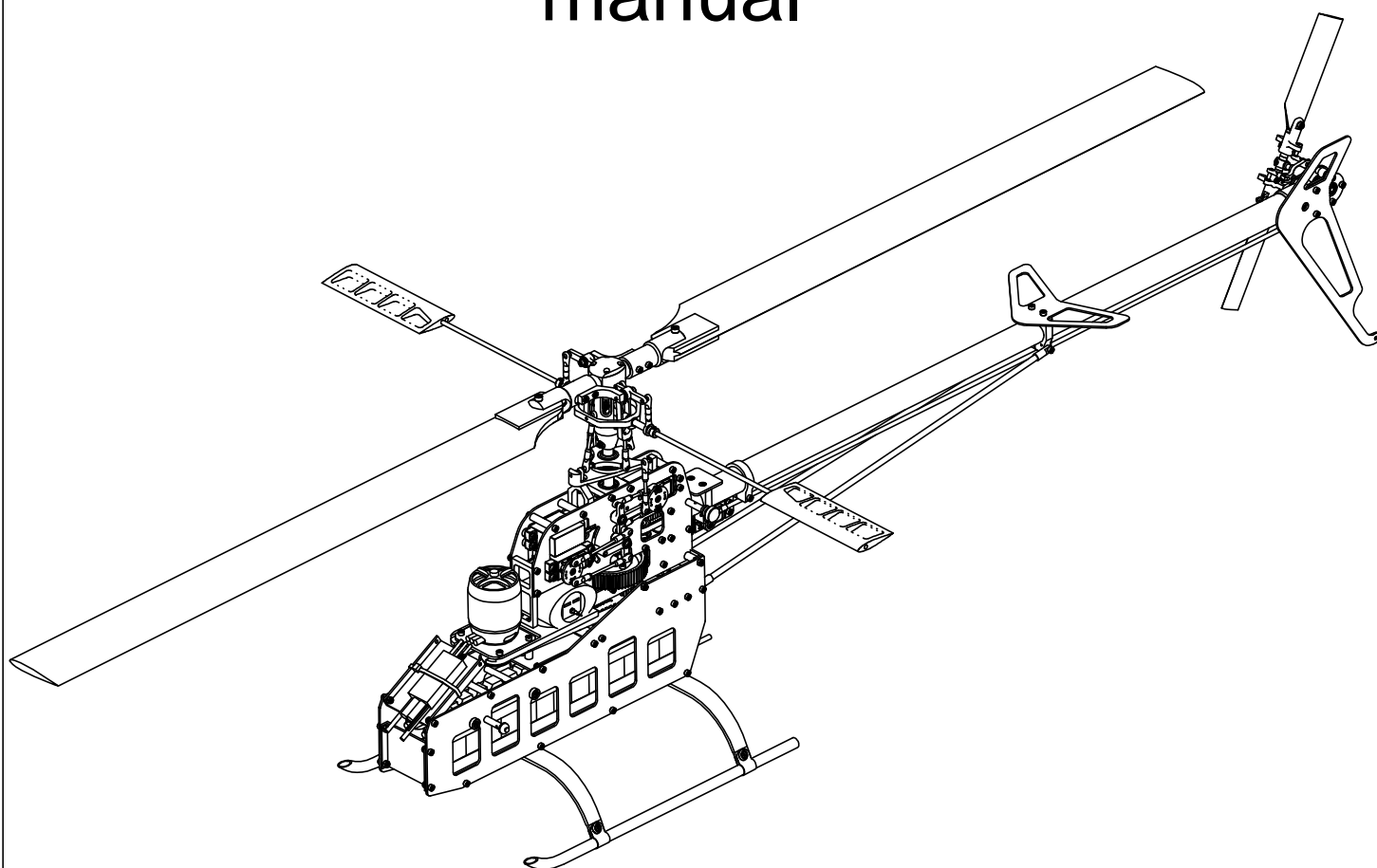


# ***Joker 2***

Ord.-No.: 2500

**manual**



***minicopter***

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34246 Vellmar

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version 4

Date: july 3rd 2007

## *minicopter*

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Congratulations on the purchase of your *Joker 2* - helicopter.

The successor of our popular Joker-series has got some new features to increase its span of usage. From beginners training over usage in scale bodies, as photo helicopter to 3D extrem flight is everything possible without modifications.

New items are a toothed belt in the first gear reduction, a better servo linkage to the swash plate, a simpler and more efficient construction and a better protection of the flight battery. Our classic MFS rotorhead is standard like before and also the quality of all parts and the long life expectancy of the model. So flying and servicing will give you a great deal of fun for a long time.

The manual contains many detailed graphics so that you should have no problems when building the helicopter. Please take a little time to study the manual before beginning. Then you get an overview of the building process.

The kit contains some hexagon wrenches. Additionally you need the following tools:

### **Tools:**

Thin walled socket wrenches to fit 5,5 and 7 mm nuts.

Open wrench 4,5/5,5 mm

Hexagon wrenches for 2/2,5/3 mm bolts

Hexagon wrench 4 mm a.f. (2 required for the feathering spindle)

Sharp tongs with 45° cranked head

Phillips screwdriver small

Screwdriver flat

Screw lock Loctite 243 blue

### **Special Tools:**

Special open wrench 5,5mm for restricted access to the nuts Ord.-No. 707

Ball joint tongs e.g. Robbe S 1360

Pitch gauge e.g. Robbe S1366

Paddle gauge e.g. Robbe S1368

### **Lubricants:**

Axial bearings: normal machine lubricant (from tool suppliers)

Autorotation coupling: grease or synthetic motor oil

The gear wheels and the belt drives don't use lubricant.

### **Recommended RC-equipment:**

Receiver: Dual conversion PCM-system

RC-battery: 4 cells Sanyo KR 1700AU or cells with similar capacity

Swash-plate servos: Futaba S9252, S9206, S9202 or similar

Gyro: Futaba GY 401 with servo S9253/4 or GY 601 with servo S9251

If you have problems when building your model please contact us. We will help you!

And now: Much fun by building your *Joker 2* !

## **Safety rules:**

Radio controlled helicopters are **no toys**. A wrong use of such models can cause accidents with heavy injuries.

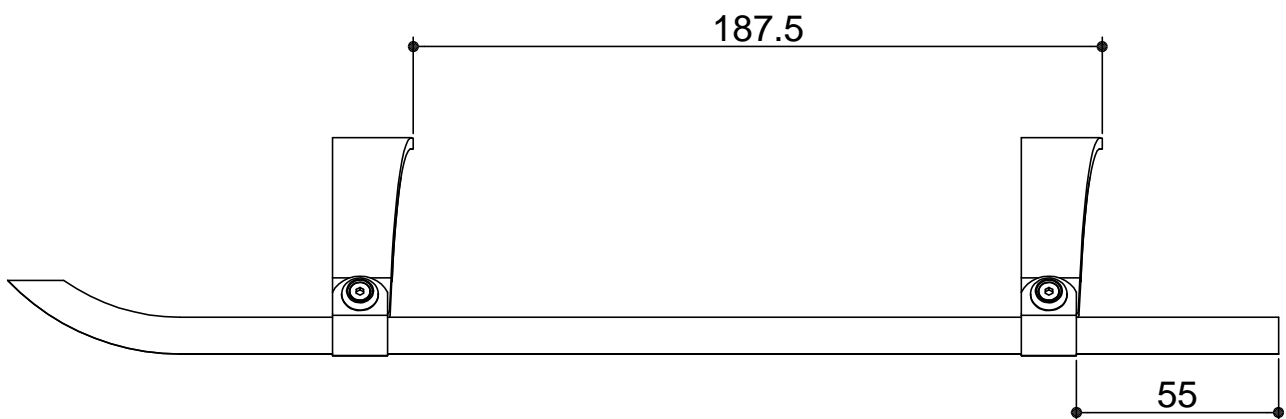
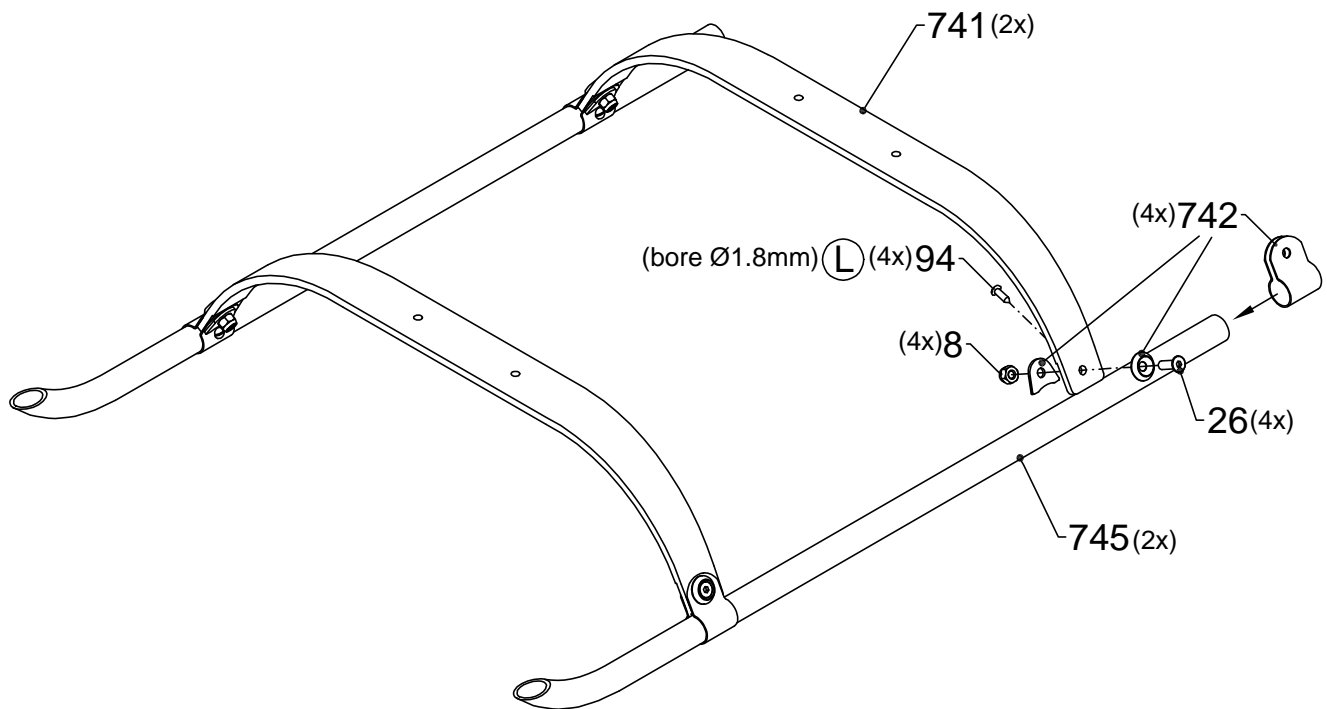
Therefore please bear following rules in your mind:

- For engine running tests on your workbench remove the complete mainrotor including all rods and the tailrotor blades. Consider that nothing can come in the tailrotor.
- You can't assess by an electric helicopter the danger of a suddenly starting engine. So remove the dangerous areas of main- and tailrotor after connecting the battery packs.
- Don't switch the controller suddenly off and on by running up. Wait some seconds if retrying.
- In hovering flight please keep a distance of at least 5 metres to the helicopter.
- Don't aim in flight persons or other creatures and keep a security distance of at least 20 metres.
- Don't fly your battery in forward flight empty, if you can't autorotate in all situations. For landing calculate a security reserve of at least 30 seconds or better one minute. Empty the battery while hovering. For safety rules for Lipo batteries please follow the rules added to the packs.
- If using Lipos add the Lipo battery just before the flight and remove it just after the flight to contain the battery always in a special metal case.
- Don't empty the battery with the last force in hovering, otherwise the battery can be damaged.
- For the first flight a partner should say you the flown time in intervals of 30 seconds so that you get a feeling for electric flight. After some time you feel an empty battery by giving full pitch for a moment. When the rotorspeed shuts down then you should search the ground for landing.
- Train autorotations with running engine as soon as possible.
- When you see that a crash is unavoidable try to stop the engine before having ground contact.

Liability exclusion:

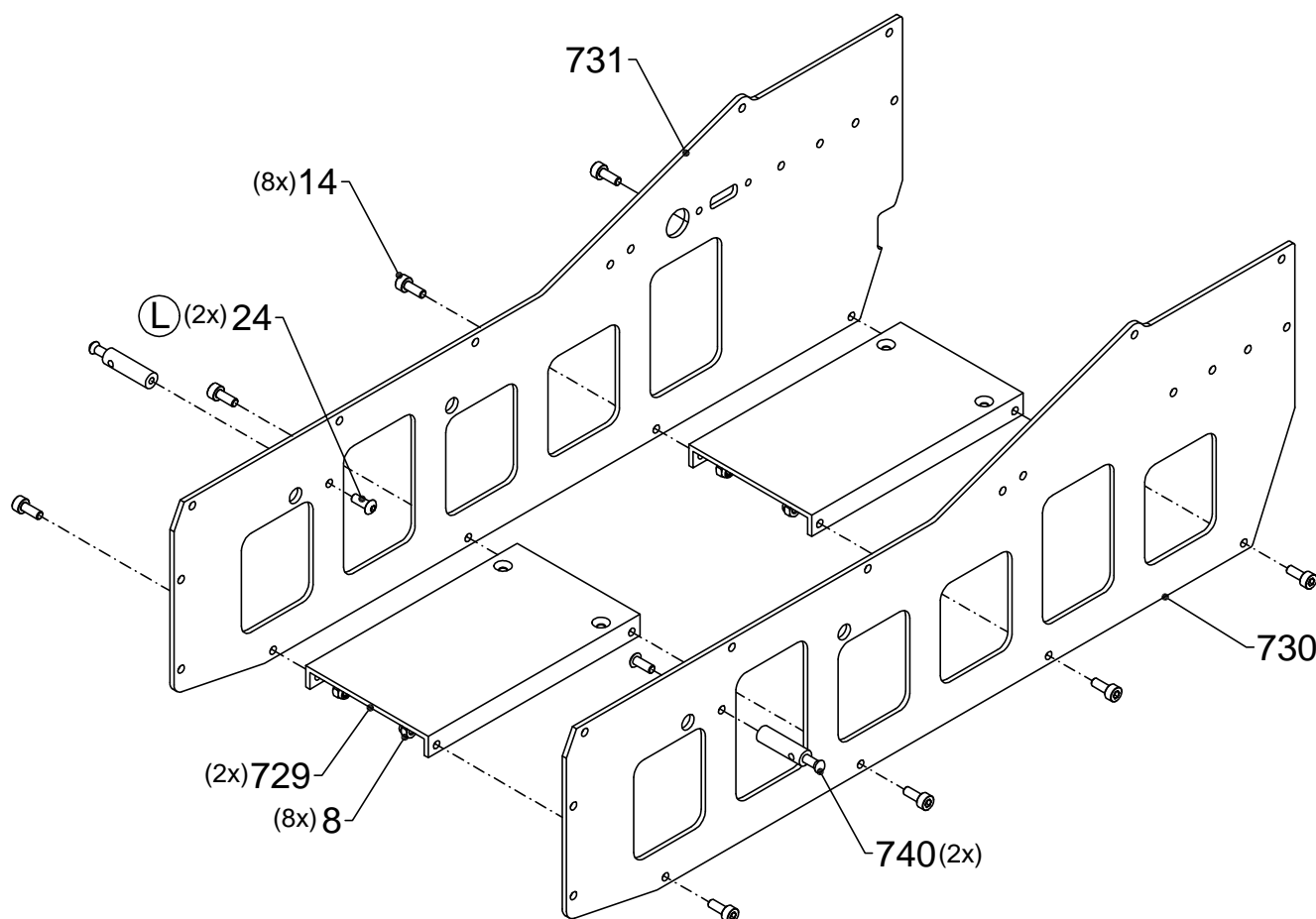
We can't observe a correct mounting, justation, maintenance and usage.  
So **no guarantee is possible**.

