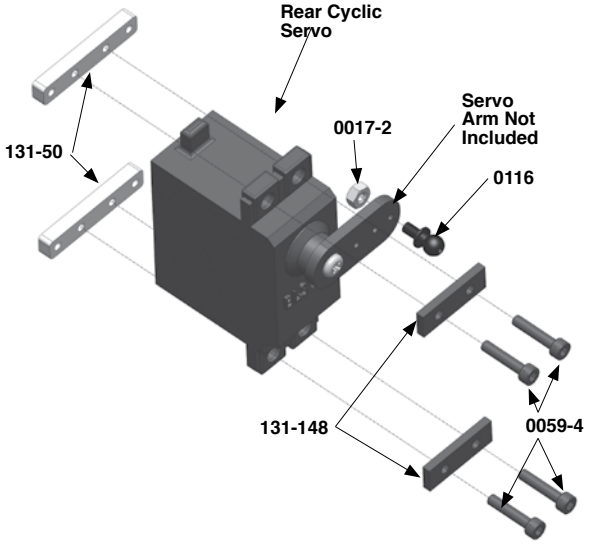
0059-7 x 4
M2.5x20 Socket Bolt

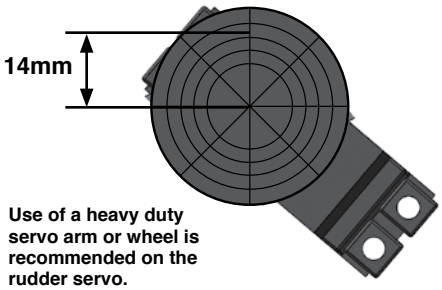
0116 x 2
M2.5 Threaded Steel Ball

Assembly Tip

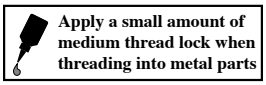
- **Do not overtighten servo mount screws. This will damage the rubber dampers of the servos.**
- **Use high quality servo arms. Don't forget to use thread lock to secure the balls 0116 and nuts 0017-2**



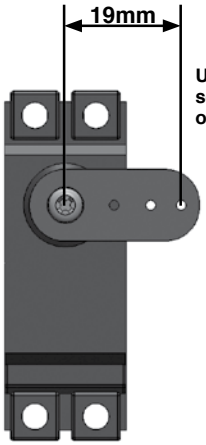




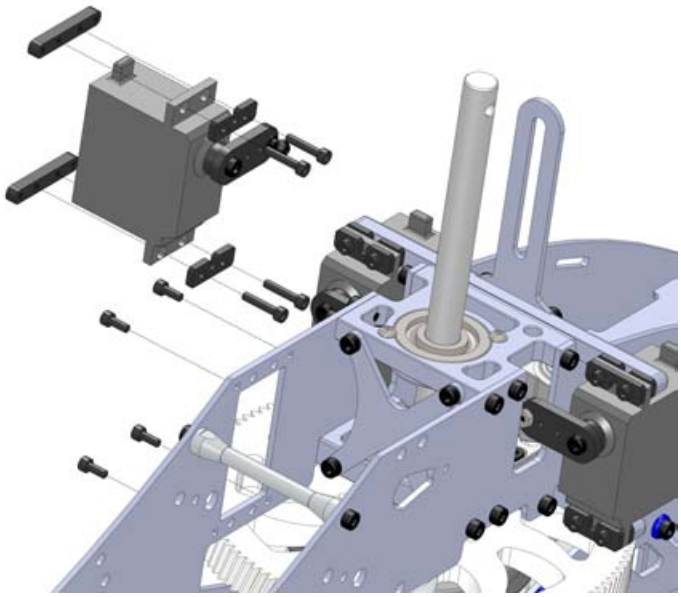
Use of a heavy duty servo arm or wheel is recommended on the rudder servo.



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



Use of heavy duty servo arms is required on the cyclic servos.