Vellmar, in september 2004



(L) = use Loctite

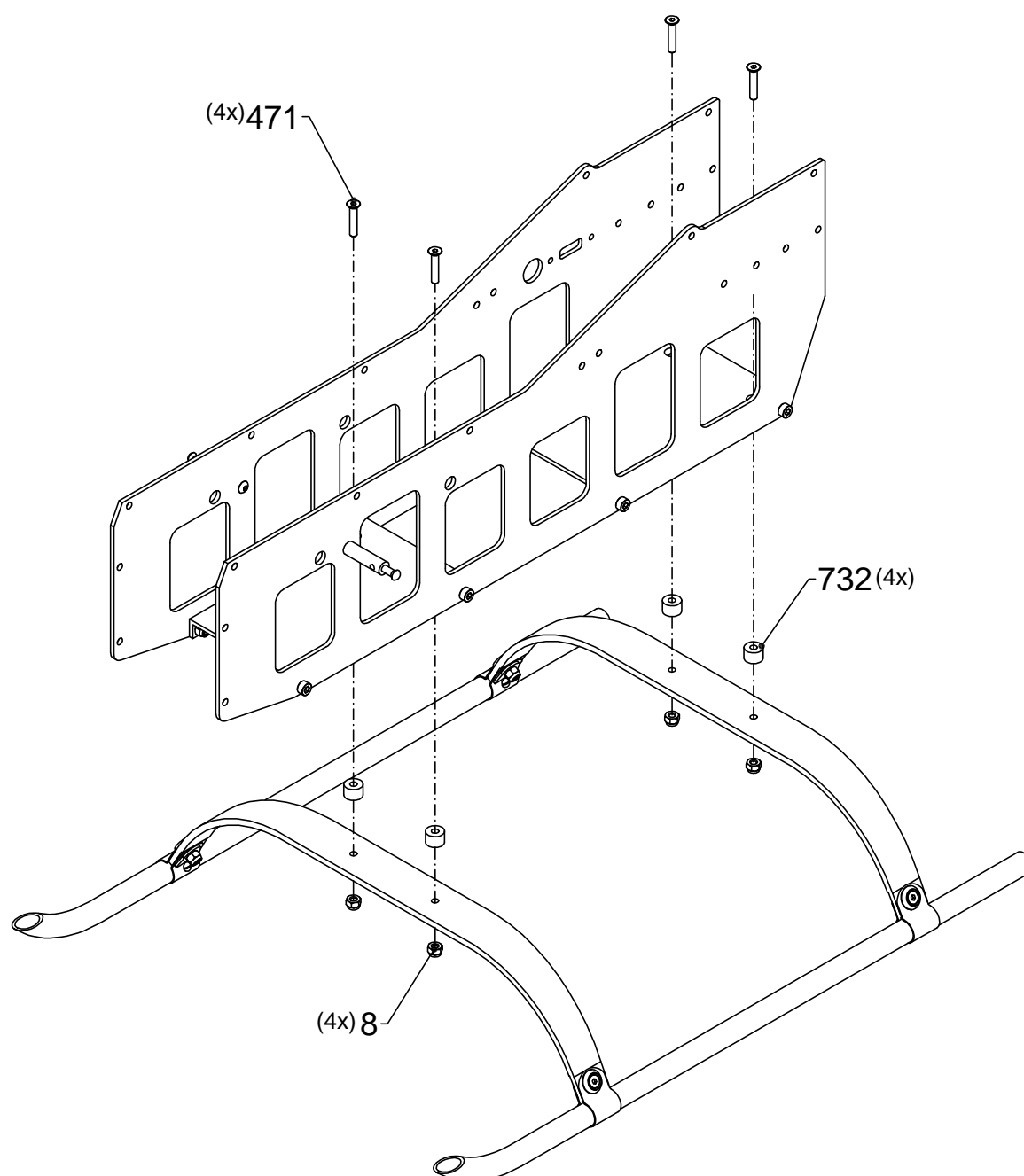
# 2a



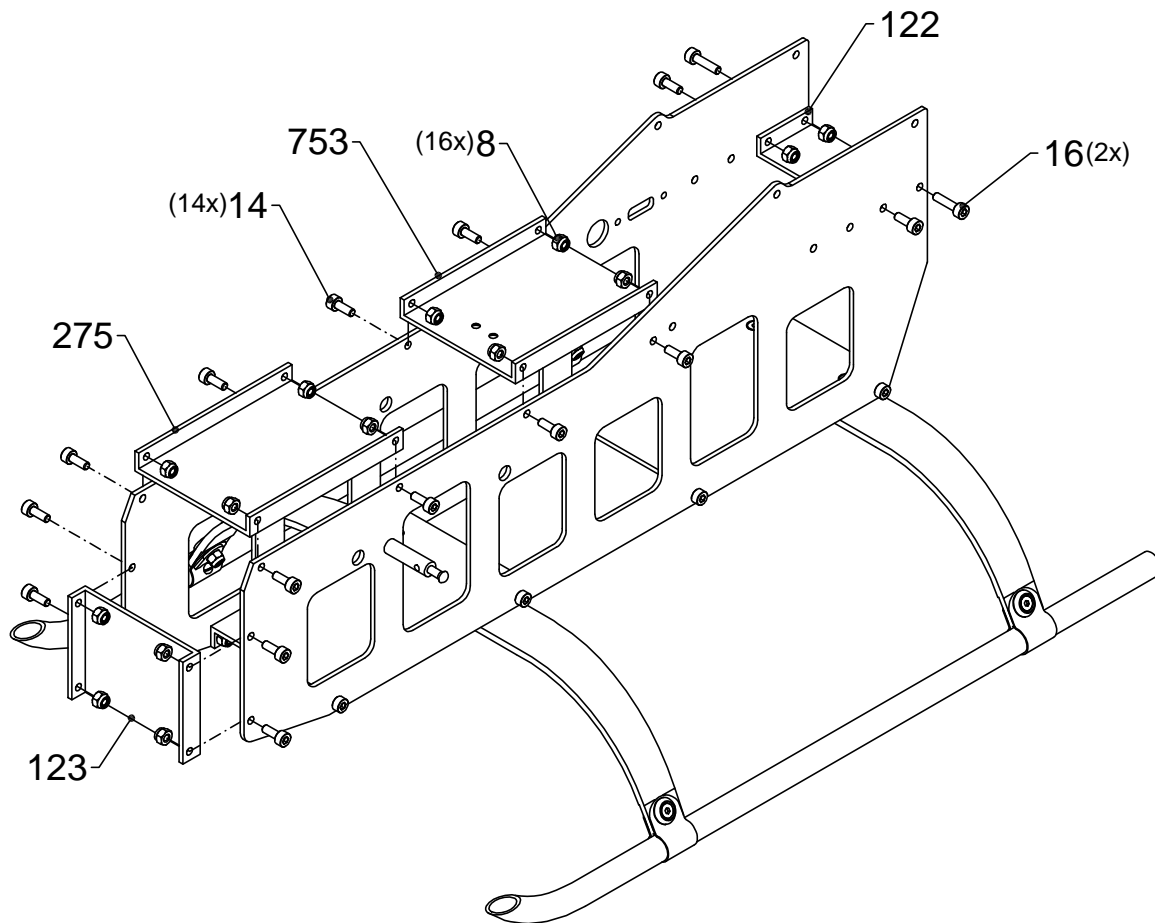
8 = lock nut M3  
14 = hexagon socket screw M3 x 8

Ⓛ = use Loctite

# 2b



8 = lock nut M3  
 471 = hexagon flat head screw M3 x 16



Tighten pos. 16 later!

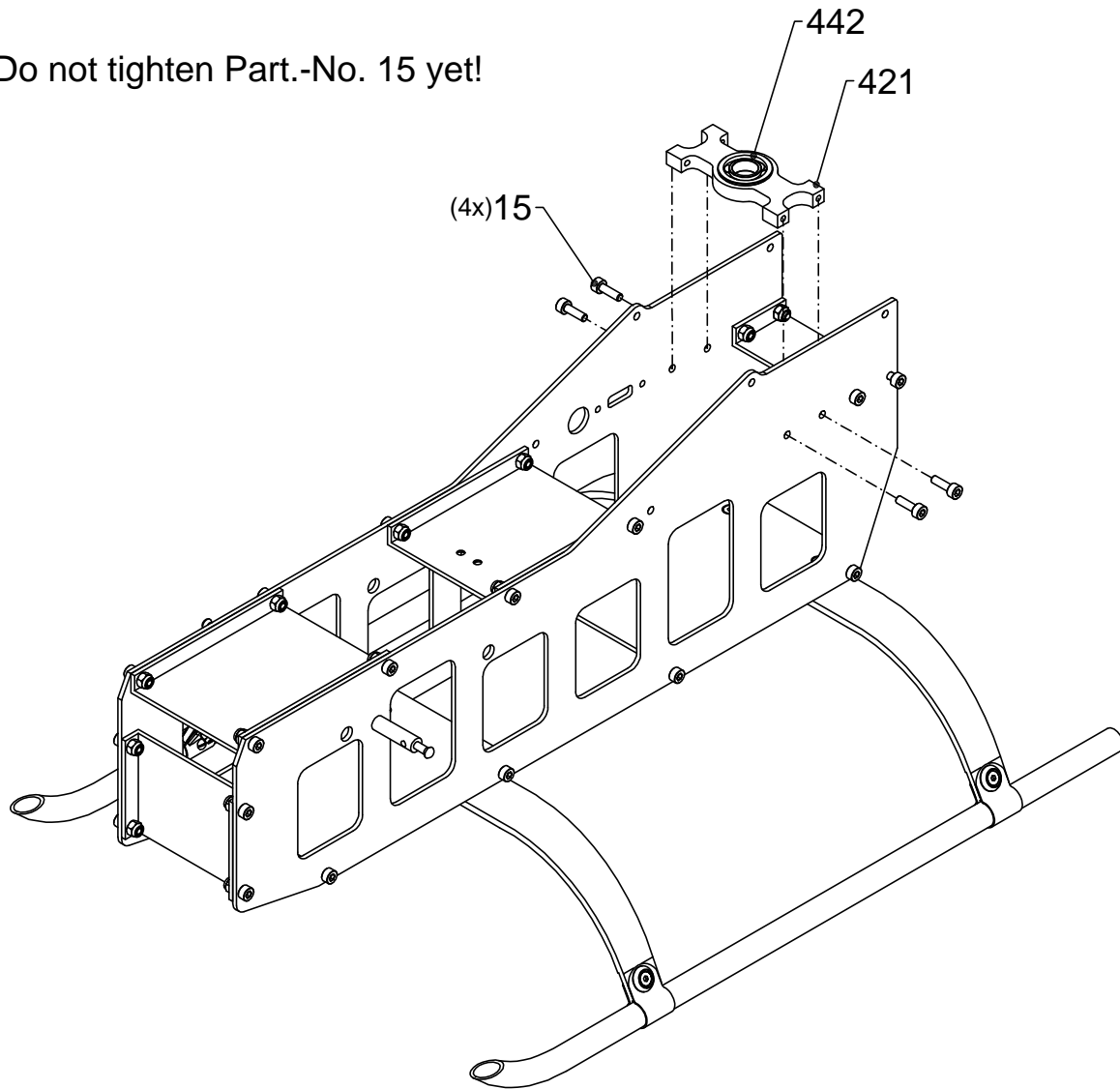
8 = lock nut M3

14 = hexagon socket screw M3 x 8

16 = hexagon socket screw M3 x 12

(L) = use Loctite

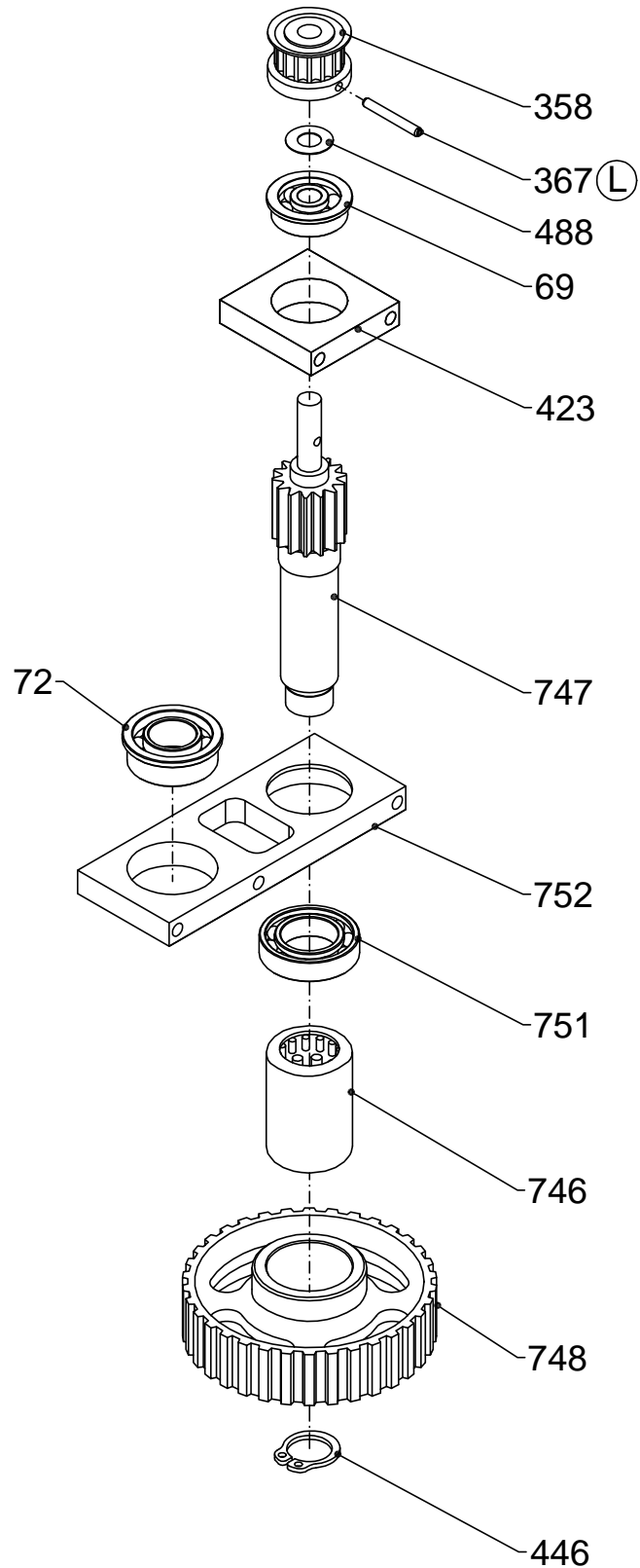
Do not tighten Part.-No. 15 yet!



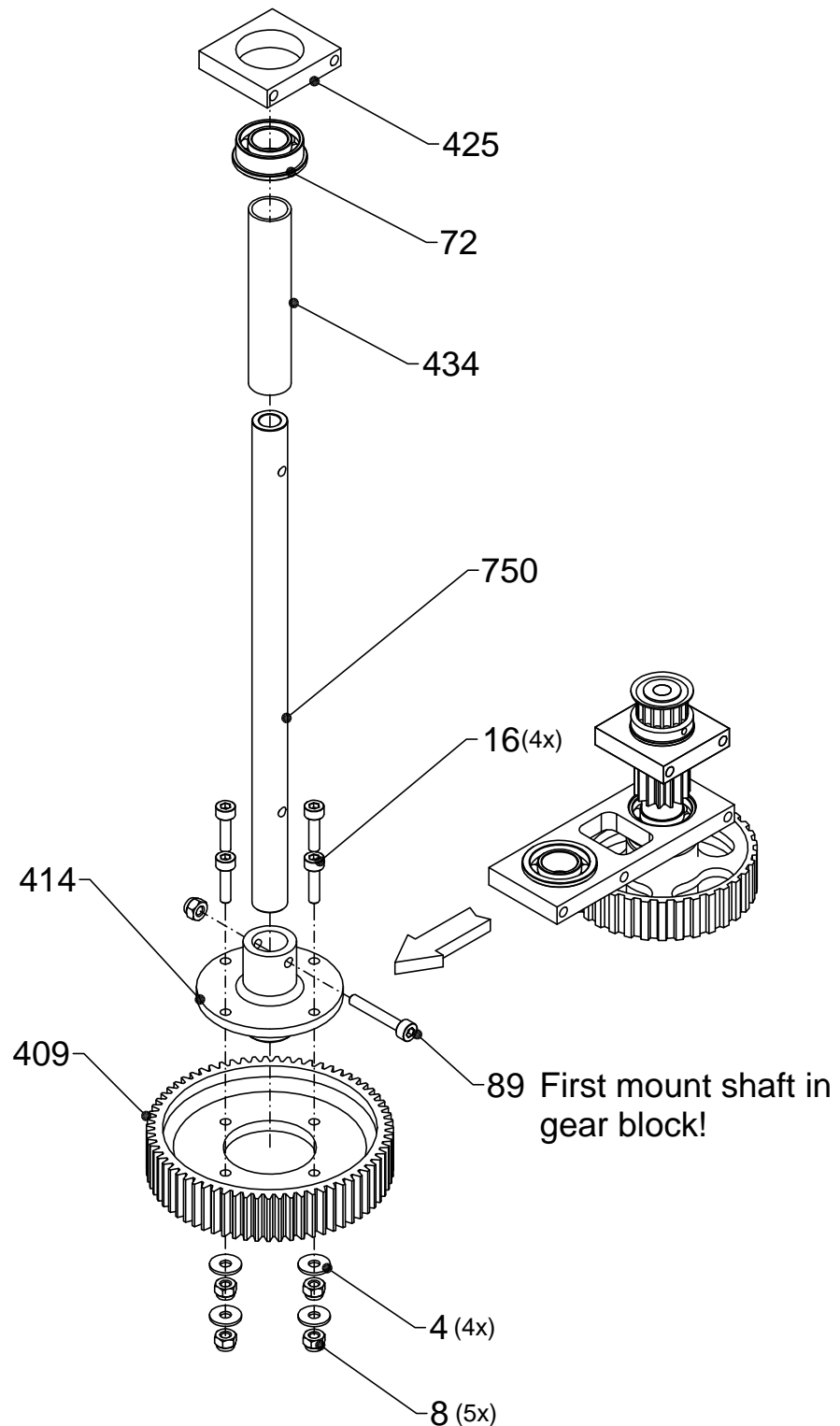
15 = hexagon socket screw M3 x 10

(L) = use Loctite





Ⓛ = use Loctite 270



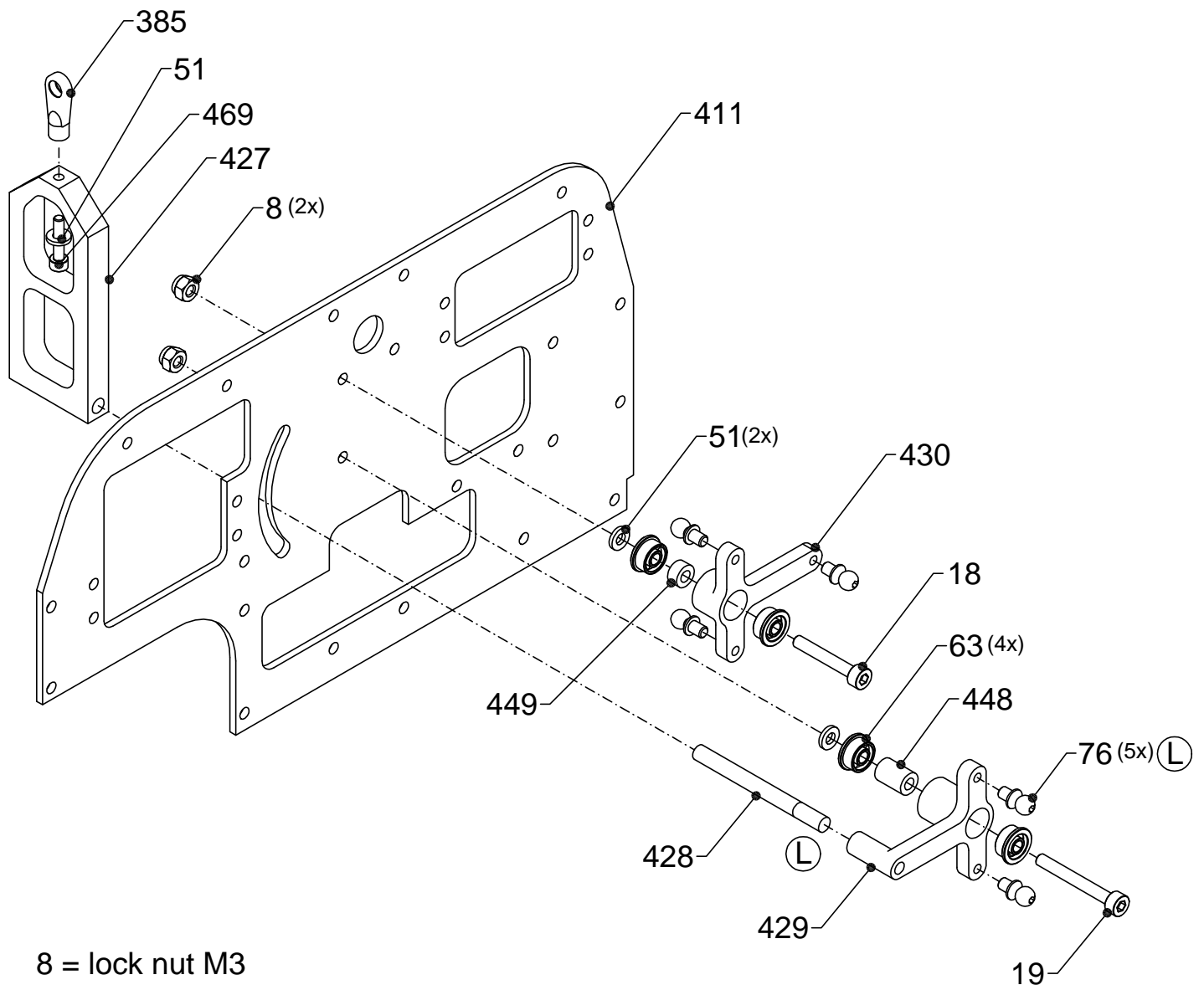
4 = washer M3 large

8 = lock nut M3

15 = hexagon socket screw M3 x 10

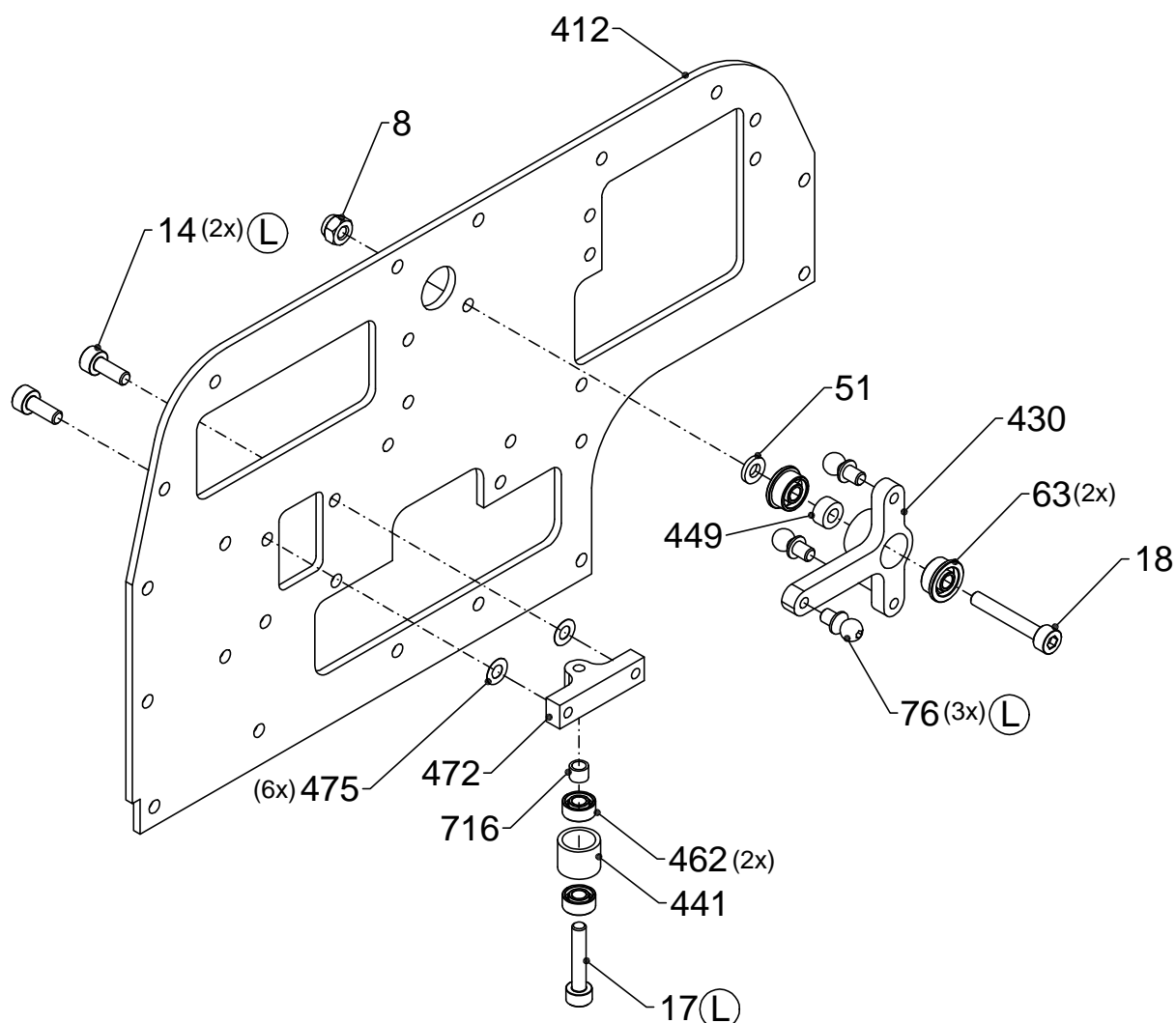
16 = hexagon socket screw M3 x 12

72 = ball bearing with flange F10x19x7



- 8 = lock nut M3  
 18 = hexagon socket screw M3 x 20  
 19 = hexagon socket screw M3 x 25  
 41 = ball joint 2.5  
 51 = shim 3 x 6 x 1  
 63 = ball bearing with flange F3 x 8 x 4  
 76 = joint bolt M3 x 4  
 469 = hexagon socket screw M2.5 x 12