Hardware for these assemblies

2700-01 x 4
Blue M3 Washer

0009 x 4
3mm small Washer

0017-2 x 2
2.5mm Hex Nut

0059-4 x 8
M2.5x10 Socket Bolt

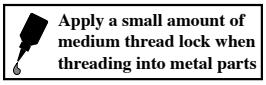
0061 x 4
M3x8 Socket Bolt

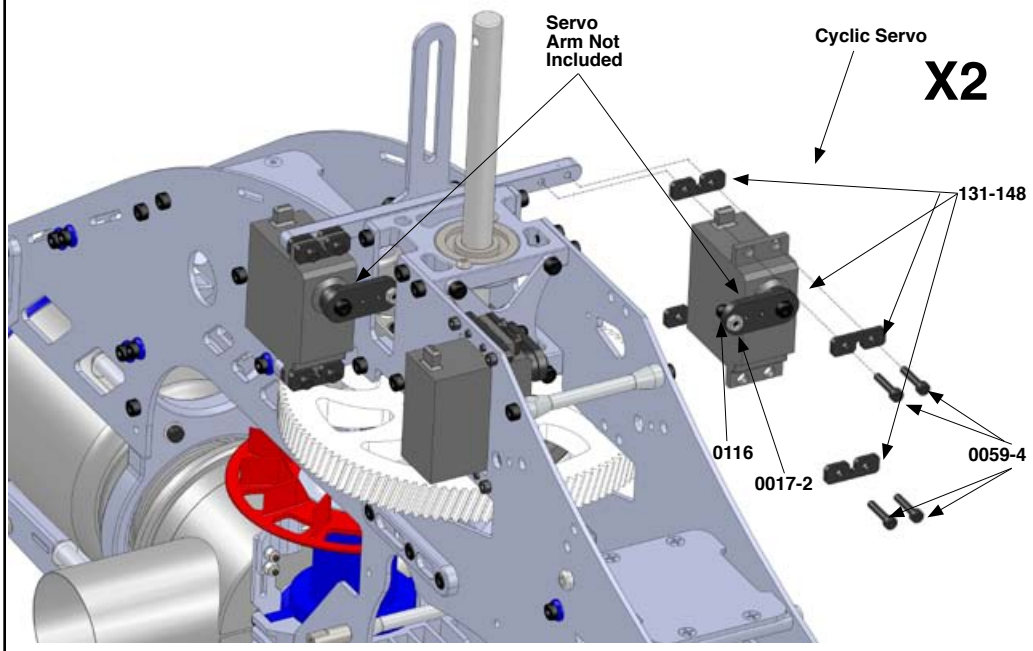
0069 x 4
M3x16 Socket Bolt

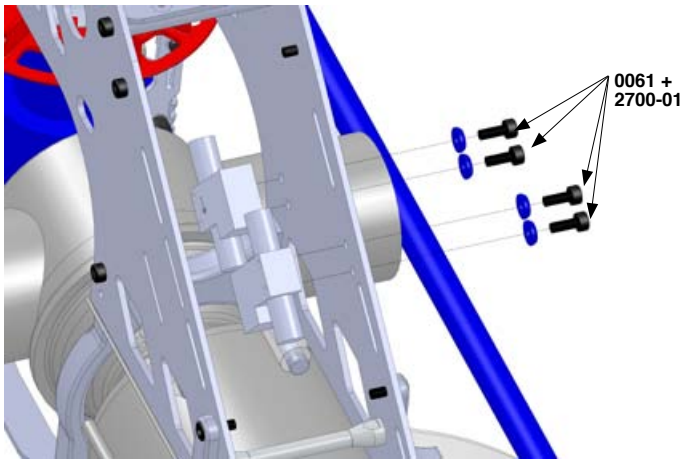
0116 x 2
M2.5 Threaded Steel Ball

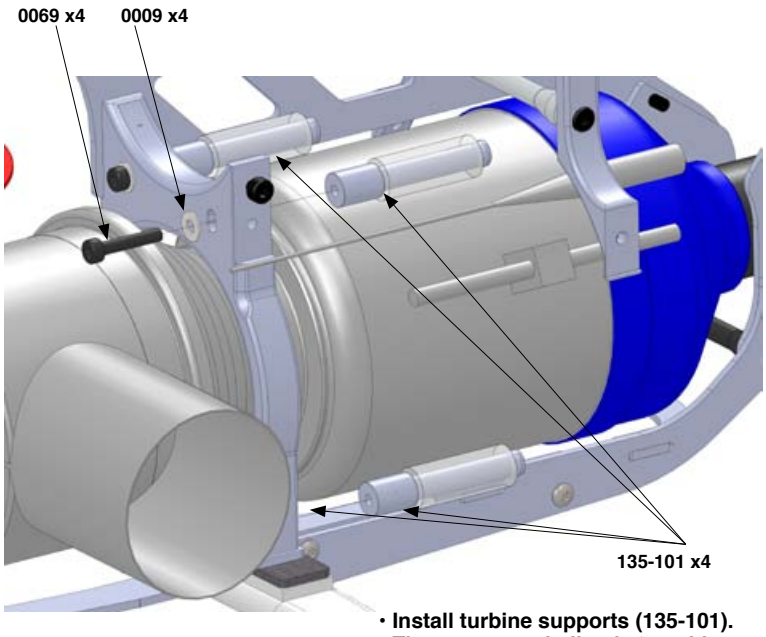
Assembly Tip

- MA131-148 Servo Spacers are included for proper servo linkage alignment, if required.
- Install valves as shown
- Use adhesive velcro and hook & loop tape to install pump

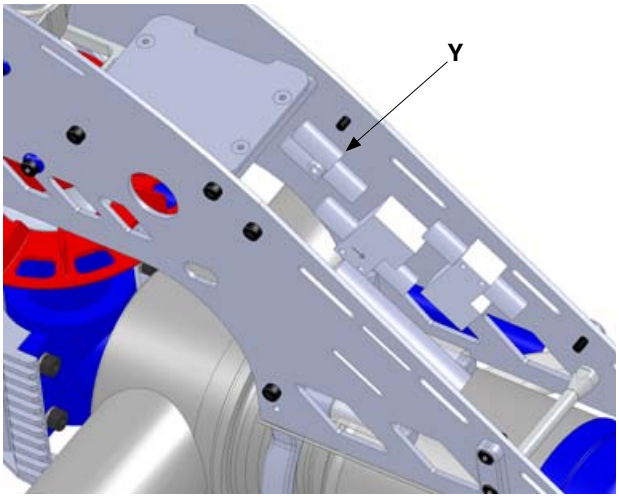


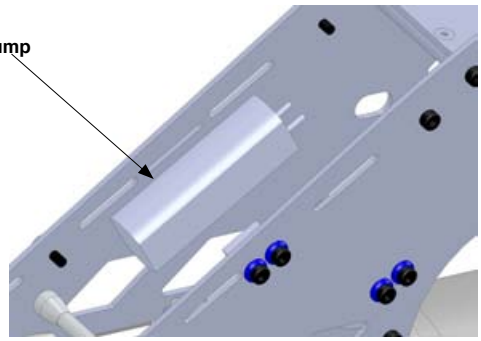






- Install turbine supports (135-101). The supports shall only 'touch' the engine. They shall not supply pressure to the engine body.