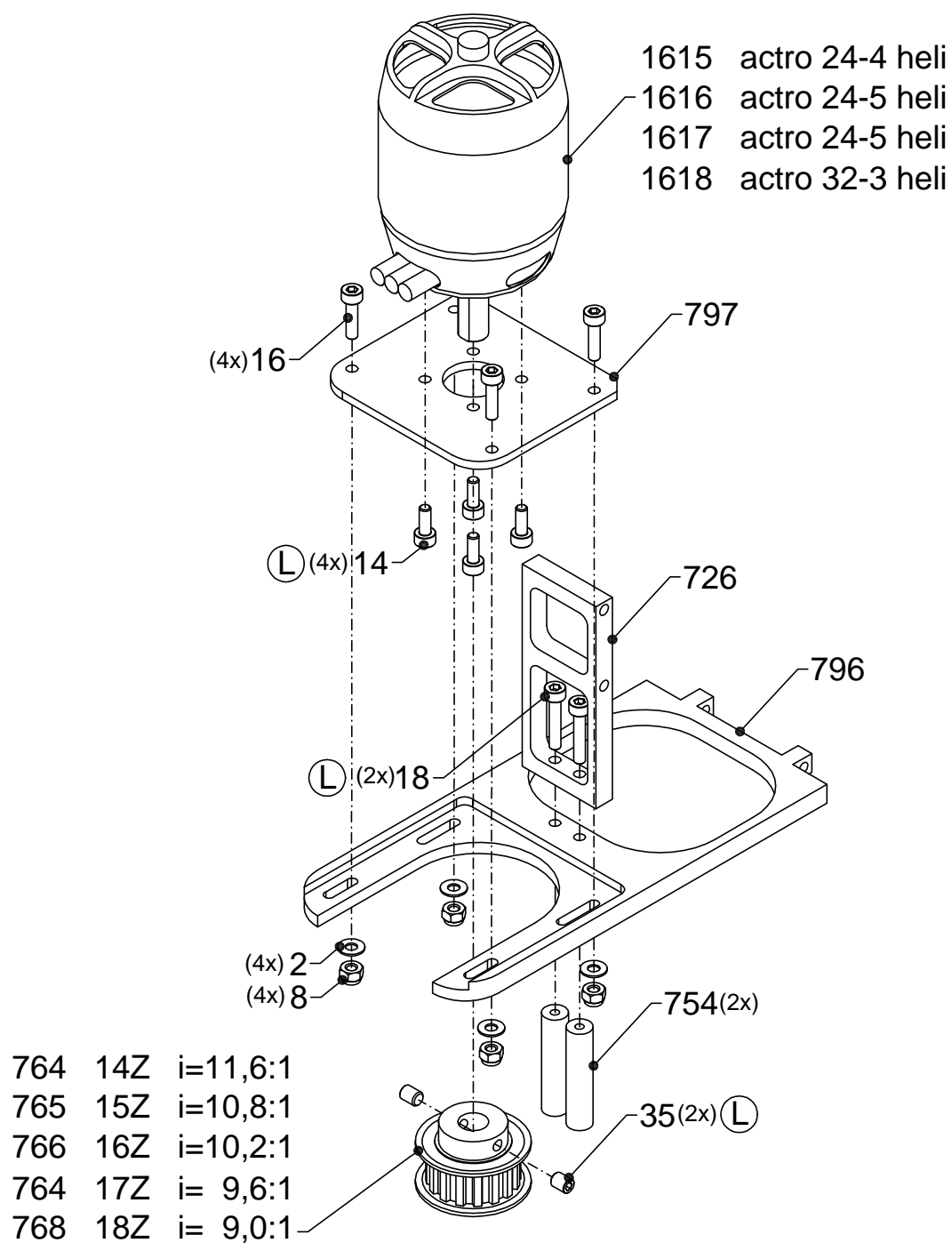
(L) = use Loctite



Bearing carrier should be tightened up after the belt is fitted! Use shims 3x6x0.1 for the right distance to the belt! Distance between bearing and belt about 0.2-0.3mm! Bearing may NOT run with the belt during normal usage!!

- 8 = lock nut M3
- 14 = hexagon socket screw M3 x 8
- 17 = hexagon socket screw M3 x 16
- 18 = hexagon socket screw M3 x 20
- 51 = shim 3 x 6 x 1
- 63 = ball bearing F3 x 8 x 4
- 76 = joint bolt M3 x 4

(L) = use Loctite



2 = washer M3

8 = Lock nut M3

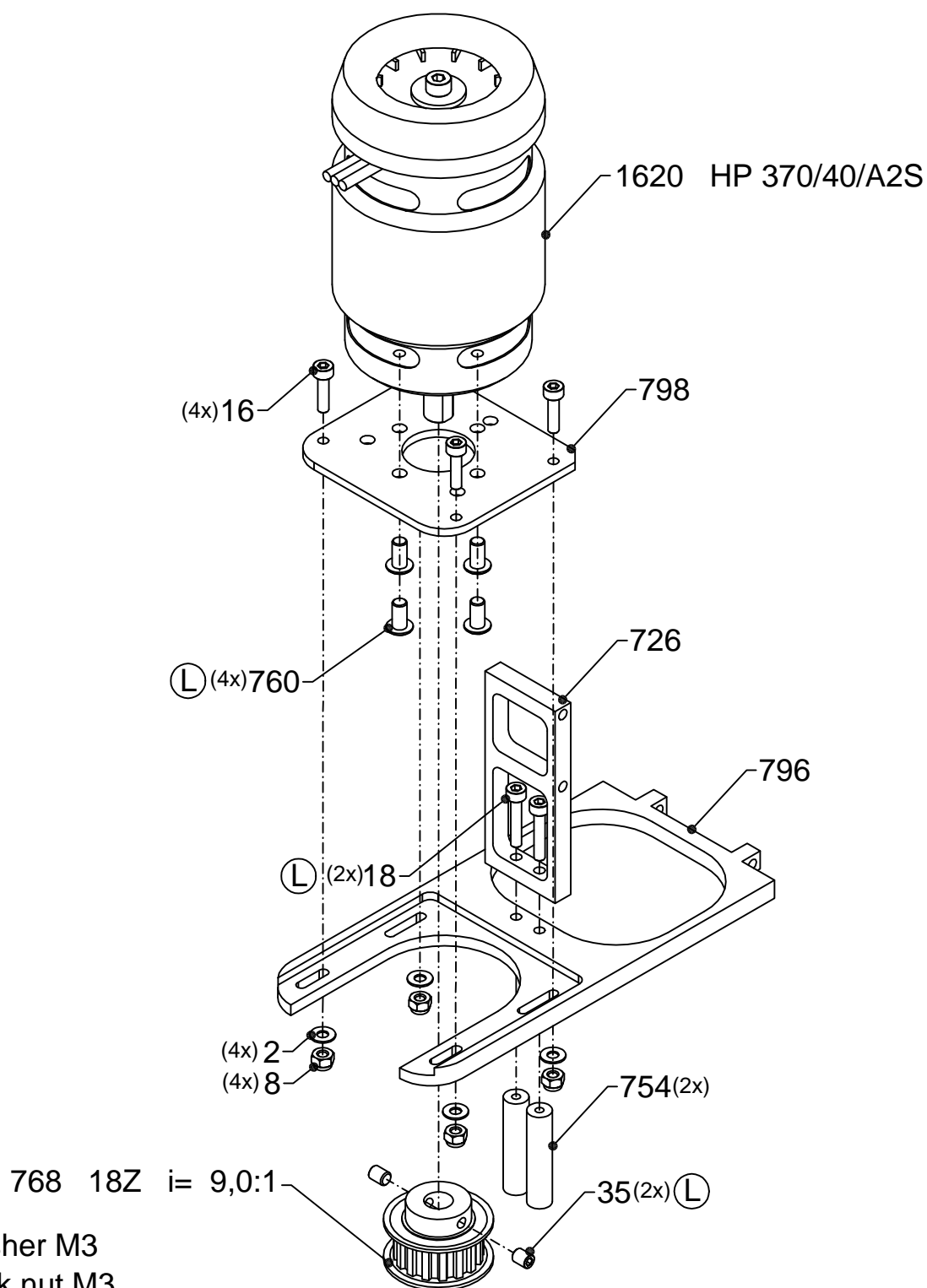
14 = hexagon socket screw M3 x 8

16 = hexagon socket screw M3 x 12

18 = hexagon socket screw M3 x 20

35 = grub screw M4 x 5

Ⓛ = use Loctite



2 = washer M3

8 = Lock nut M3

14 = hexagon socket screw M3 x 8

16 = hexagon socket screw M3 x 12

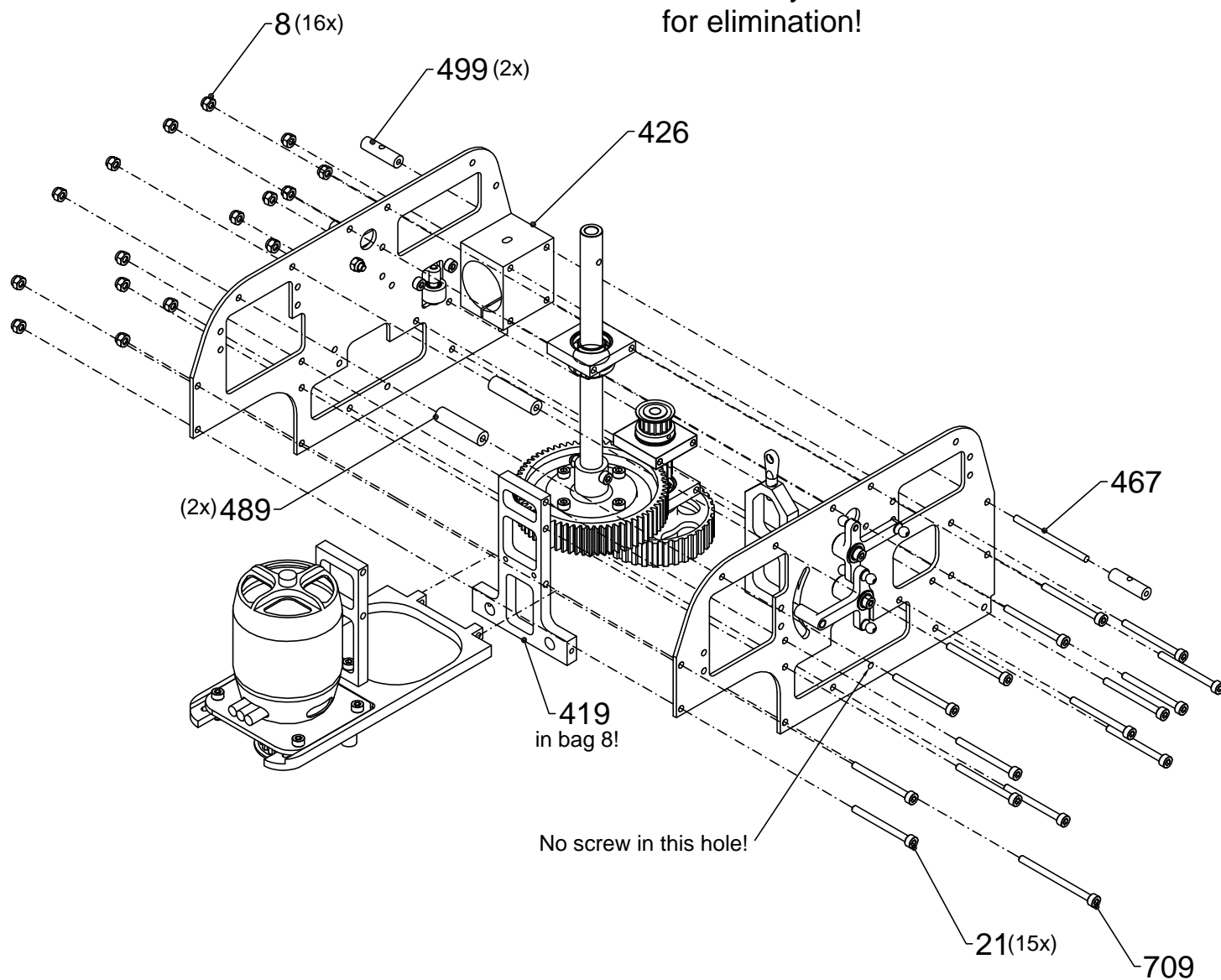
18 = hexagon socket screw M3 x 20

35 = grub screw M4 x 5

760 = hexagon lense screw M4 x 8

Ⓛ = use Loctite

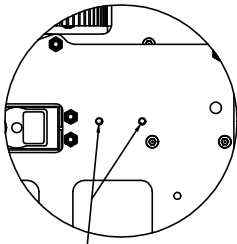
Mainshaft may not have any endplay!  
Eventually use shims 10x16x0.1/0.2  
for elimination!



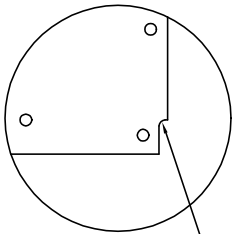
8 = lock nut M3

21 = hexagon socket screw M3 x 35

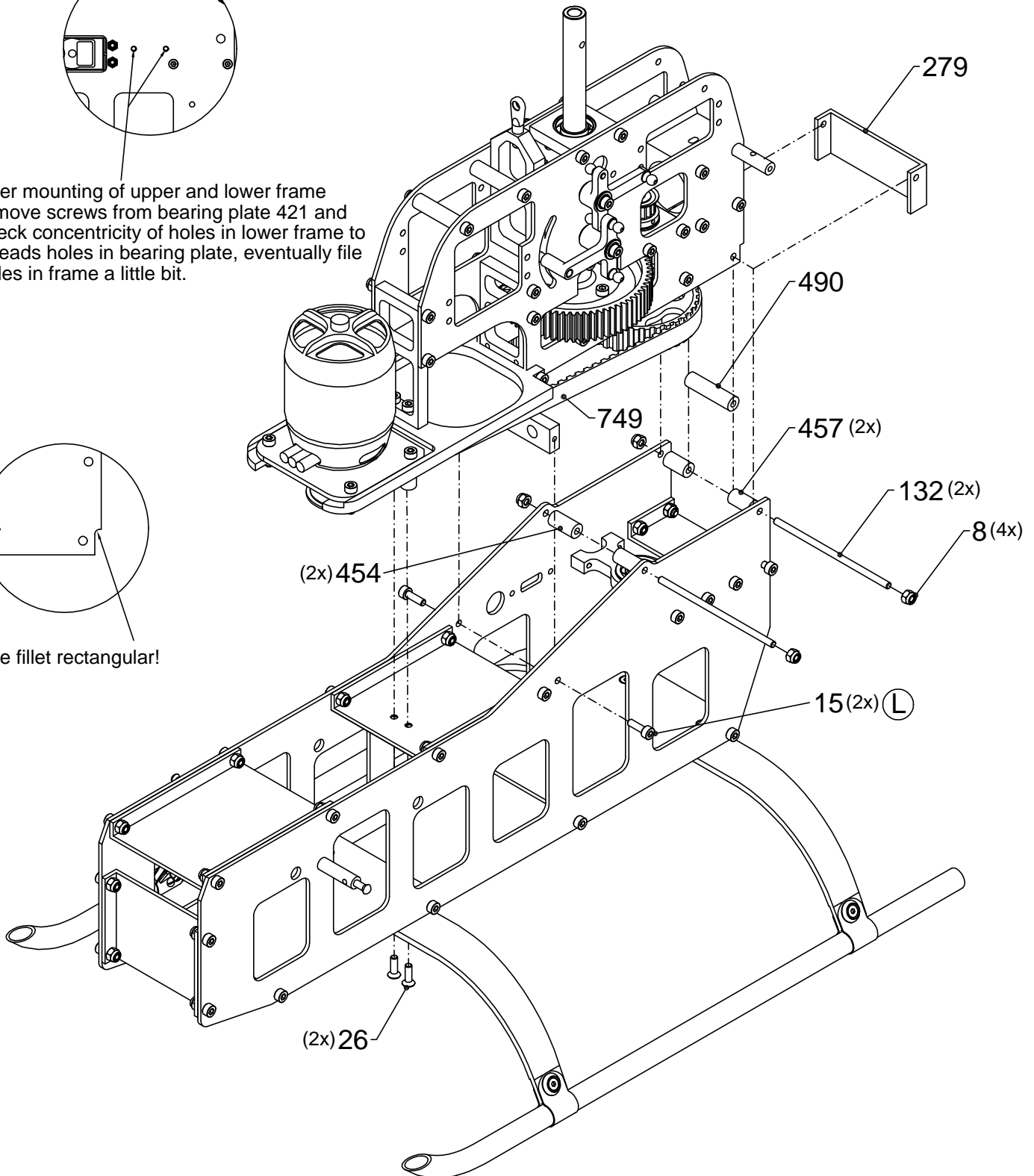
709 = hexagon socket screw M3 x 45



After mounting of upper and lower frame remove screws from bearing plate 421 and check concentricity of holes in lower frame to threads holes in bearing plate, eventually file holes in frame a little bit.



file fillet rectangular!



8 = lock nut M3

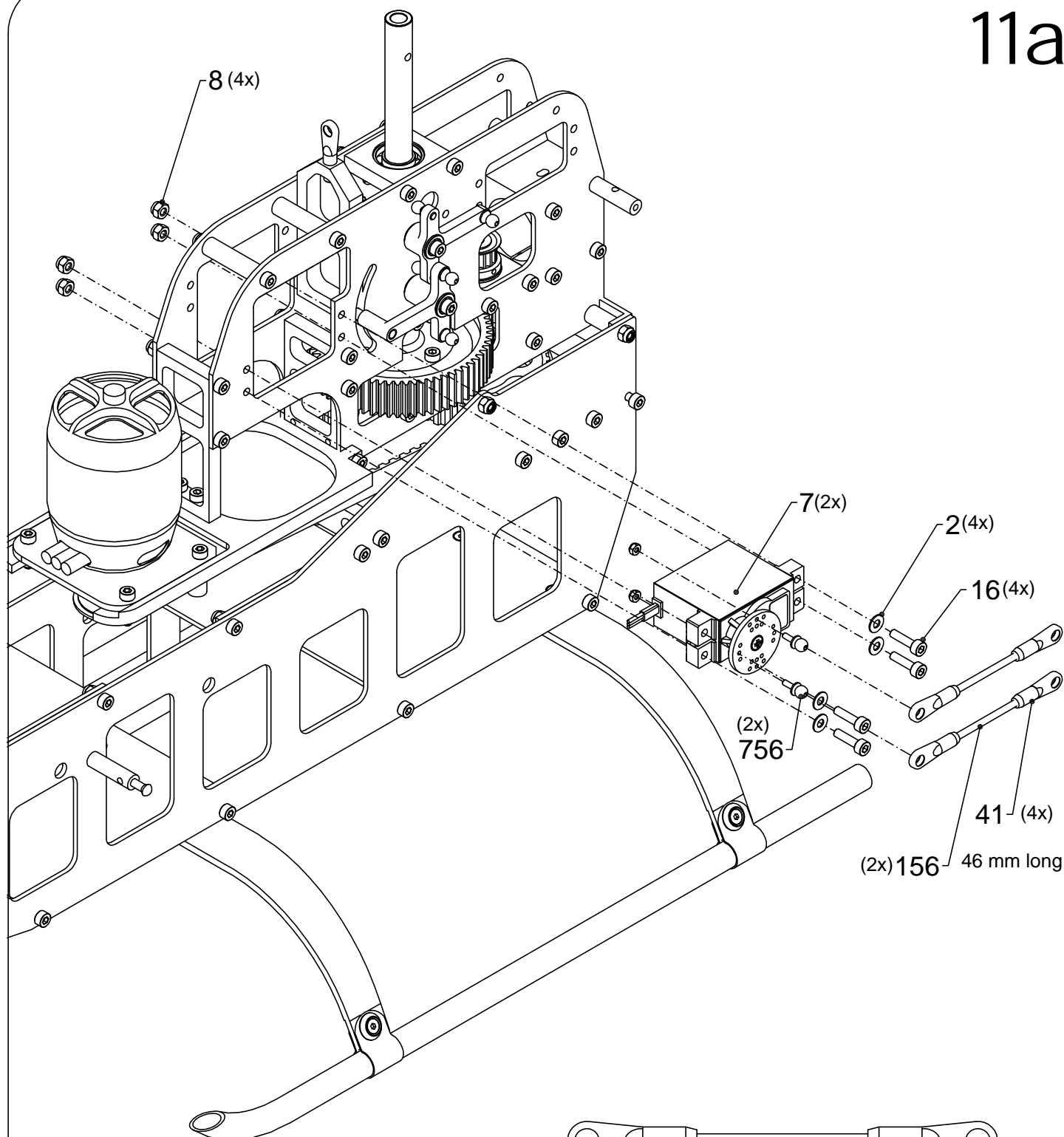
15 = hexagon socket screw M3 x 10

26 = hexagon flat head screw M3 x 10

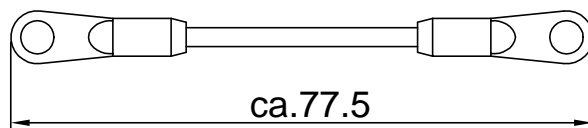
(L) = use Loctite



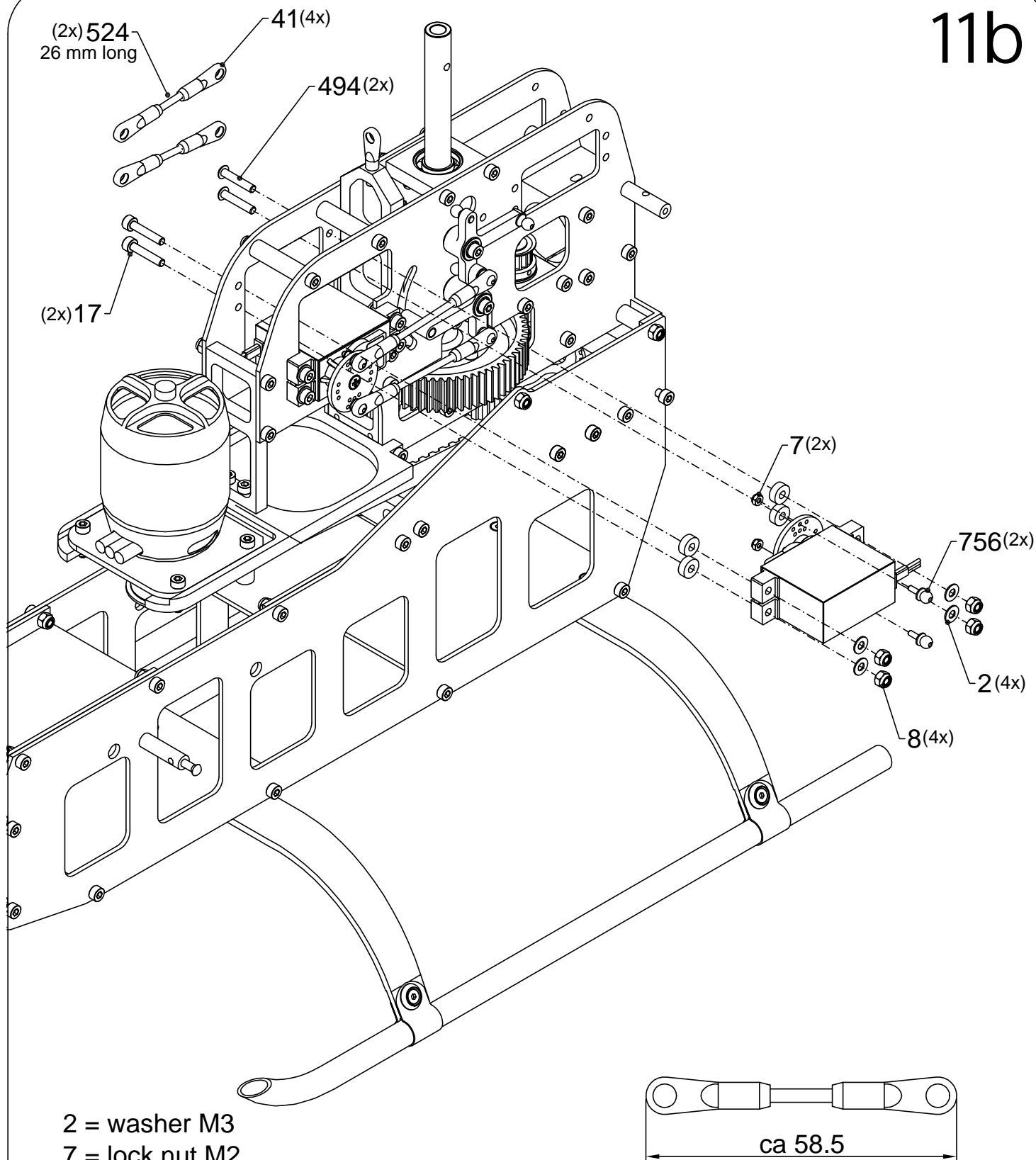
# 11a



- 2 = washer M3
- 7 = lock nut M2
- 8 = lock nut M3
- 16 = hexagon socket screw M3 x 12
- 41 = ball joint 2.5

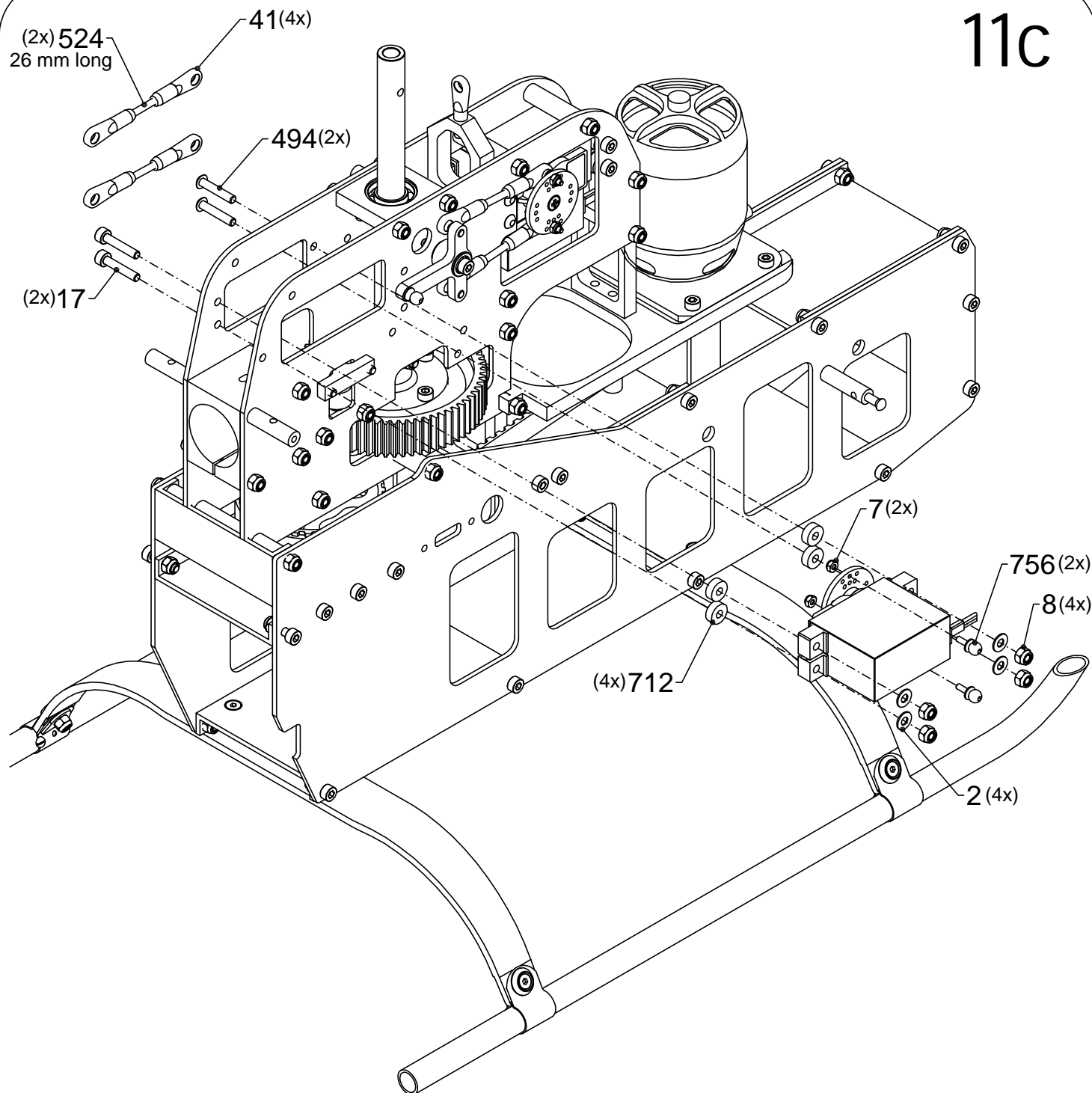


# 11b

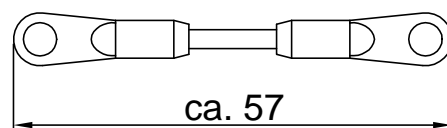


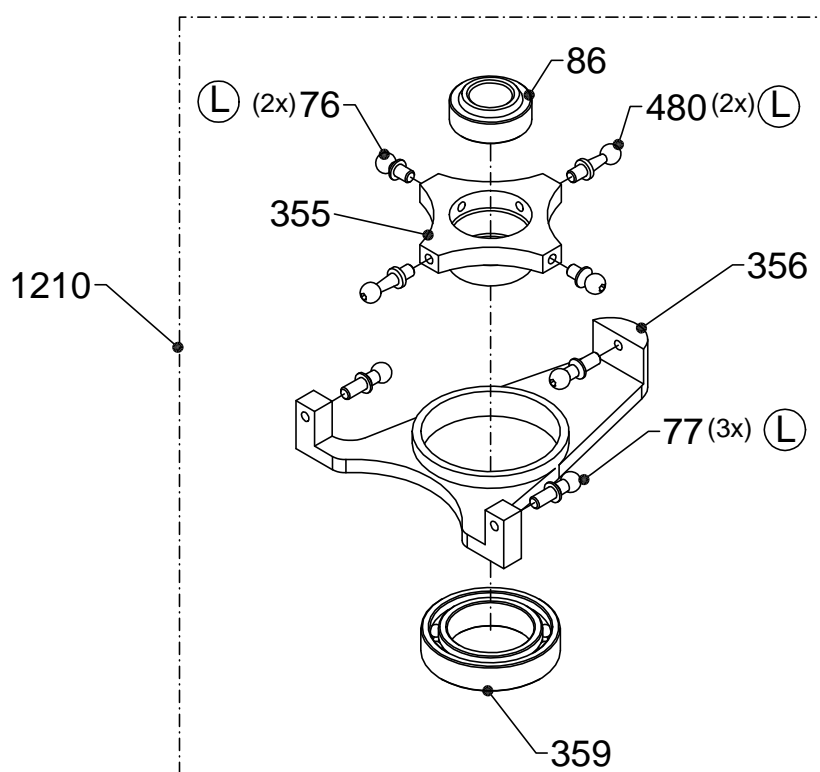
- 2 = washer M3
- 7 = lock nut M2
- 8 = lock nut M3
- 16 = hexagon socket screw M3 x 12
- 41 = ball joint 2.5
- 494 = hexagon lense screw M3 x 16

# 11c

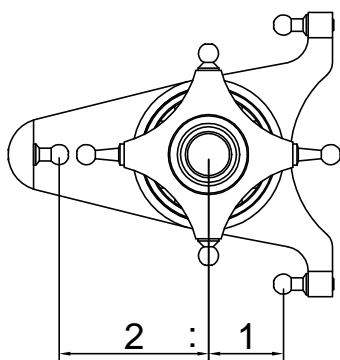


- 2 = washer M3
- 7 = lock nut M2
- 8 = lock nut M3
- 16 = hexagon socket screw M3 x 12
- 41 = ball joint 2.5
- 494 = hexagon lense screw M3 x 16

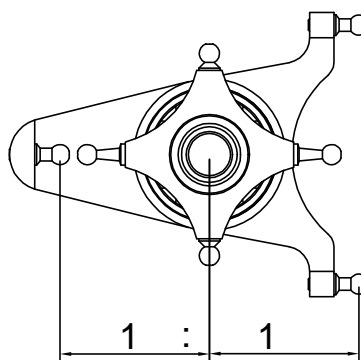




120°-mode (recommended)

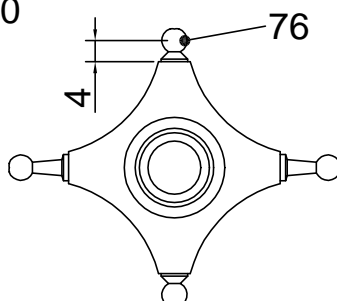


140°-mode

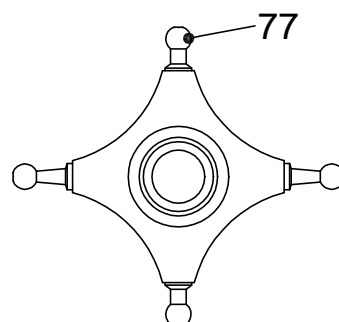


Screw the joint balls 480  
with care!