Hardware for these assemblies

0016-2 x 4
4mm Saftey Washer

0060-1 x 3
M3x6 Socket Bolt

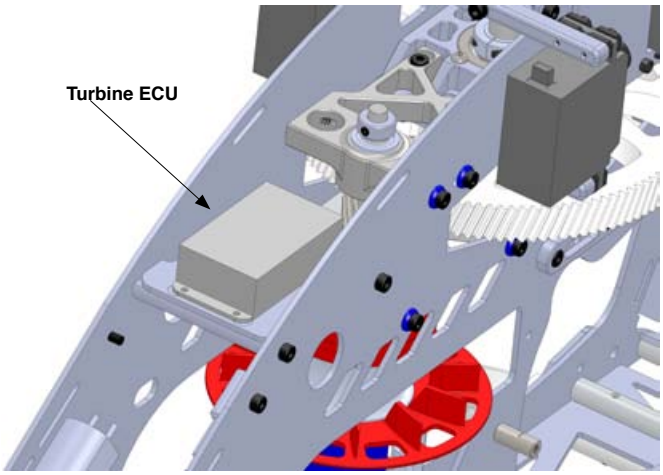
0067 x 2
M3x10 Socket Bolt

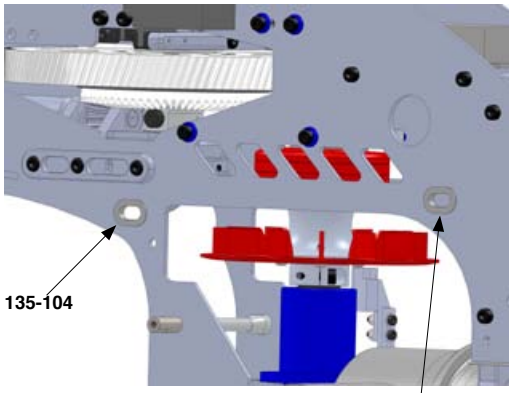
0078 x 2
M4x12 Socket Bolt

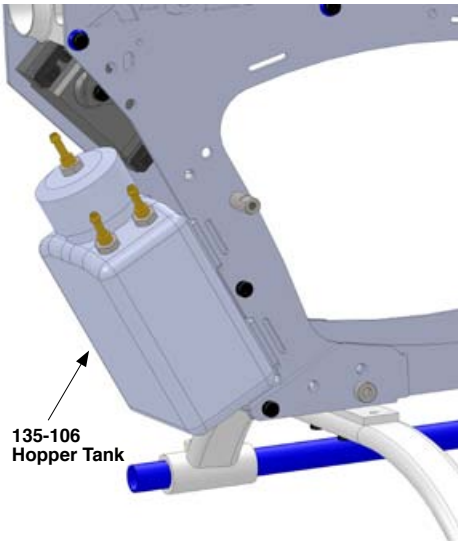
0087 x 2
M4x20 Socket Bolt

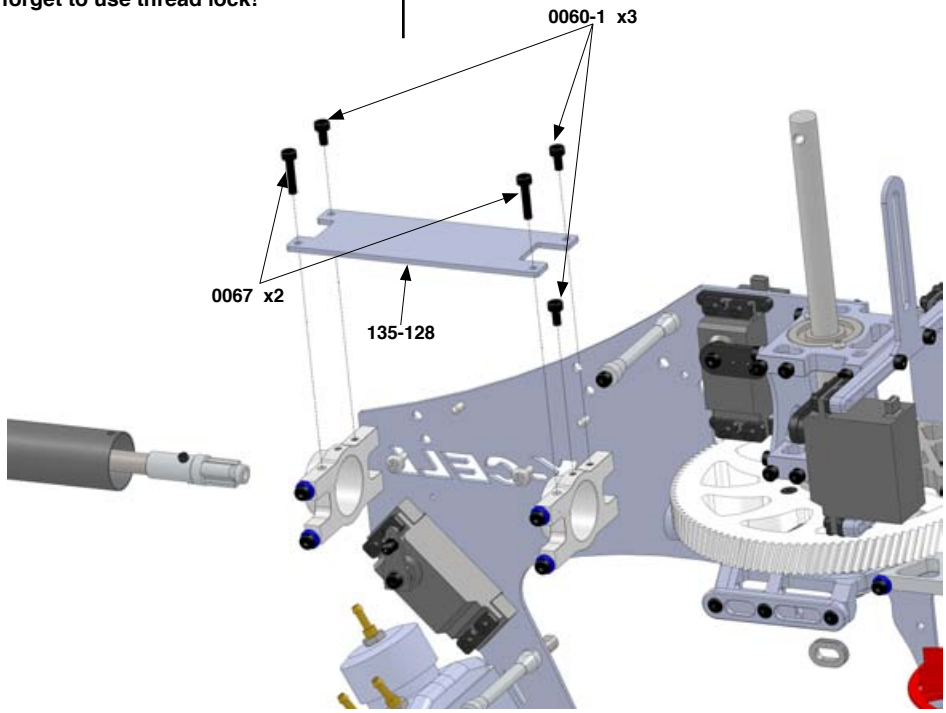
Assembly Tip

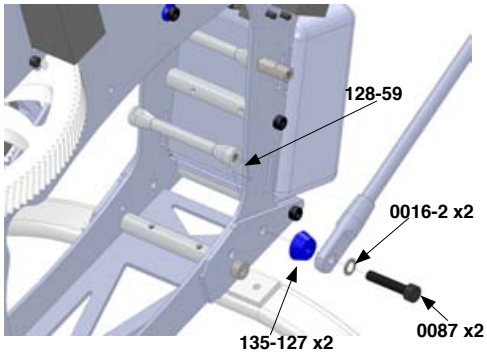
- **Install rubber grommets 135-104. Through this grommets the fuel line goes out of the frame, passes the fan and goes inside again to the pump.**
- **Install header tank using double sided tape and hook & loop tape to secure it. The center nipple is connected to the engine fuel pump. The right nipple (picture on the right side) is connected to the main tank. The left nipple is used to fuel the tank system.**
- **Install tail boom assembly. Don't forget to use thread lock!**

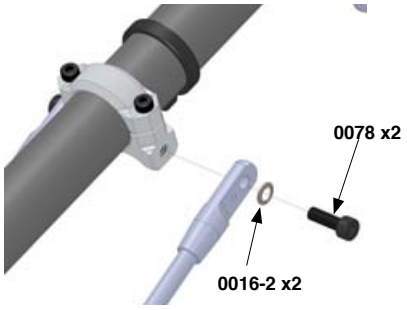












Hardware for these assemblies

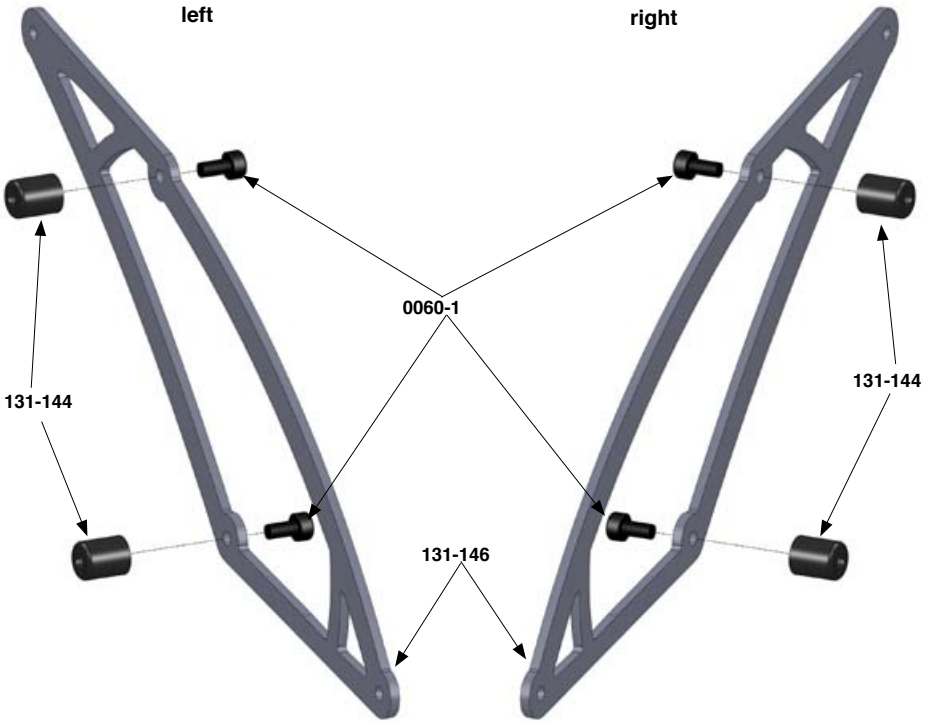
2700-01 x 2
Blue M3 Washer

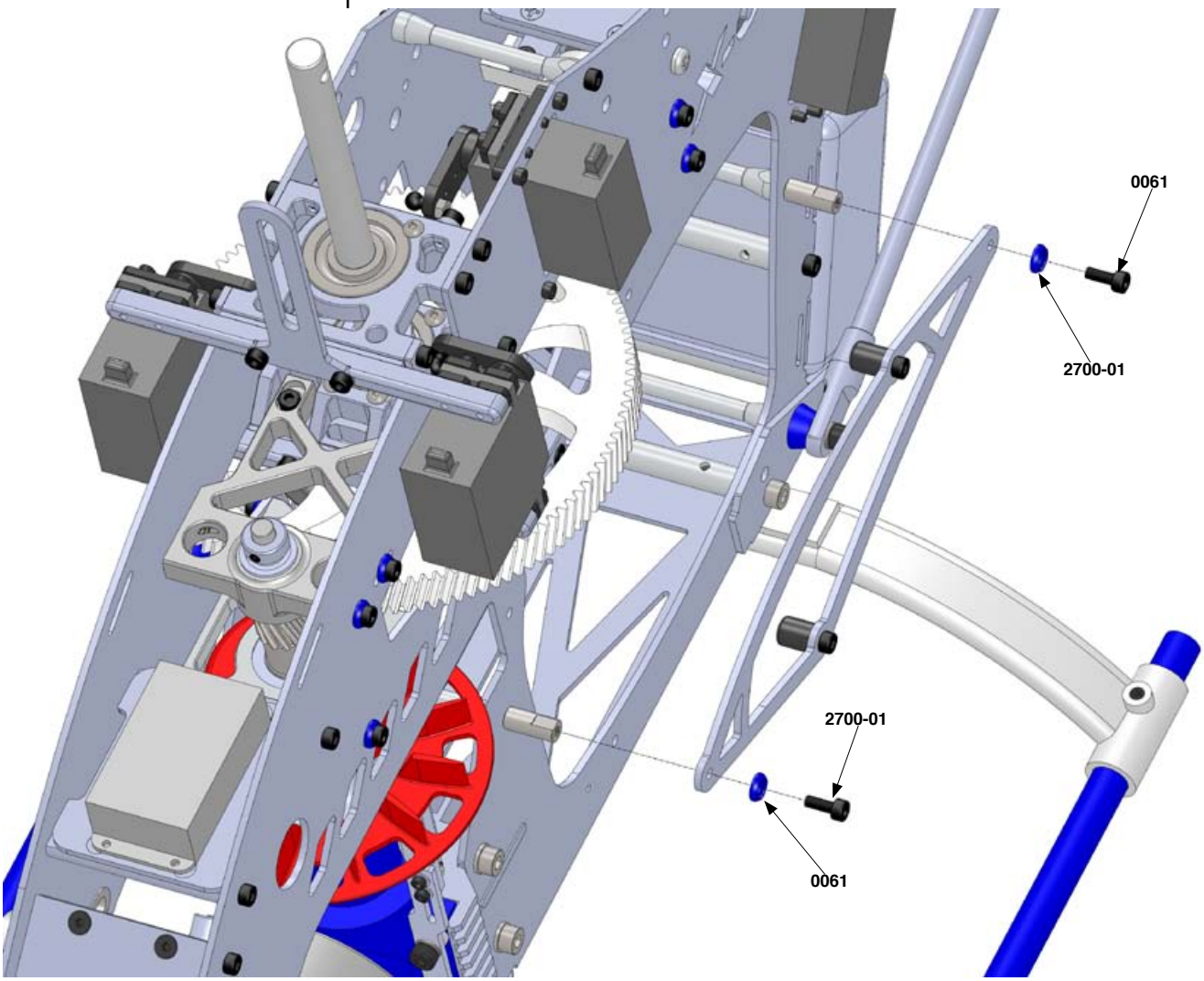
0060-1 x 4
M3x6 Socket Bolt

0061 x 2
M3x8 Socket Bolt

Assembly Tip

- **Preassemble the tank supports. Take care that there is a left and a right side version.**
- **Install the left side at the main frame**