FAI/3D-soft



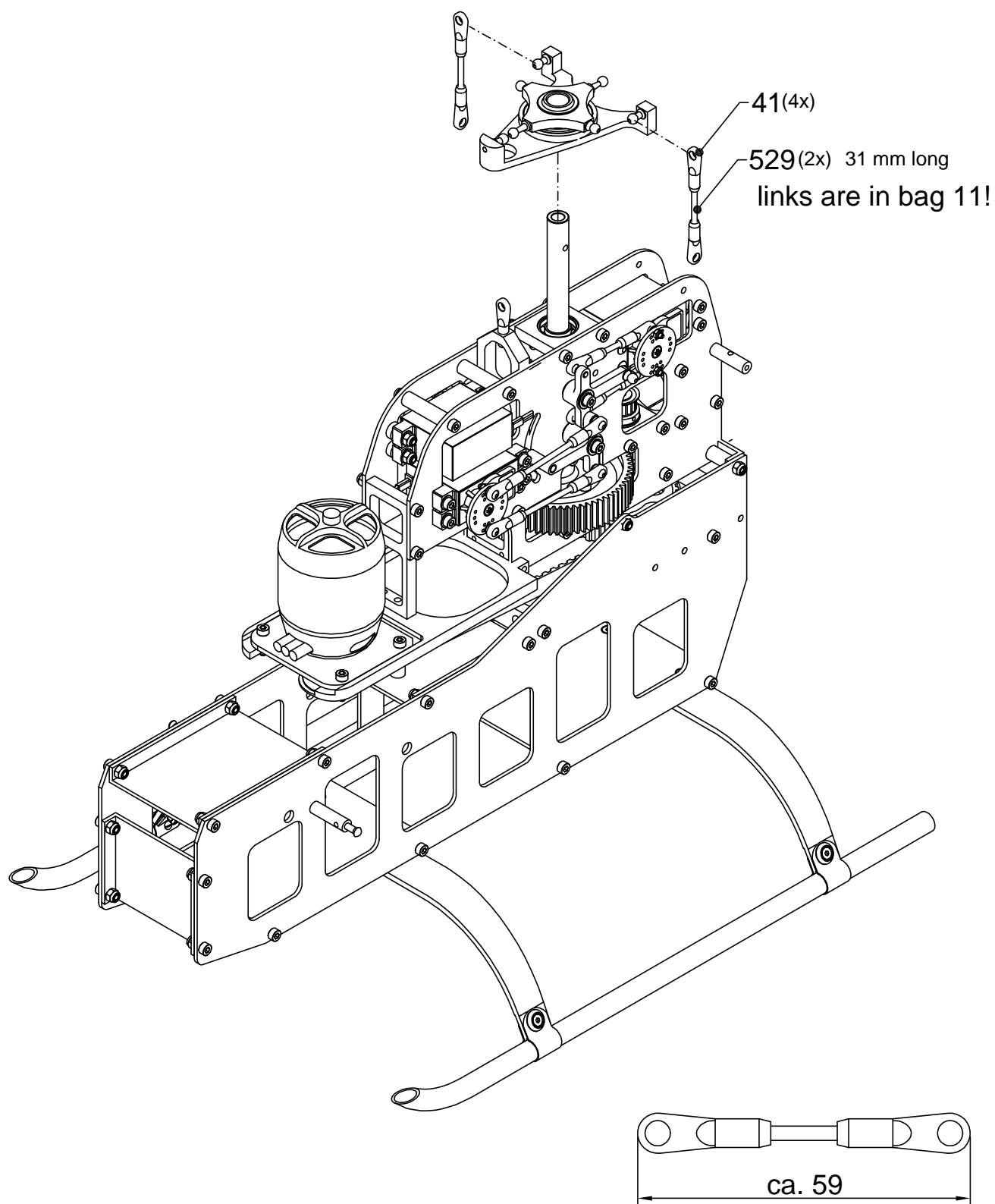
3D-hard



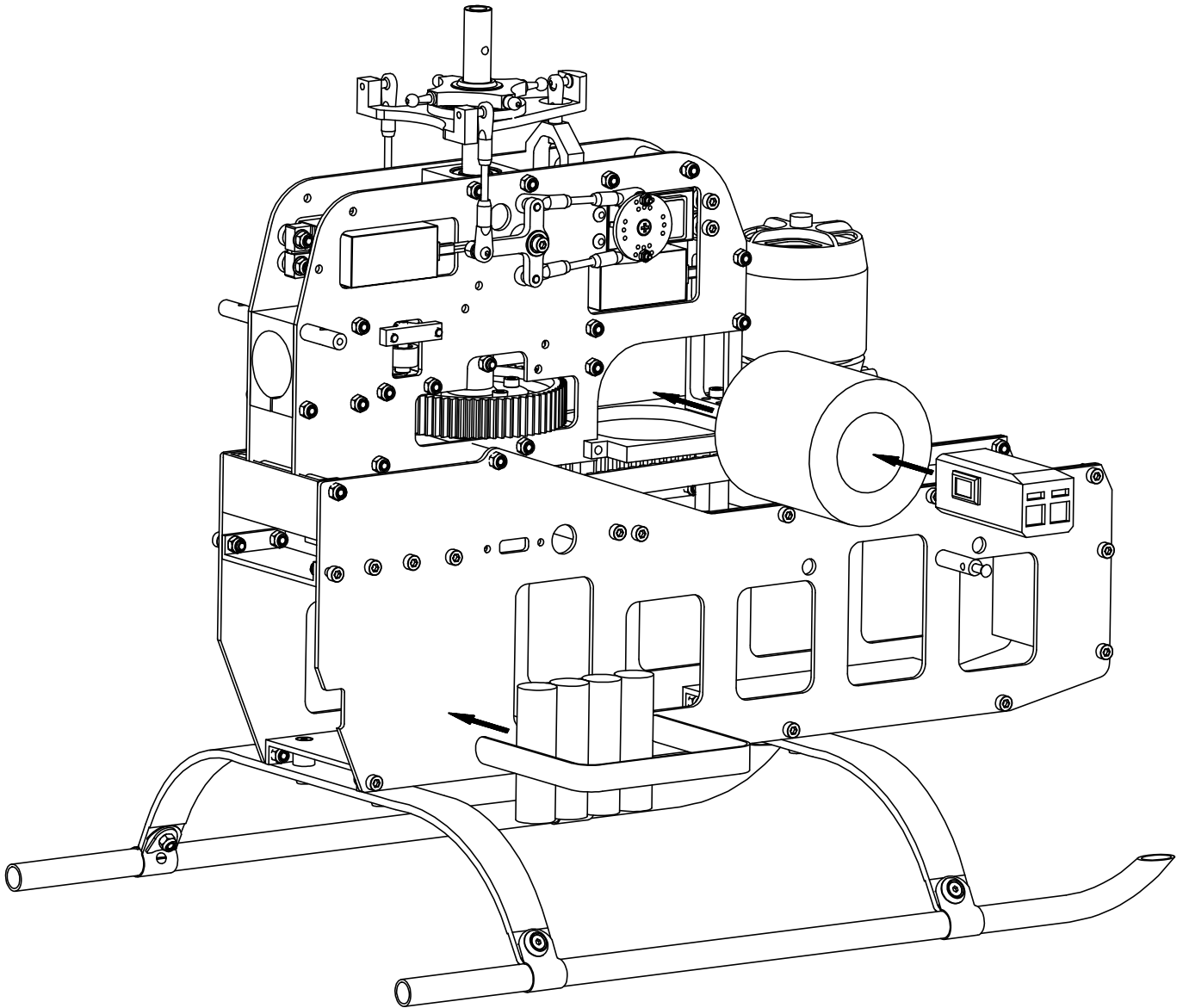
51 = washer 3 x 6 x 1  
76 = joint bolt M 3 x 4  
77 = joint bolt M 3 x 6  
78 = joint bolt M 3 x 9

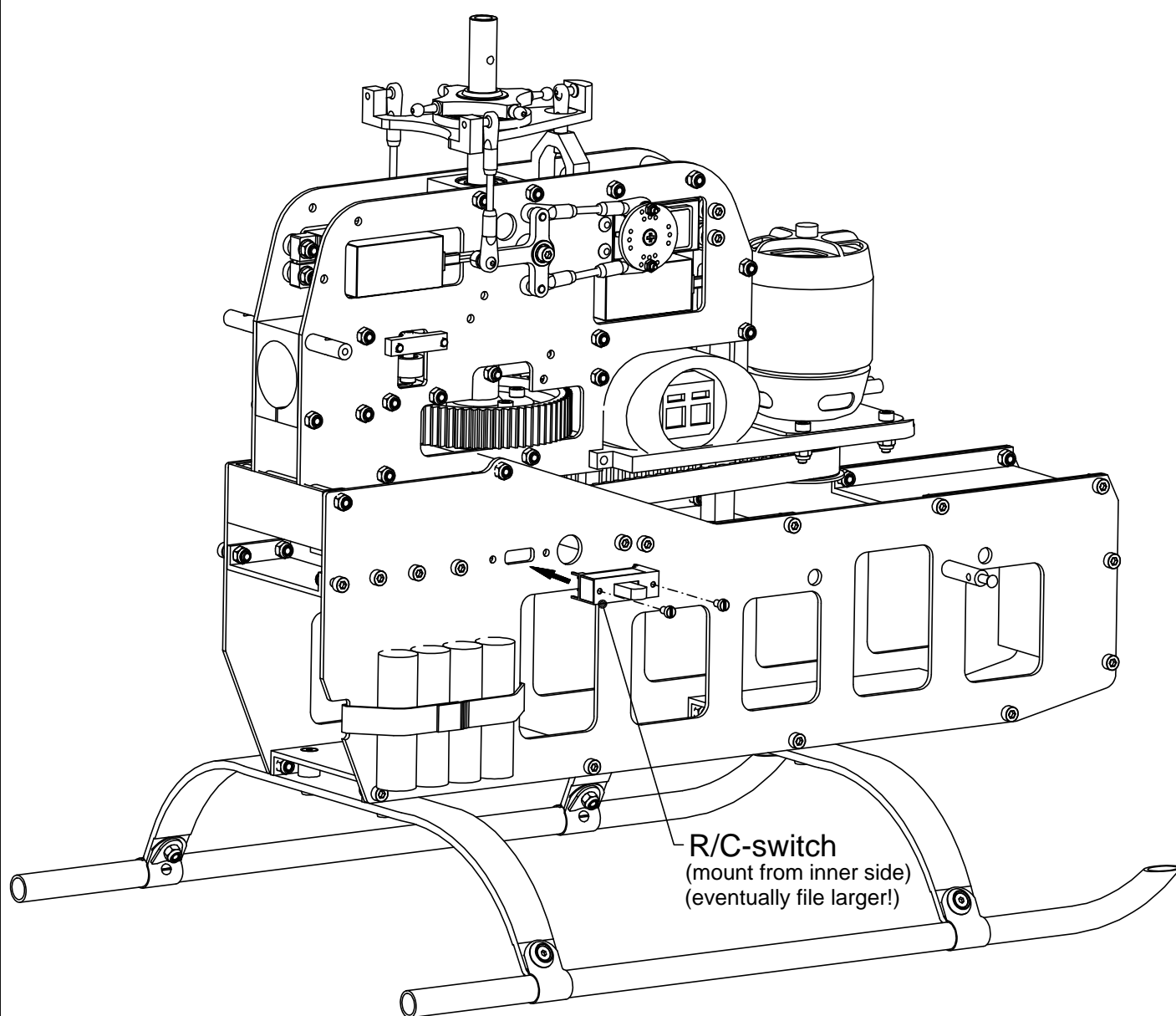
Ⓛ = use Loctite

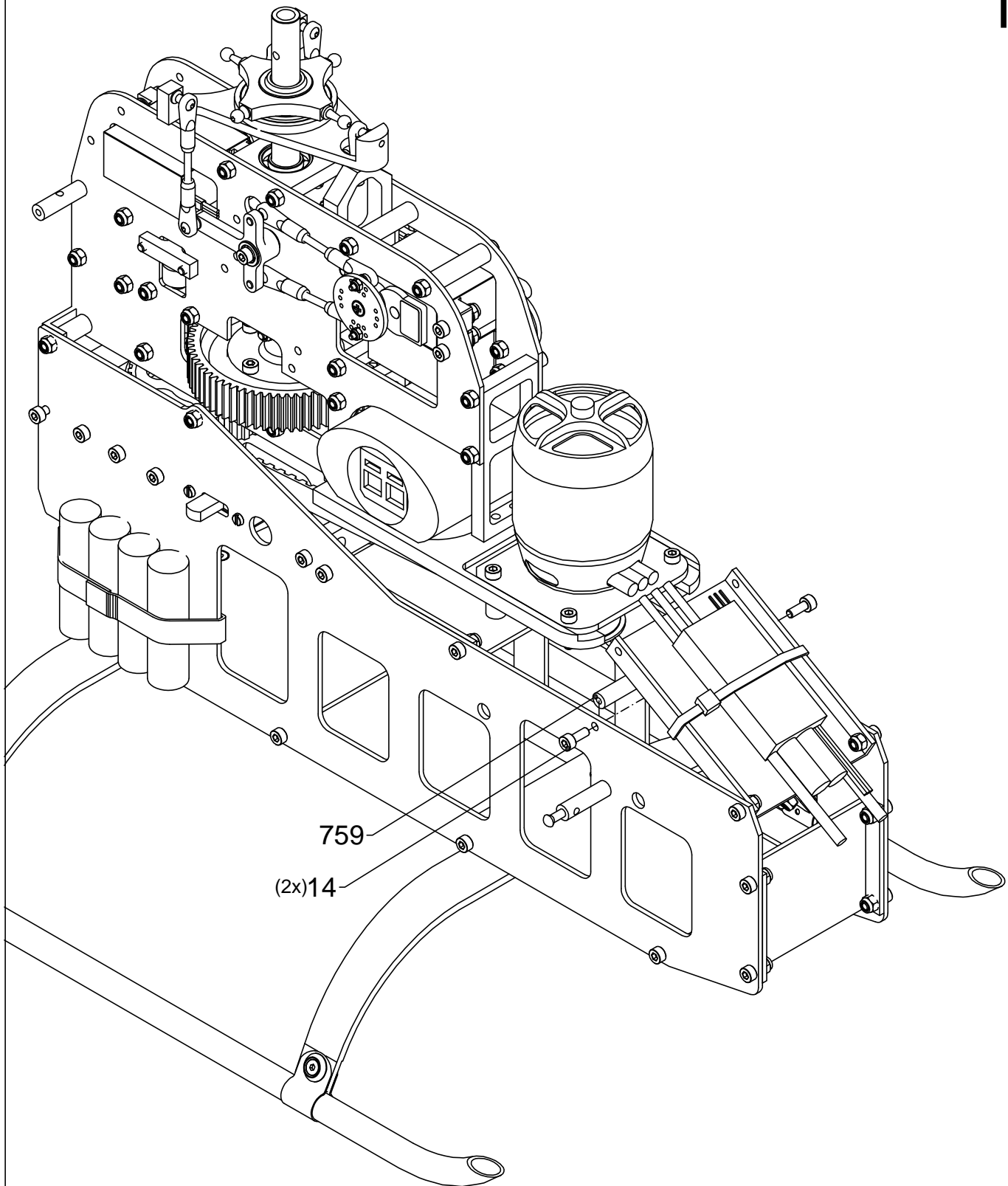
# 12b



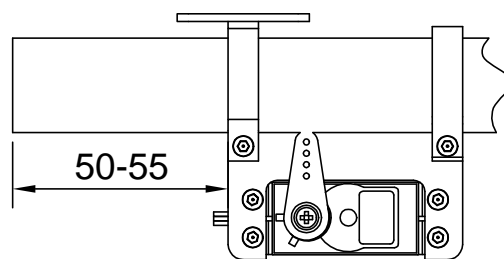
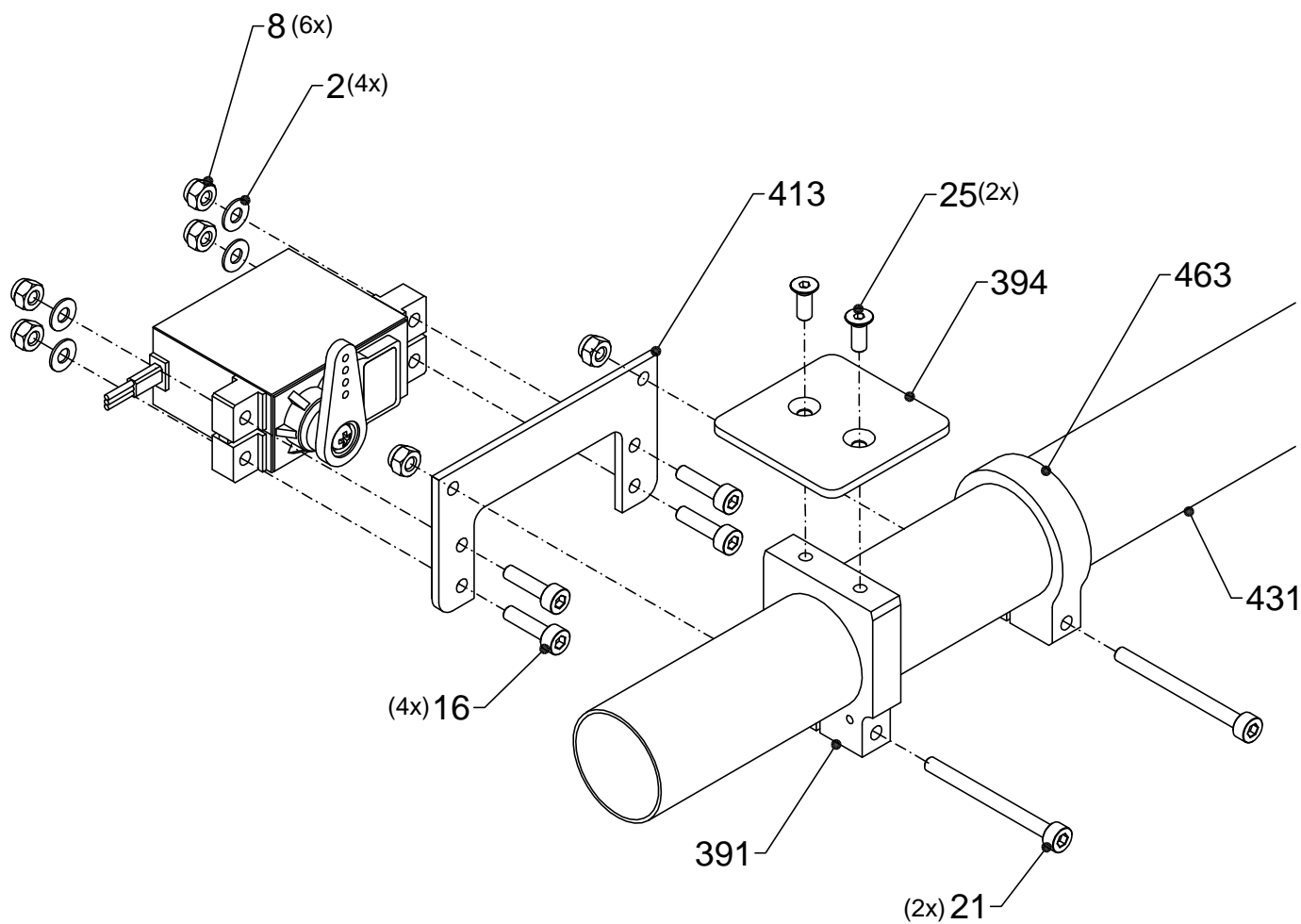
41 = ball joint 2.5



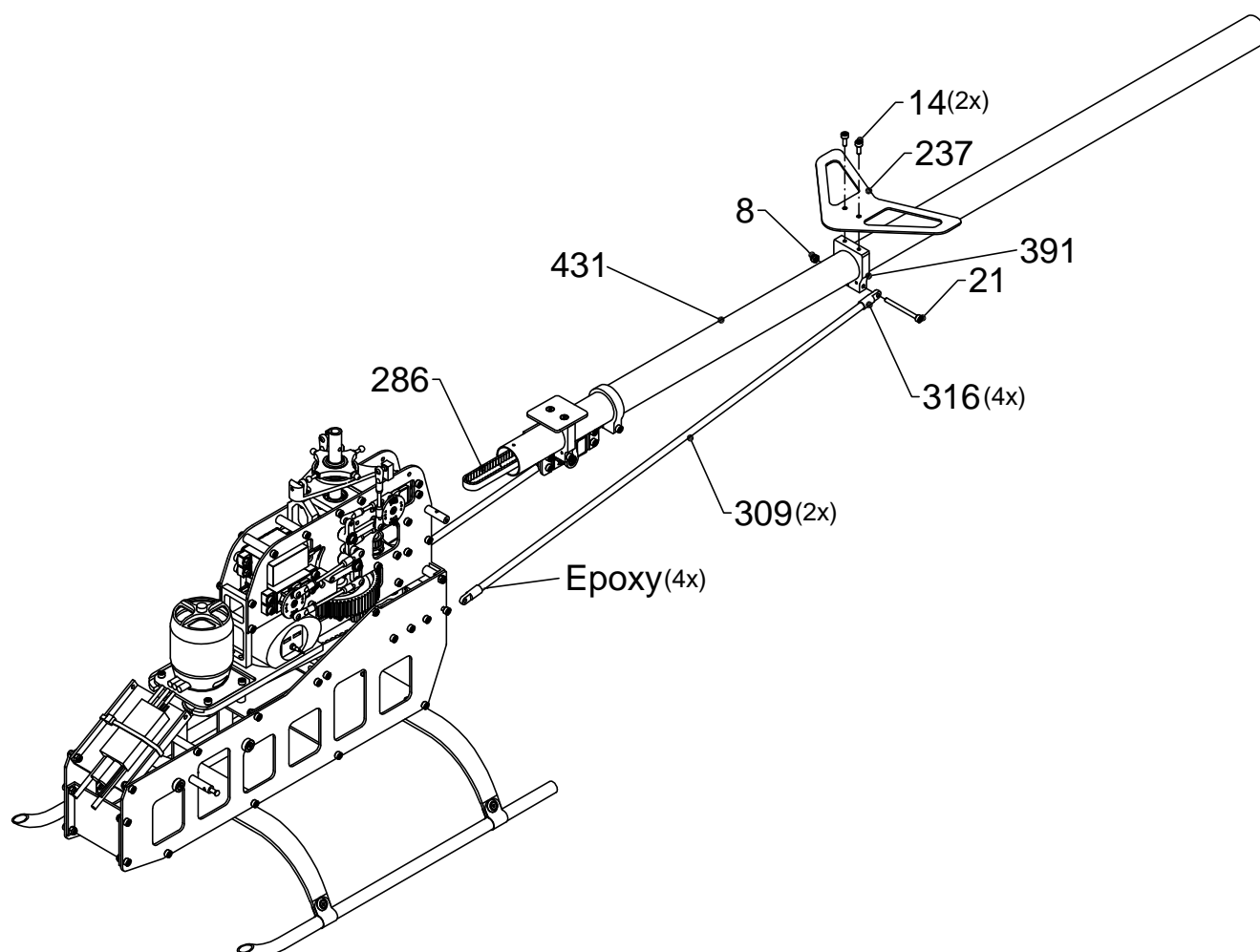








- 2 = washer M3  
 8 = lock nut M3  
 16 = hexagon socket screw M3 x 12  
 21 = hexagon socket screw M3 x 35  
 25 = hexagon flat head screw M3 x 8