Hardware for these assemblies

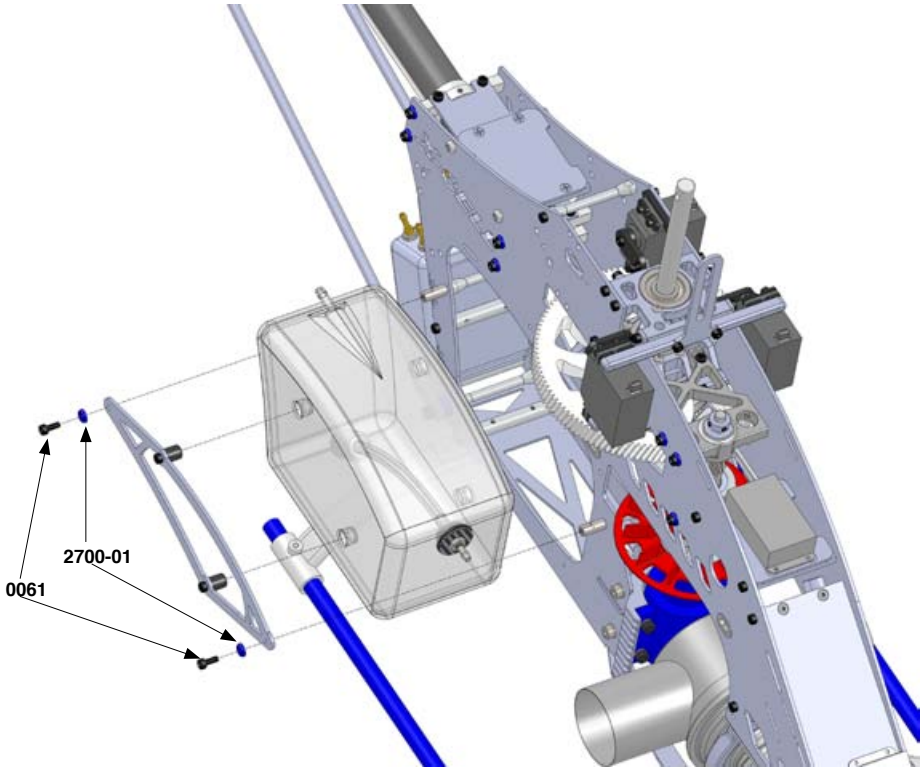
2700-01 x 6
Blue M3 Washer

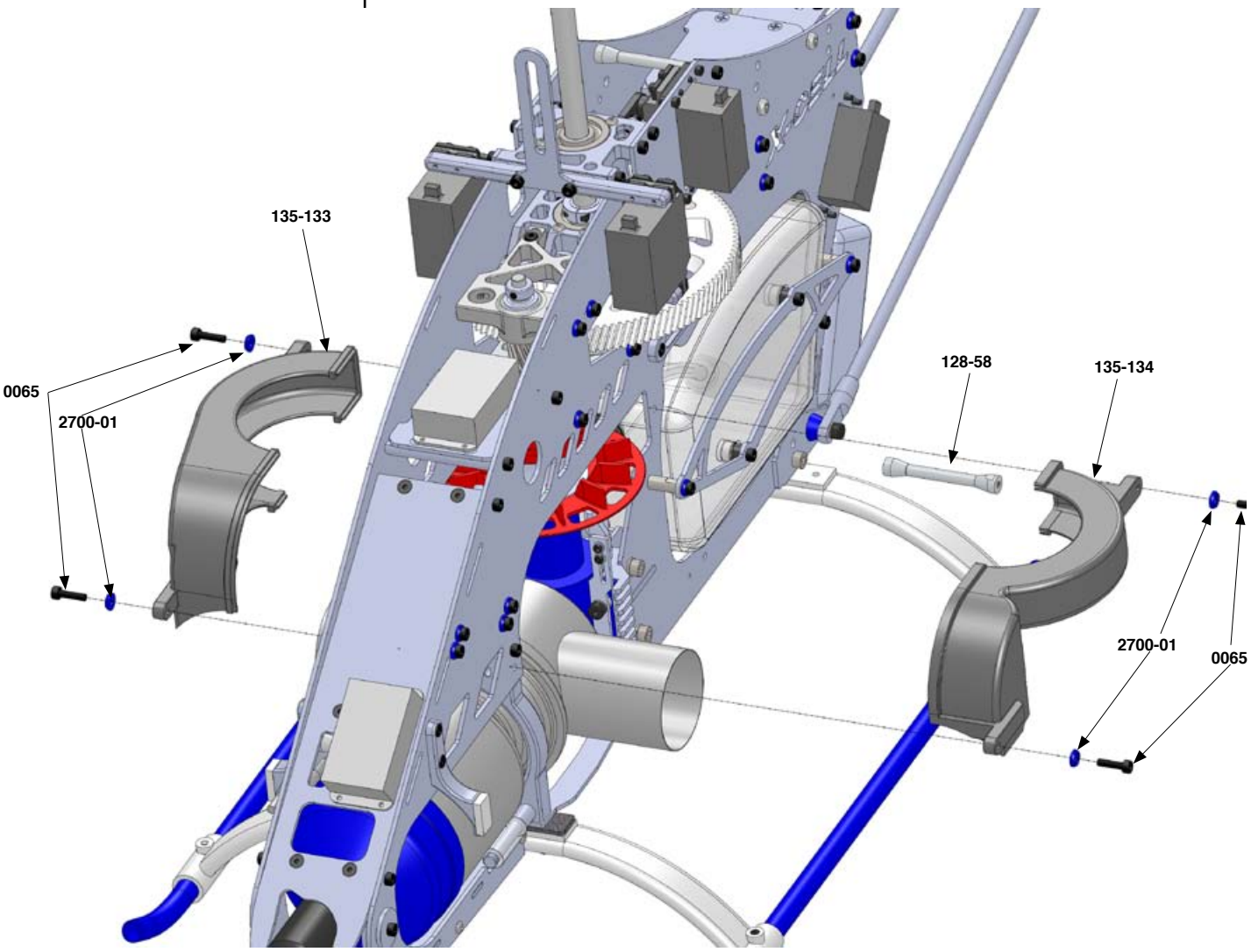
0061 x 2
M3x8 Socket Bolt

0065 x 4
M3x12 Socket Bolt

Assembly Tip

- **Install fuel lines to fuel tank before installing it into the frame.**
- **Do not overtighten bolts for fan shroud.**





Hardware for these assemblies

0021 x 1
M4 Hex Locknut

0061 x 6
M3x8 Socket Bolt

0063 x 2
M3x10 Socket Bolt

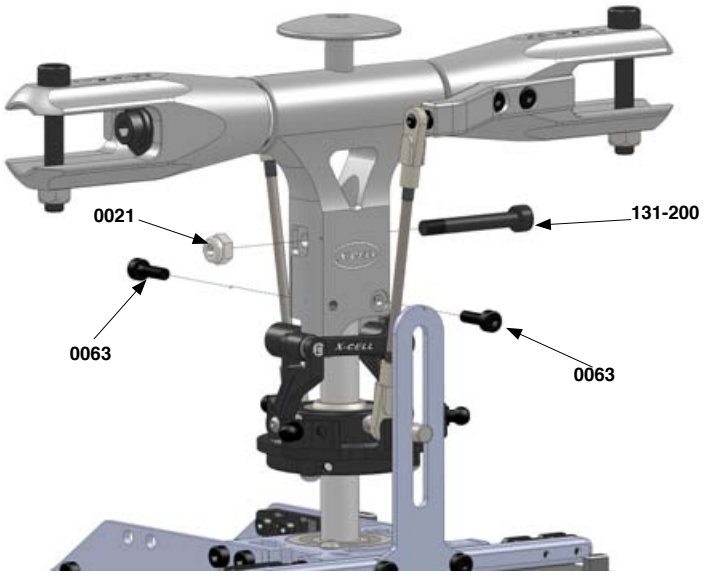
131-200 x 1
M4 Jesus Bolt OWB V2

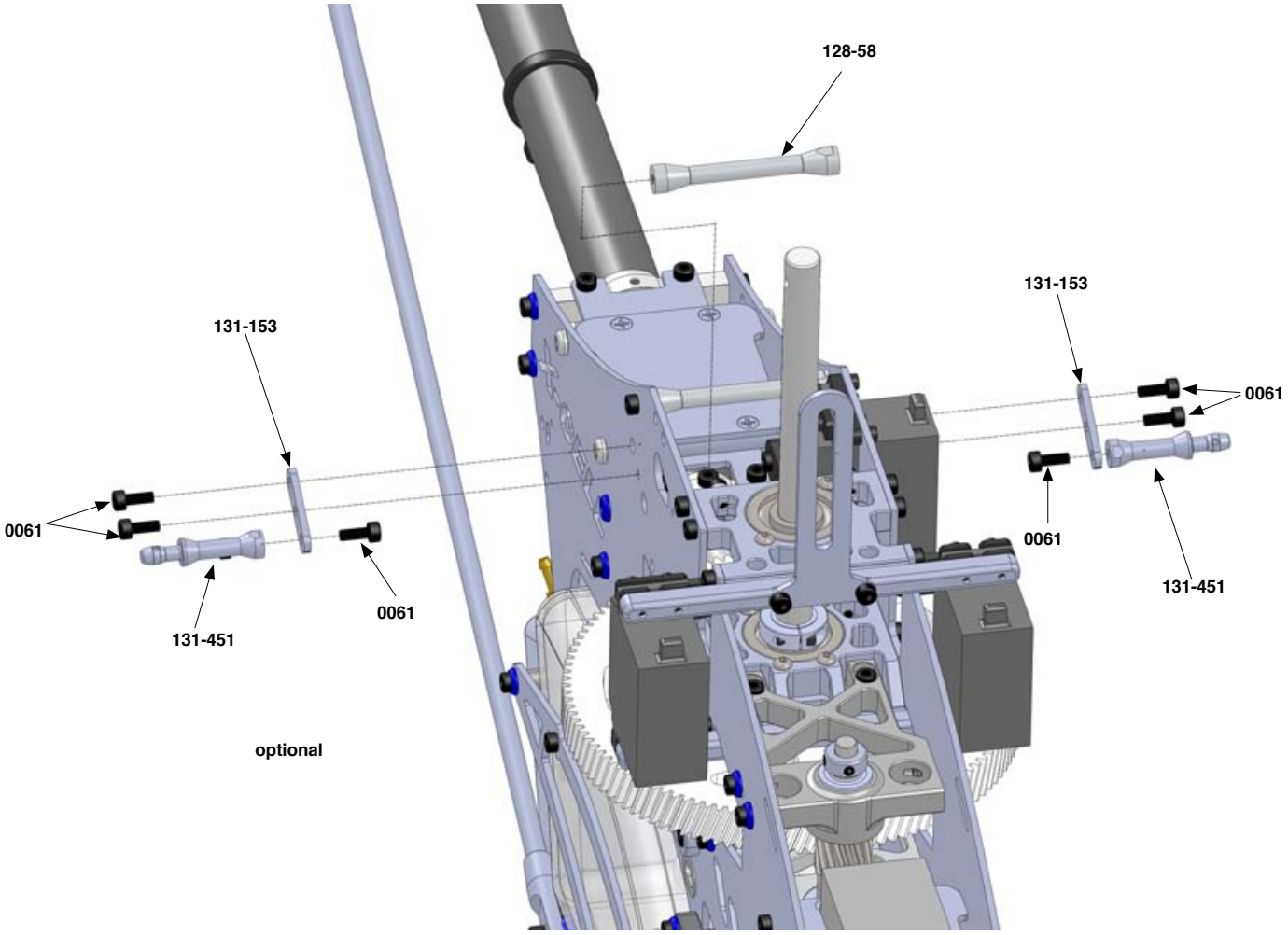
Assembly Tips

- **Install main rotor head. Tighten bolts 0063 carefully and equal.**
- **Install rear canopy mounts at the carbon safety parts and install them at the frame.**