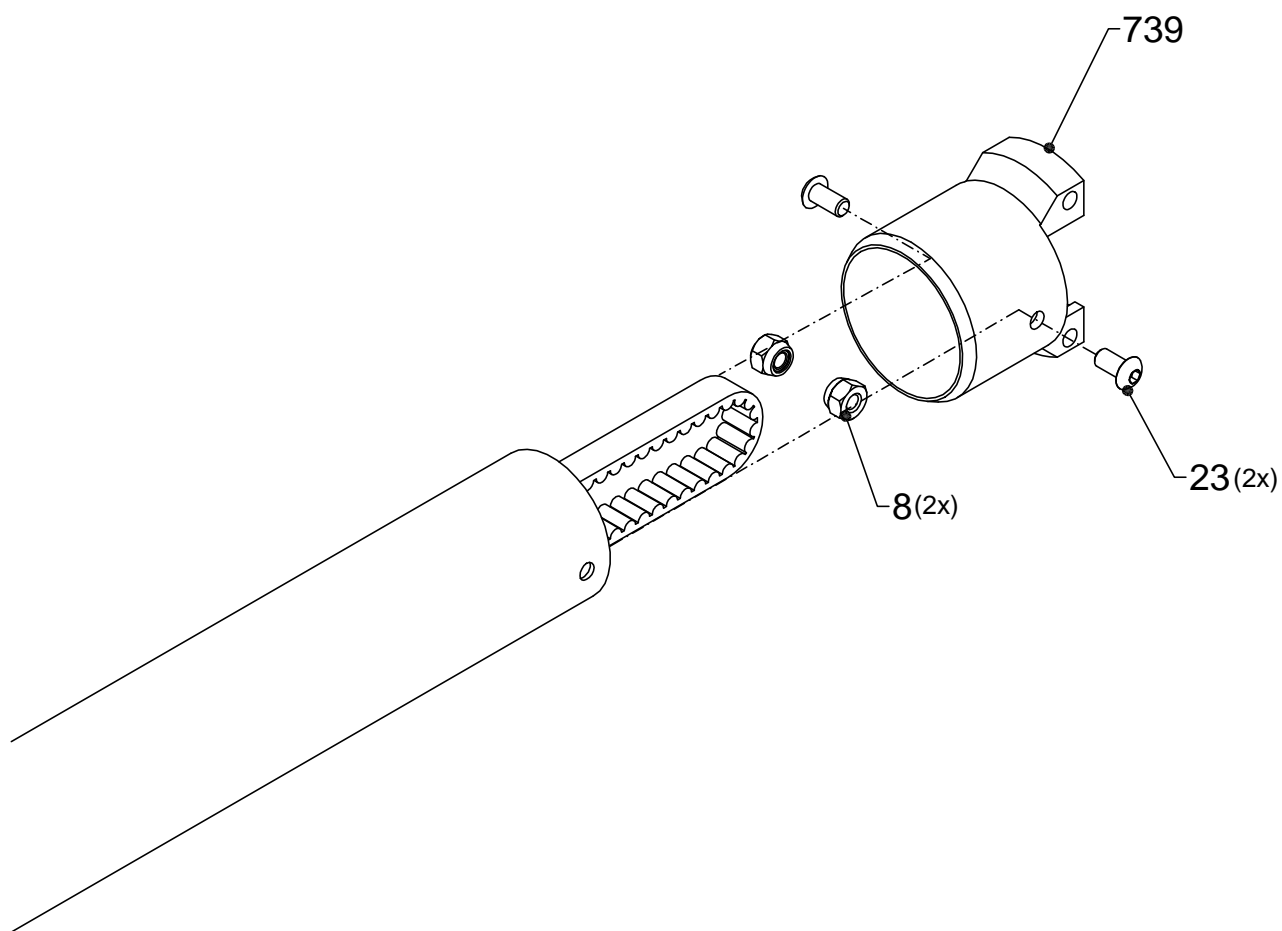


Tip: Pull belt with a cranked steel wire thru the tube!

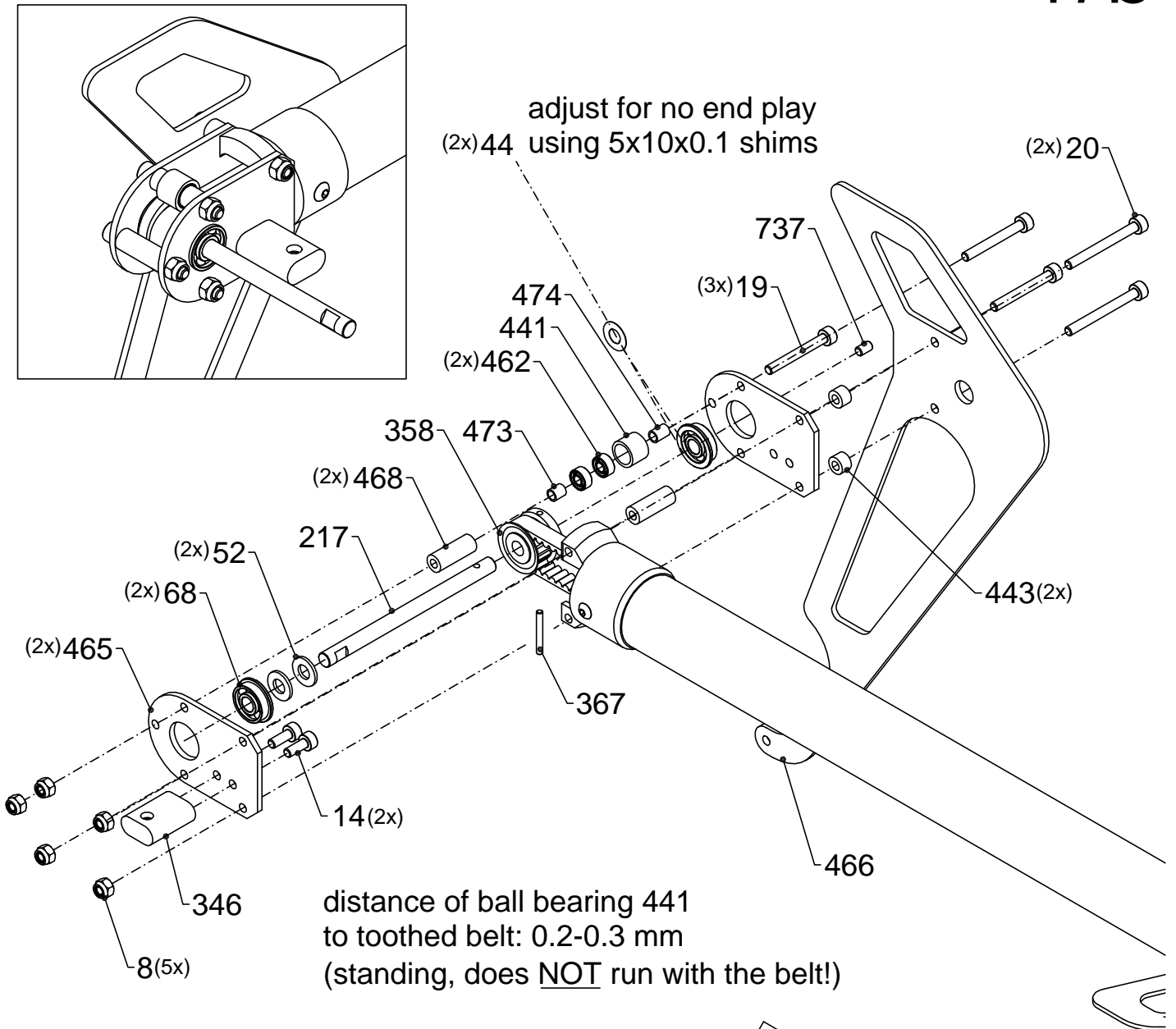
8 = lock nut M3

14 = hexagon socket screw M3 x 8

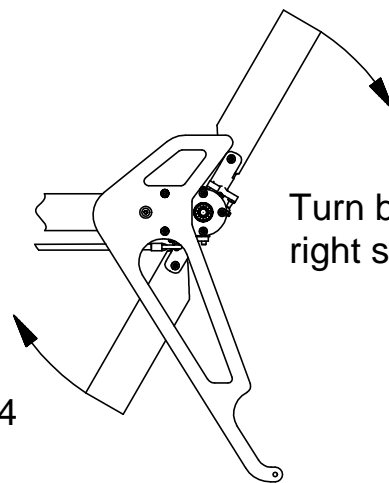
21 = hexagon socket screw M3 x 35



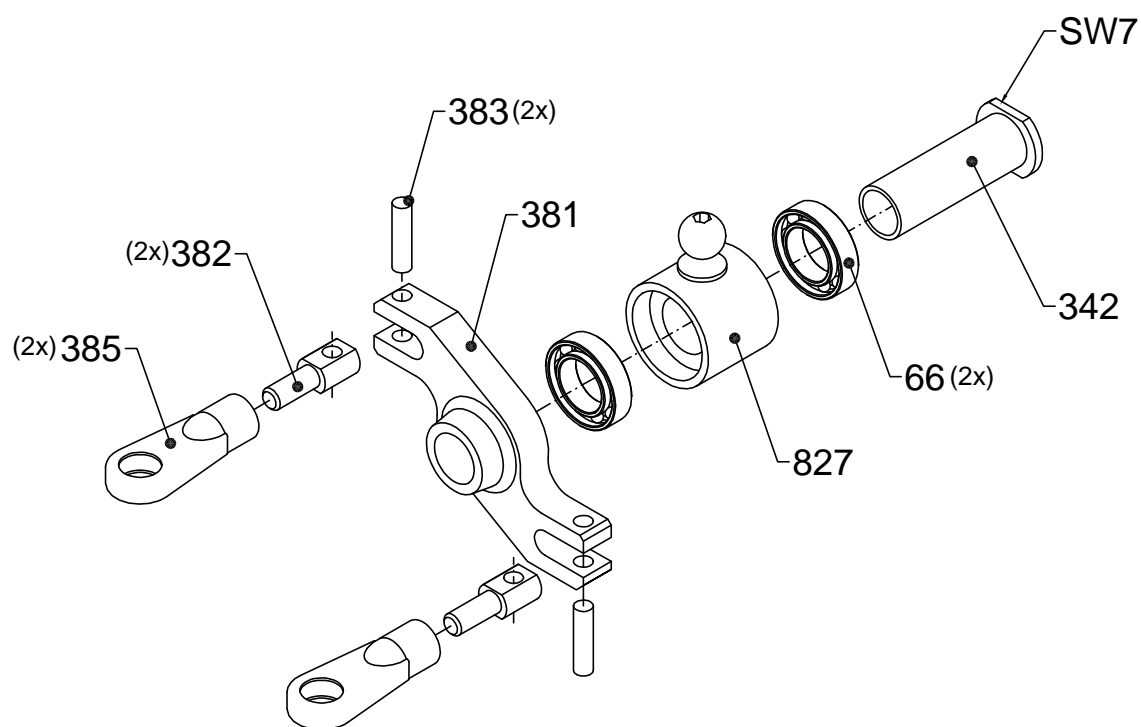
8 = lock nut M3  
23 = hexagon lense screw M3x6



- 8 = lock nut M3
- 14 = hexagon socket screw M3x8
- 19 = hexagon socket screw M3 x 25
- 20 = hexagon socket screw M3 x 30
- 38 = rolled pin 2 x 16
- 52 = shim 5 x 10 x 1
- 68 = ball bearing with flange F5 x 13 x 4
- 443 = distance bush 3 x 6 x 4
- 473 = distance bush 3 x 6 x 5



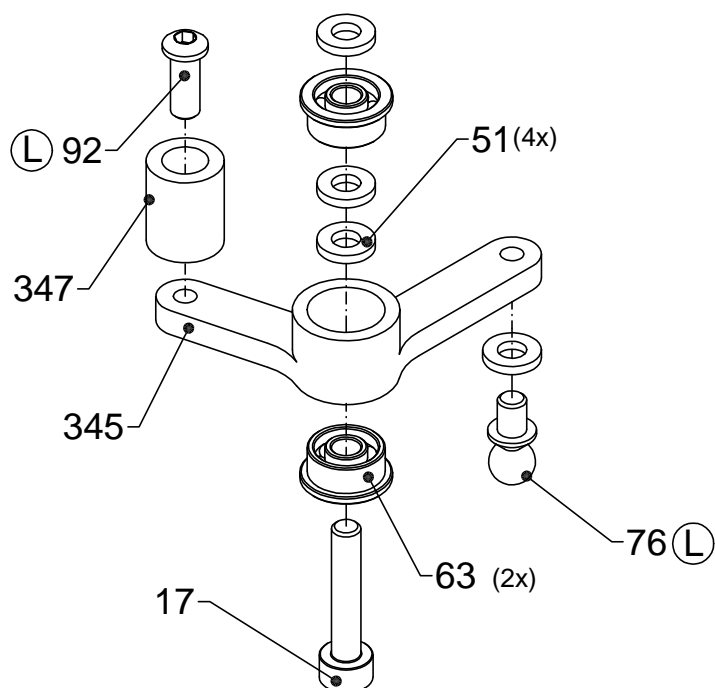
Turn belt 90 degree to the right side (view from behind)!



66 = ball bearing 6 x 10 x 2,5

Oil bearings frequently!

Tip: Don't screw in by hand,  
but press bridge on in a vice  
(check for squareness)!



17 = hexagon socket screw M3 x 16

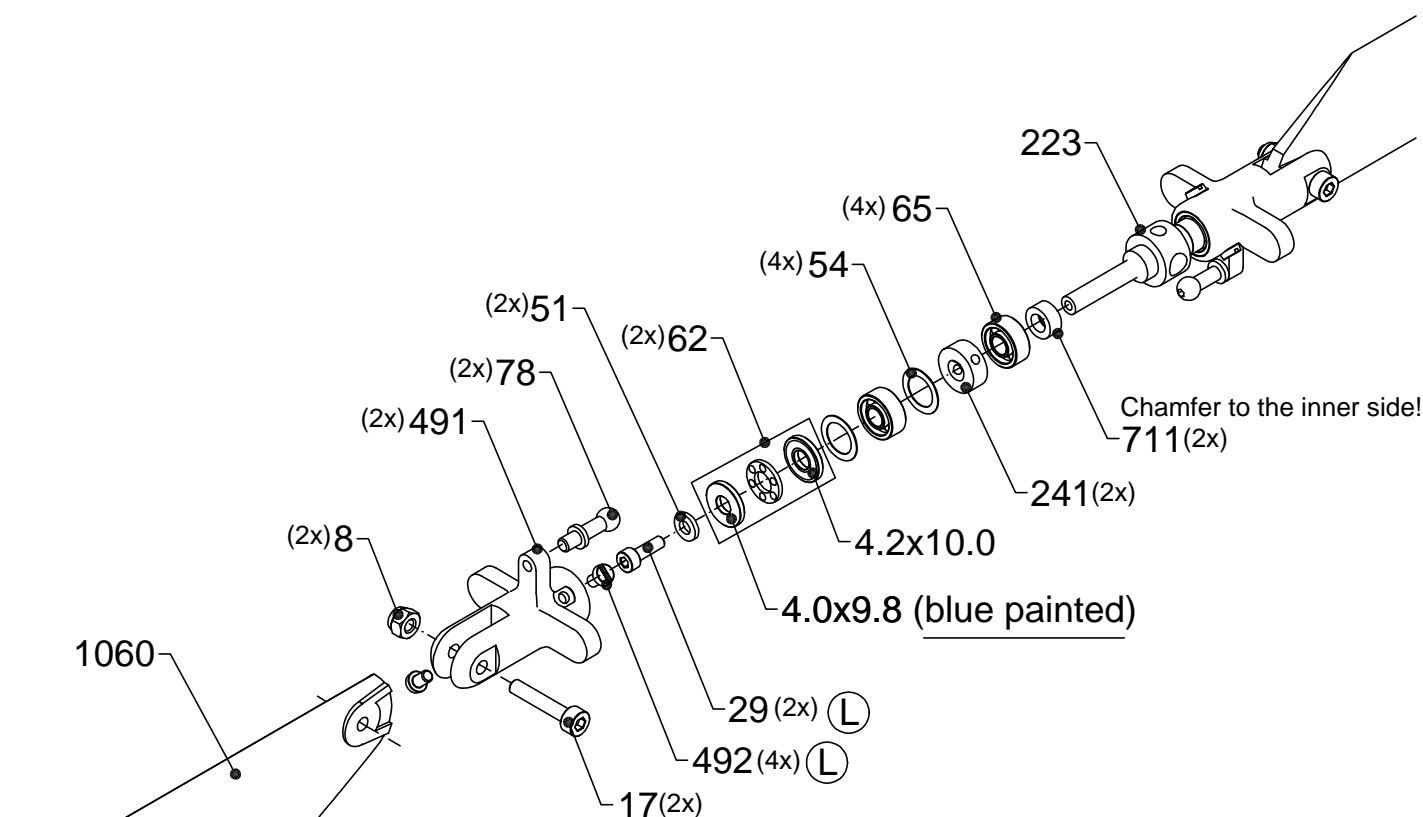
51 = shim 3 x 6 x 1

63 = ball bearing with flange F3 x 8 x 4

76 = joint bolt M3 x 4

92 = hexagon lense screw M3 x 8 Spezial

(L) = use Loctite



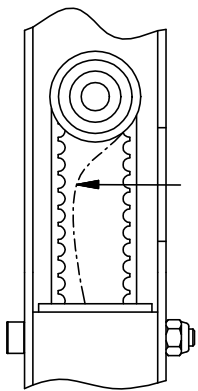
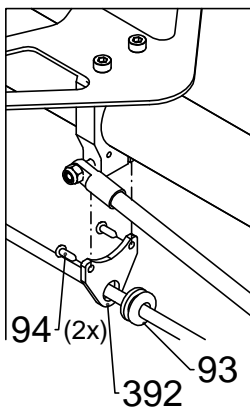
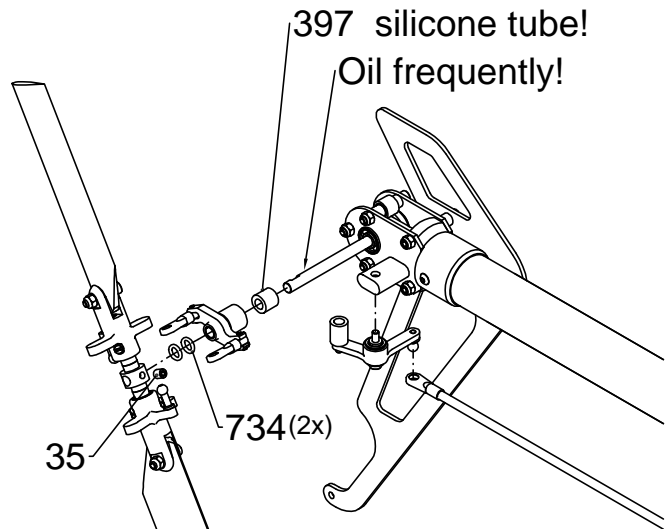
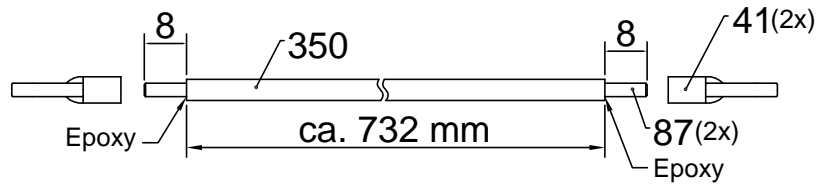
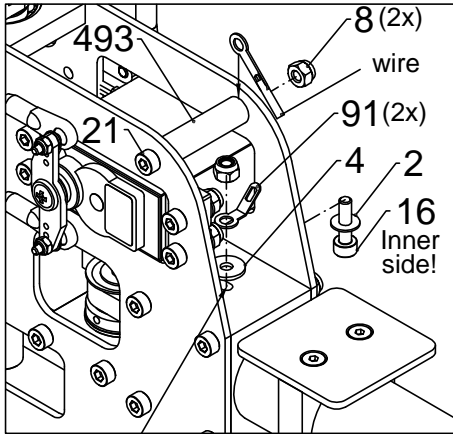
Before mounting the blade grips check the easy running of each bearing unit, eventually shorten bush 711 a little bit (remove from side with chamfer with sandpaper)!