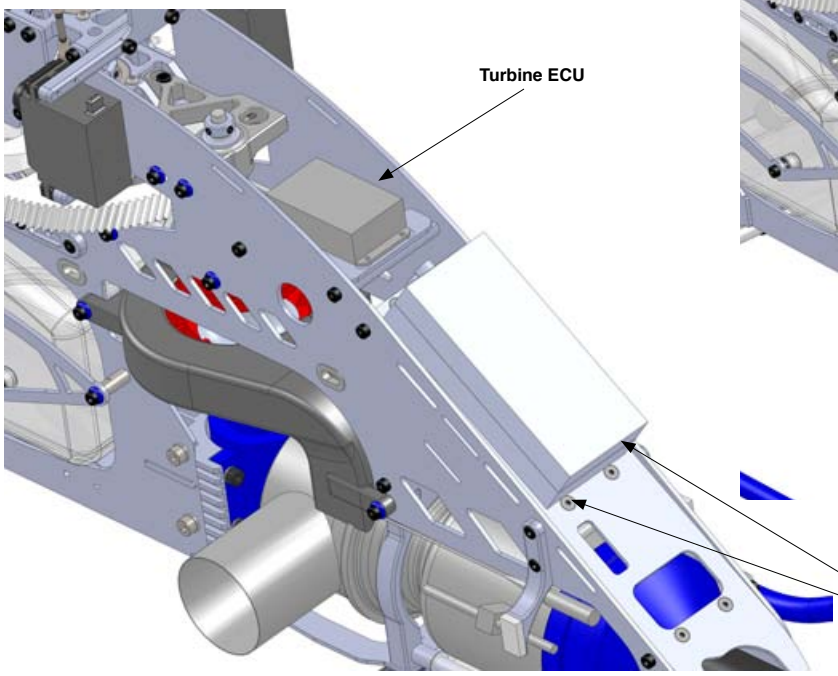
After Main Shaft is bolted to the Main Gear, adjust Bottom Main Shaft Bearing Block to eliminate any vertical play. Tighten Bottom Bearing Block bolts.

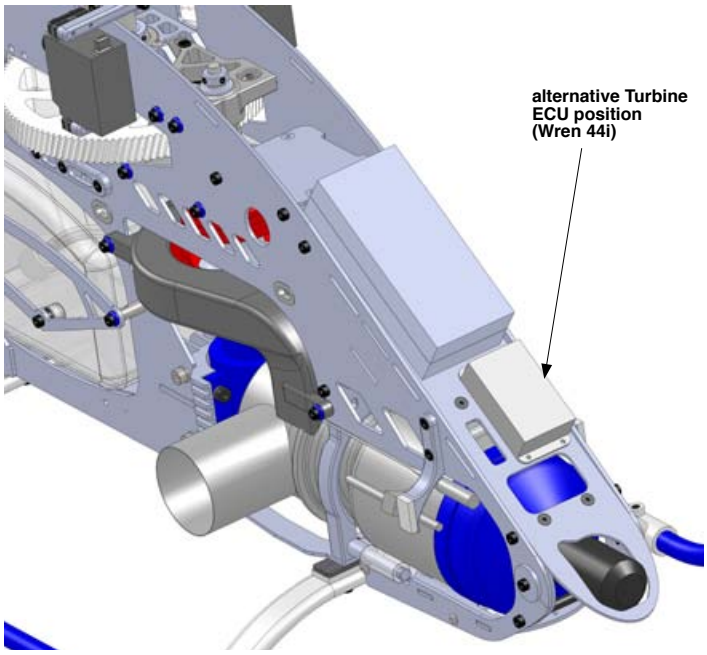
Apply a small amount of medium thread lock when threading into metal parts