Important: Blue painted thrust bearing washer must be mounted at the outside!

- 8 = lock nut M3
- 17 = hexagon socket screw M3 x 16
- 29 = hexagon socket screw M 2,5 x 8
- 30 = hexagon flat head screw M2,5 x 5
- 51 = shim 3 x 6 x 1
- 54 = shim 7 x 10 x 0,2
- 62 = axle bearing B4
- 65 = ball bearing 4 x 10 x 4
- 78 = joint bolt M3 x 9
- 492 = cylindric screw M2.5 x 4

Ⓛ = use Loctite

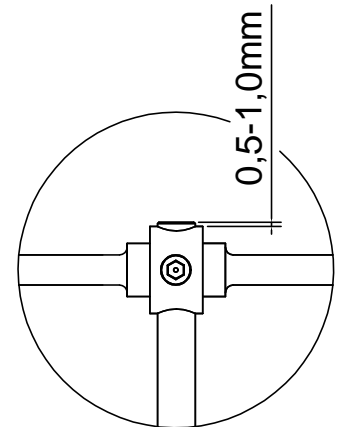
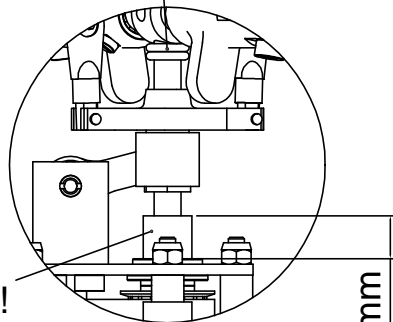
## ground strap



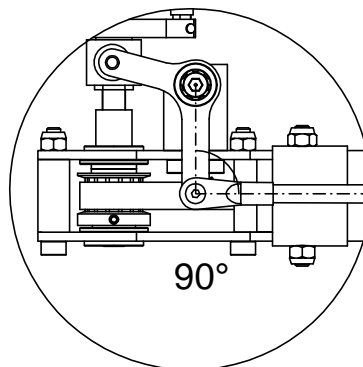
belt should not touch other side of belt (press with thumb)

O-Rings!  
Don't forget!

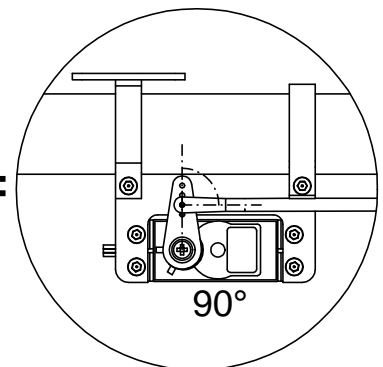
Silicone tube!  
Don't forget!



0,5-1,0mm



min. 8,5mm



2 = washer M3

4 = washer M3 large

6 = clevis 2.5 PA

8 = lock nut M3

16 = hexagon screw M3 x 12

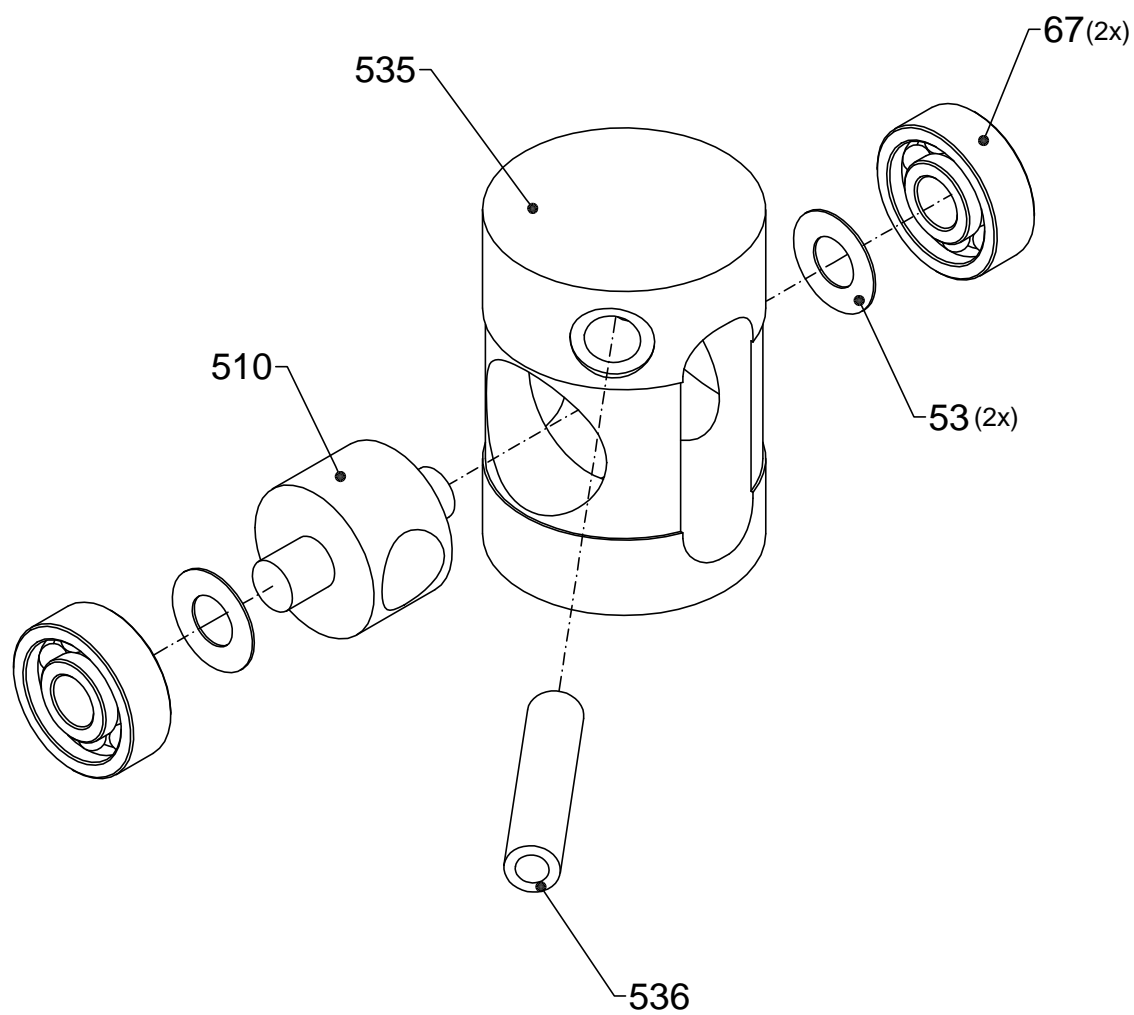
35 = grub screw M4 x 5

41 = ball joint 2.5

87 = control rod 2.5 x 26

94 = self tapping screw 2.2 x 6.5

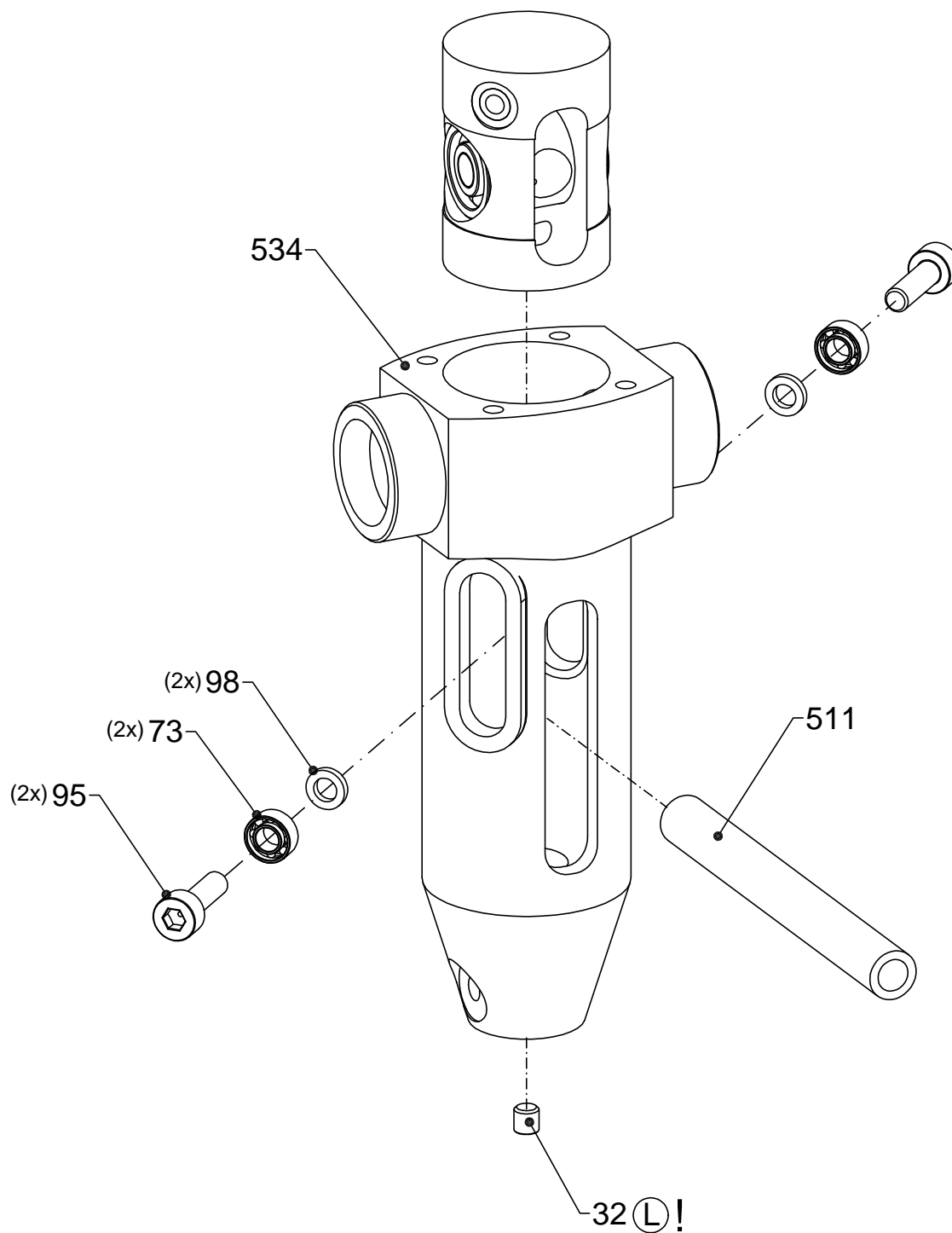




53 = shim 4x8x0.1

67 = ball bearing 4x12x4

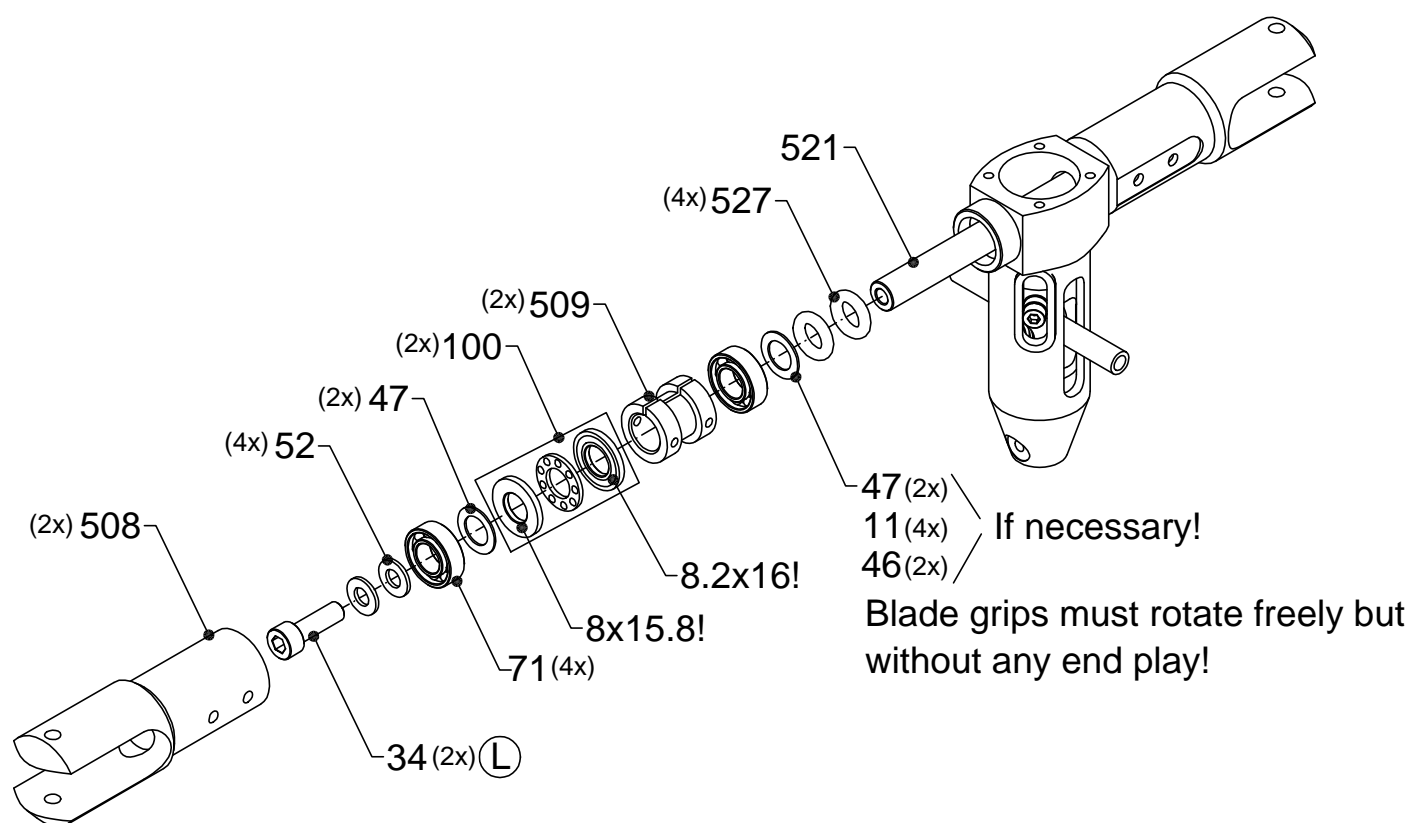
Do not oil or lubricate piston!  
Keep dry and clean!



95 = hexagon socket screw M3 x 10 alloy steel

32 = hexagon grub screw with cone point M4x5 alloy steel

(L) = use Loctite



Lubricate O-Rings!

assembly may require the blade grips  
to be heated to 150°C/300°F

11 = shim 8x14x0.2

34 = hexagon socket screw M5x12 12.9

46 = shim 8x14x0.1

47 = shim 8x14x0.5

52 = shim 5x10x1

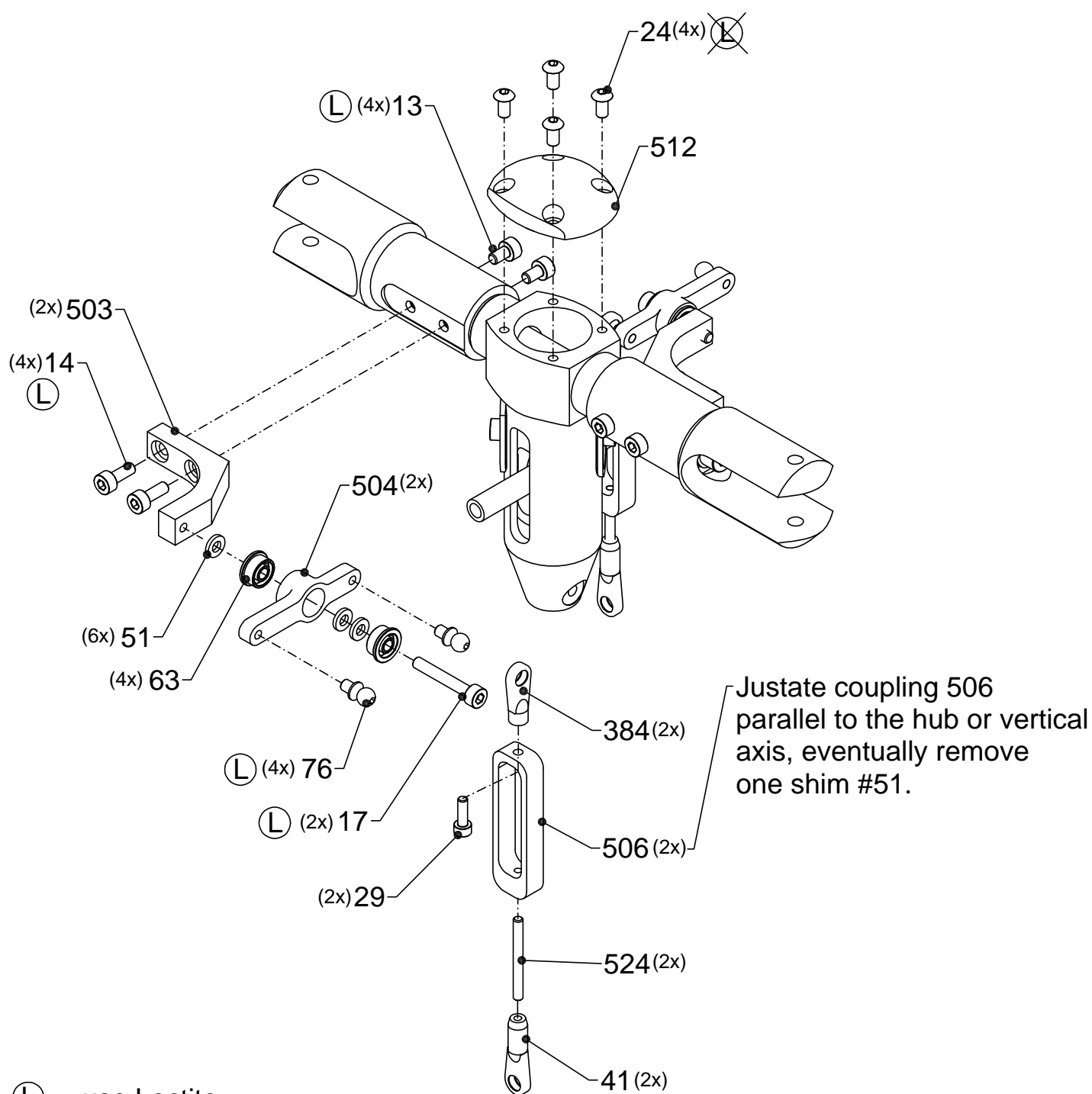
71 = ball bearing 8 x 16 x 5

100 = axle bearing B8

(L) = use Loctite

Note: Steering arm 503 is on the backside of the rotorblade!