Suggested Electronics Mounting Positions



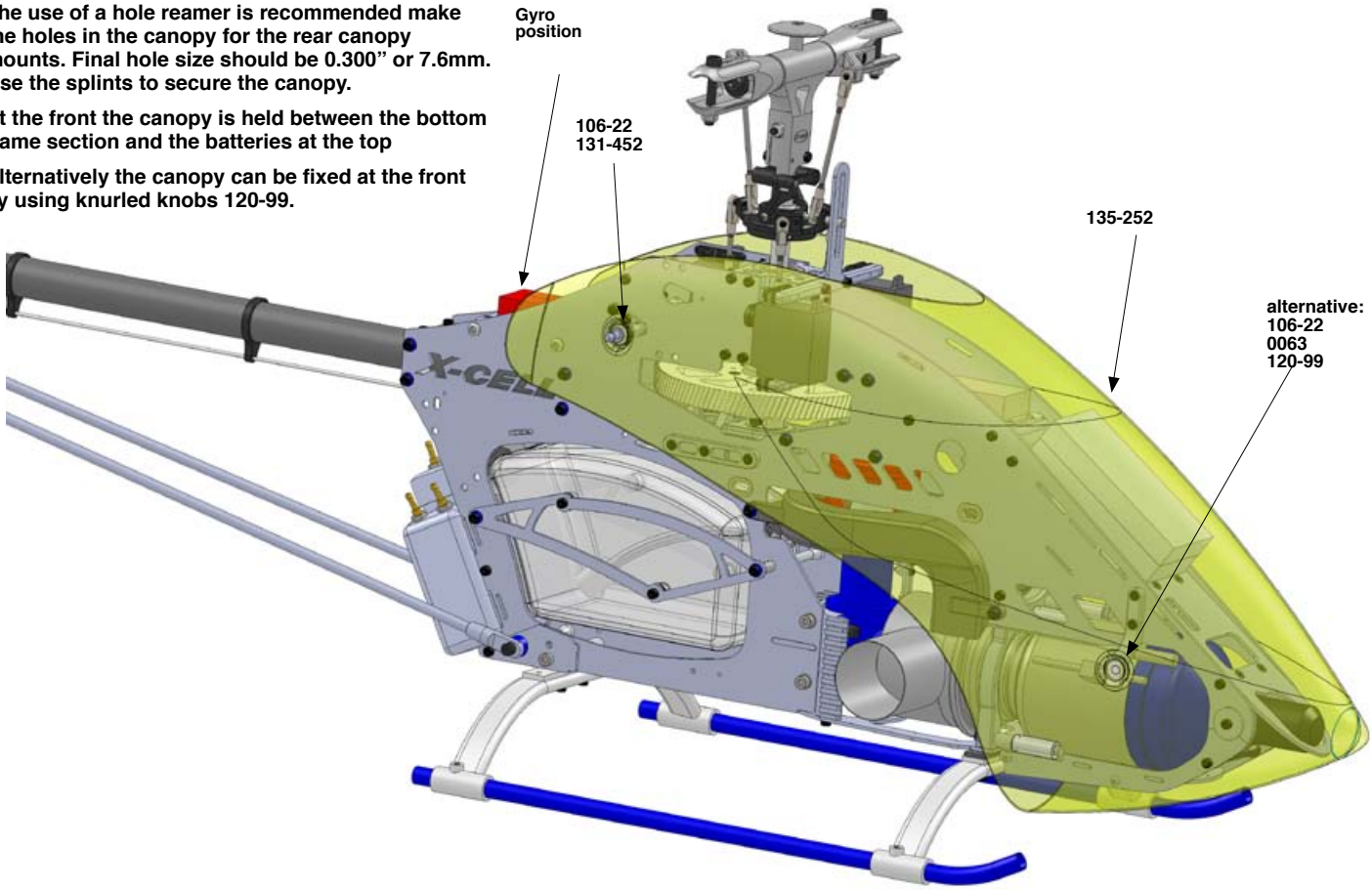


(!) Two seperate Batteries: Receiver Battery and Turbine Battery

OptiPower 2S3500 RX packs are recommended (OPR35002SRX, 99mm x 44mm x 14mm). They fit perfect below the canopy and hold the canopy in position.

Assembly Tips

- **The use of a hole reamer is recommended make the holes in the canopy for the rear canopy mounts. Final hole size should be 0.300” or 7.6mm. Use the splints to secure the canopy.**
- **At the front the canopy is held between the bottom frame section and the batteries at the top**
- **Alternatively the canopy can be fixed at the front by using knurled knobs 120-99.**



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 cyclic 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 to 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:

The TS 45i Whiplash edidtion turbine engine can be controlled by a throttle curve for sport flying. But it is higly recommended to use a high performance, adaptive governor like the Futaba GY701 or CGY 760 to stabilize the head speed.

Typical head speed for hovering is 1650 rpm, for sport flying it is 1800 rpm, for 3D flying and fast maneuvers 2050 rpm head speed is recommende.

In all flying conditions and all situations the maximum headspeed **must never exceed 2,200 rpm**. Otherwise the turbine engine will overspeed and will result in a defect of the engine.

Follow the manual of the turbine engine to setup the radio and turbine ECU for correct operation.

Always (!) setup the failsafe function of your radio system to 'engine off' in case of a failsafe condition. Never operate the turbine engine without having setup this correctly.

Follow the instructions of the governor manual to setup the function correctly. In case of any questions please contact Miniature Aircraft.

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.

Take care to only using Flybareless Systems which are capable to handle the supersonics emitted by the turbine engine. Otherwise the FBL system will fail and this will result in the loose of control of the helicopter.

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
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
131-62	Tail Boom
131-64	Tail Hub
131-66	4x10 Thrust Bearings - Tail Grips
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
131-112	T/R Blade Grip
131-117	Fan Hub
131-119	Clutch
131-120	Engine Fan
131-129	Tail Box
131-130-B	Tail Pitch Control Bellcrank
131-131	C/F Tail Bellcrank Bracket
131-132-B	Bellcrank Slider Cup
131-133	Whiplash Fan Shroud - Left
131-134	Whiplash Fan Shroud - Right
131-135	Bracket Washer
131-136	Strut
131-138	Whiplash Fuel Tank
131-144	Rubber Fuel Tank Mount
131-145	Fuel Tank Standoff
131-146	C/F Fuel Tank Plate
131-148	C/F Servo Plates
131-153	C/F Breakaway Tab
131-161	Main Blade Grip
131-163	FBL Pitch Arm
131-179	Whiplash 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
131-368	FBL Head Block
131-400	Torque Tube End
131-408	FBL Main Shaft
131-420	Middle Main Shaft Bearing Block
131-424	Main Gear Hub
131-440	Bearing Block Mount A
131-441	Bearing Block Mount B
131-442	Bearing Block
131-451	Rear Canopy Post
131-452	Splint
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
131-490	Damper Sleeve
131-491	Damper 80D O-ring
132-117-B	Main Gear 117T
133-60	C/F Tail Fin
133-144	Skid Tube
133-458	Torque Tube
135-29	C/F X-Brace
135-55	Front Battery Tray
135-57	Spacer
135-58	Frame Spacer
135-100	Eninge Mount
135-101	Engine Support
135-103	Spacer
135-104	Rubber Grommet
135-106	Hopper Tank
135-107	C/F Frame Doubler
135-115	C/F Bottom Plate
135-124	Turbine Mount
135-127	Boom Support Spacer
135-128	C/F Boom Clamp Plate
135-133	Fan Shroud R
135-134	Fan Shroud L
135-252	Whiplash Canopy
135-380	White Struts
135-411	Clutch Bell
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
3400-38	Fuel Line
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.

For updates to this manual, or any other Miniature Aircraft manual, go to www.miniatureaircraft.de

miniature aircraft

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