25



(L) = use Loctite

13 = hexagon socket screw M3 x 5

14 = hexagon socket screw M3 x 8

17 = hexagon socket screw M3 x16

24 = hexagon lense screw M3 x 8

29 = hexagon socket screw M2,5 x8

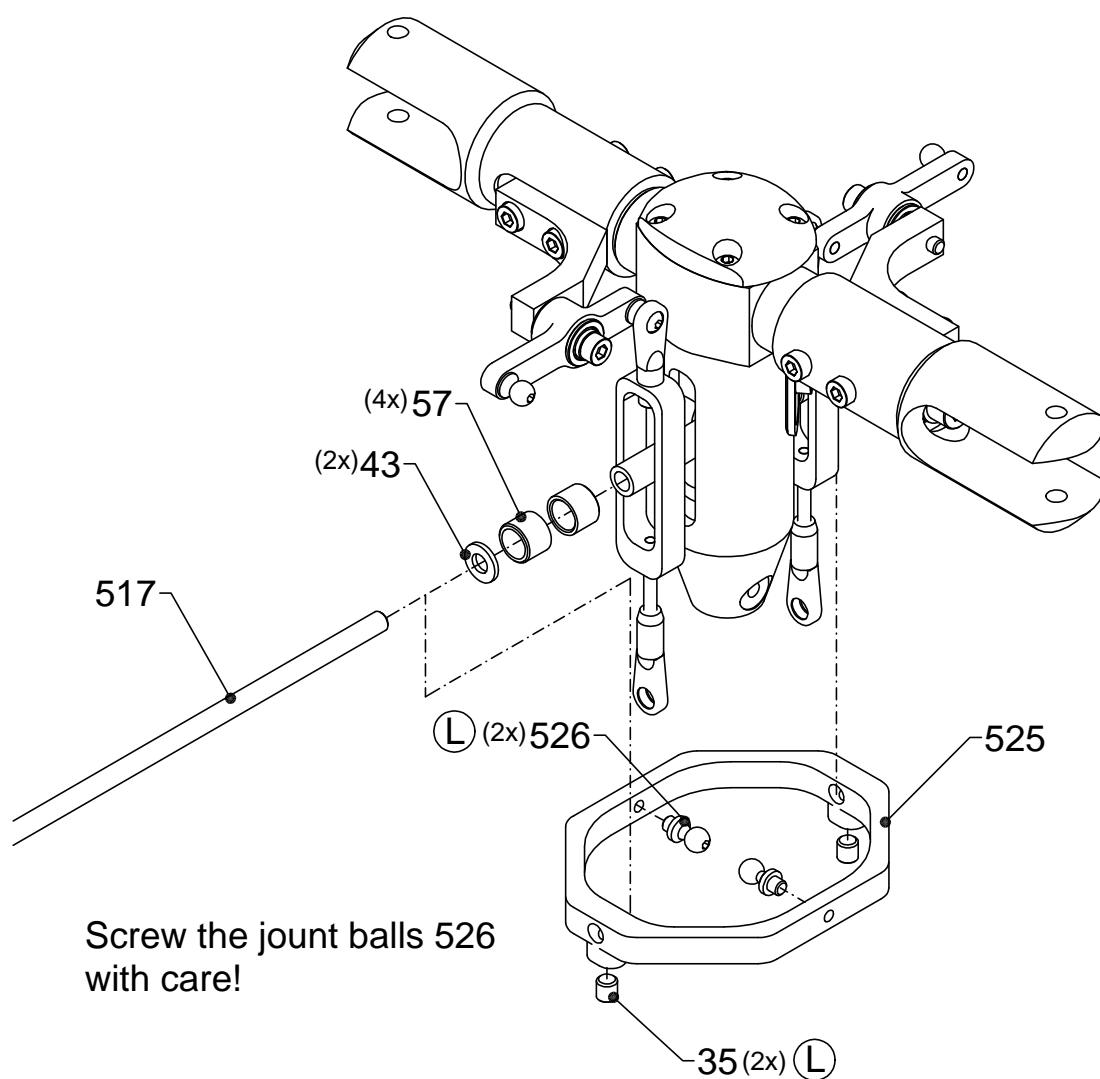
~~L~~ = do not use Loctite

41 = ball joint 2.5

51 = shim 3x6x1

63 = flange bearing F3x8x4

76 = joint bolt M3 x 4

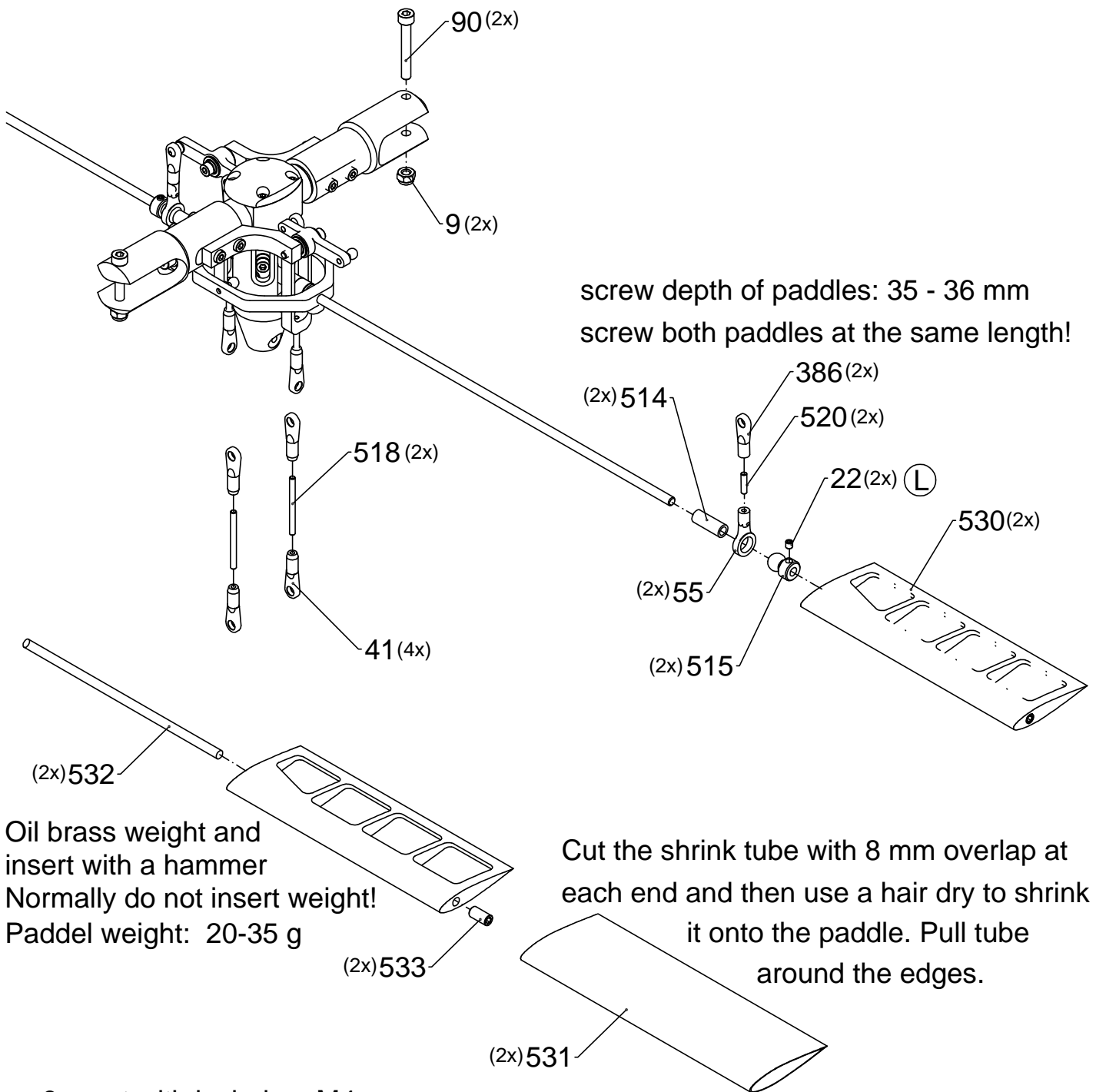


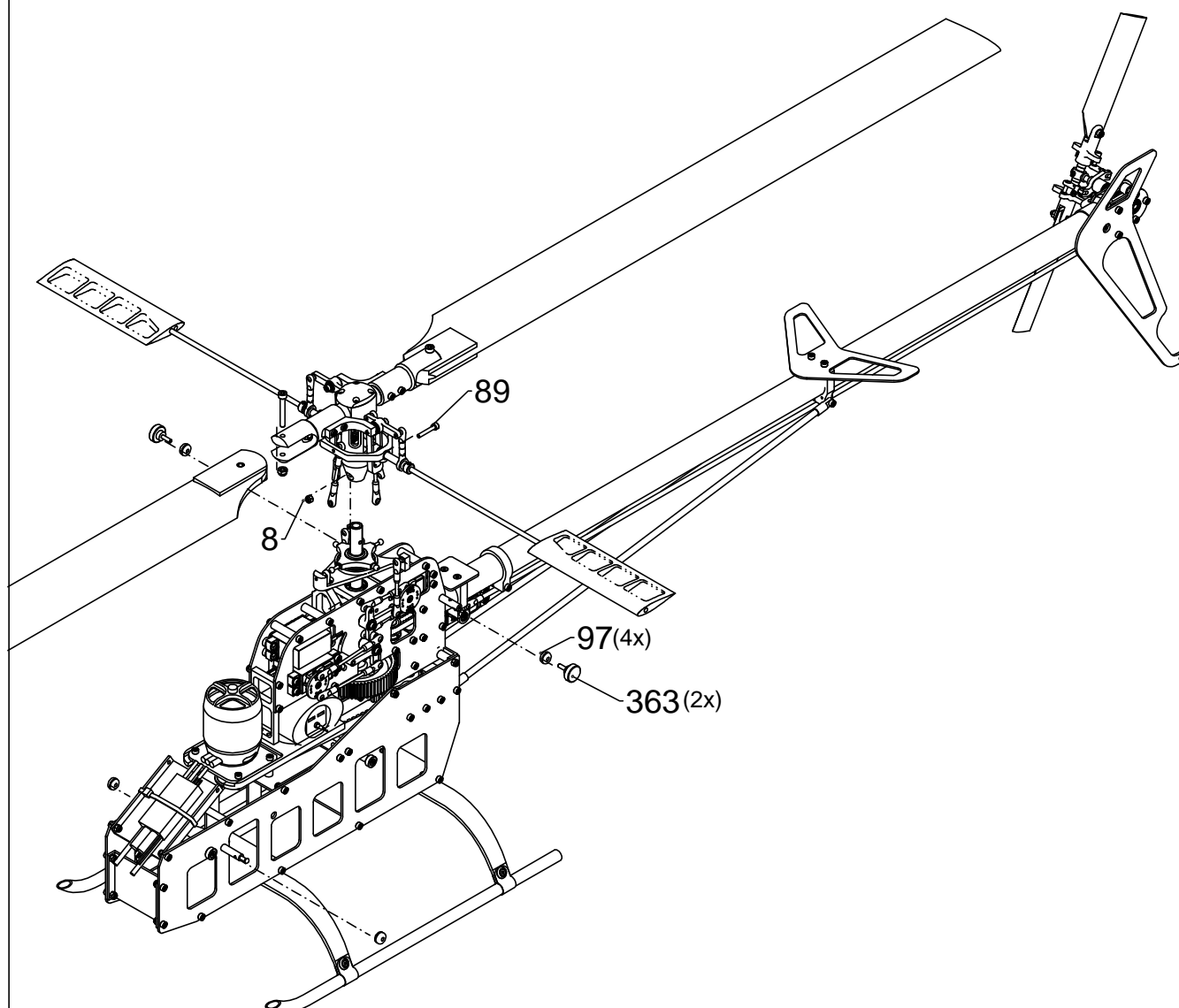
35 = grub screw M4 x 5

43 = shim 4 x 8 x 1

57 = teflon bearing

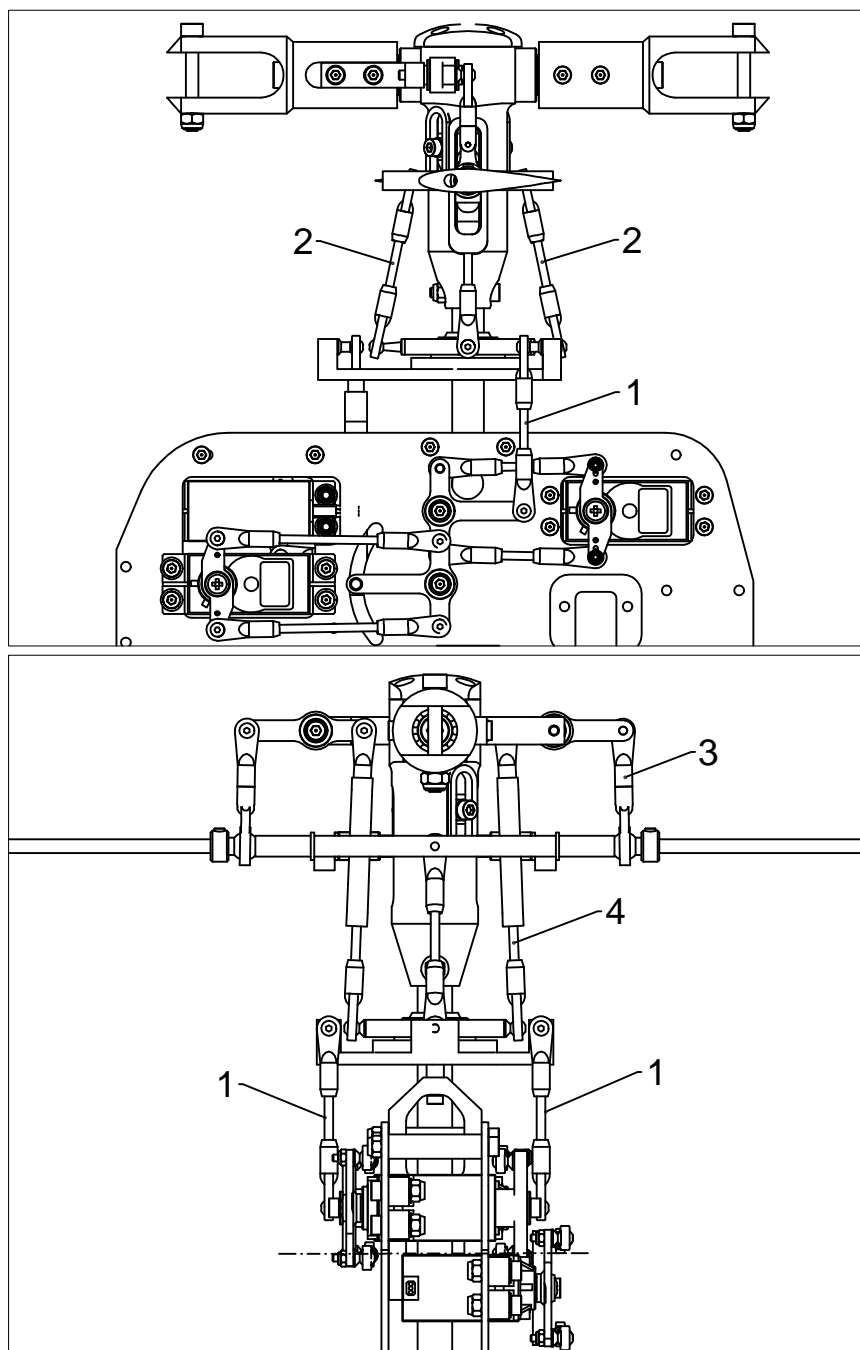
Ⓛ = use Loctite





Use oil for the first mounting of the rotorhead. DO NOT TURN, push only straight! If the hub jams, then remove, clean and try again!

- 8 = lock nut M3
- 89 = hexagon socket screw M3 x19 Spezial
- 97 = rubber grommet 3 mm

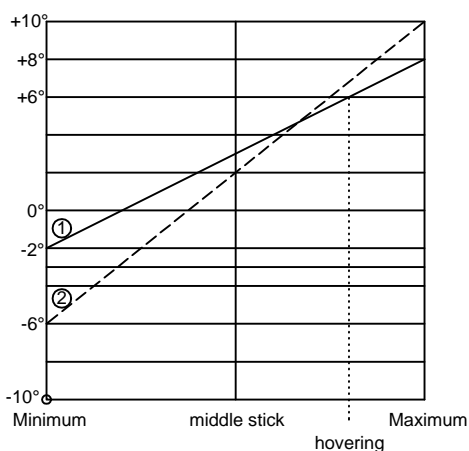


1. All servo arms and bellcranks must be vertical or horizontal.
2. Adjust pushrods (1) to level the swashplate.
3. Adjust pushrods (2) to the Hiller bridge until the antorotation ball bearing is centered in its brass lined slot.
4. Double ball links (3) between flybar and mixer arm are 42 mm long.
5. Adjust the lower ball links (4) between swash plate and mixer arms until the mixer arms are horizontal.
6. With a pitch gauge check the actual blade pitch and adjust lower ball links of rod 4 until both blades are at zero degrees pitch.



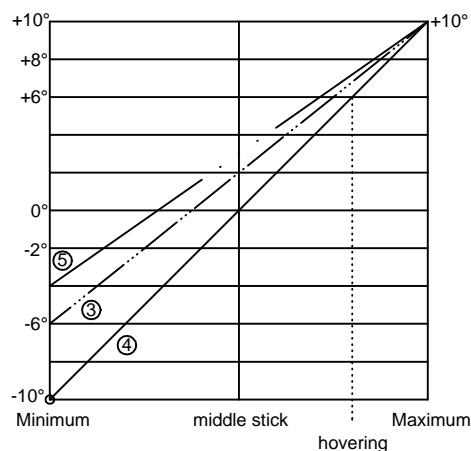
## Pitch gauge

1. normal flight, 1350 1/min



- ① Hovering/Beginner
- ② Forward flight/Advanced

2. aerobatic, 1500 bis 1800 1/min



- ③ Aerobatic FAI
- ④ Aerobatic 3D
- ⑤ Autorotation

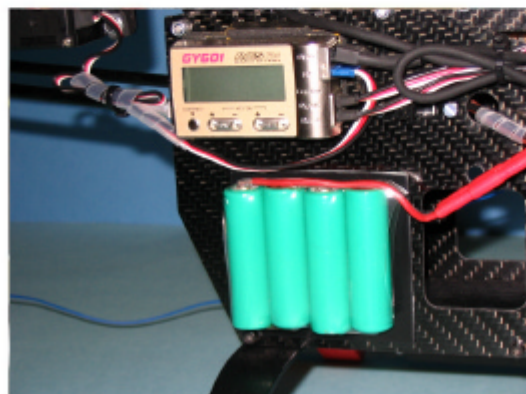
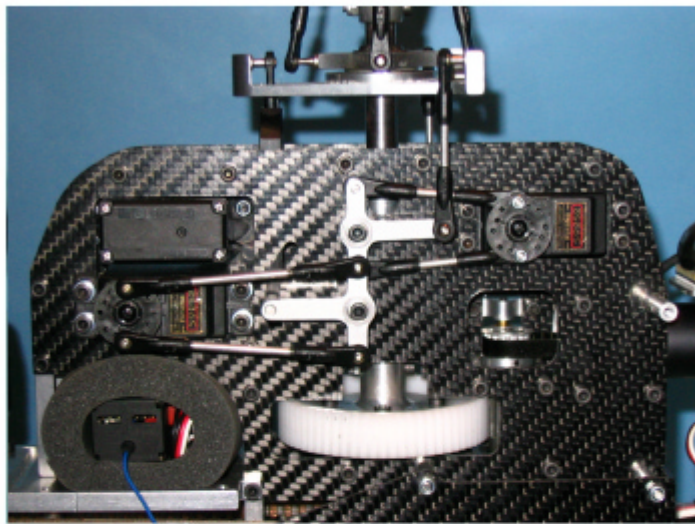
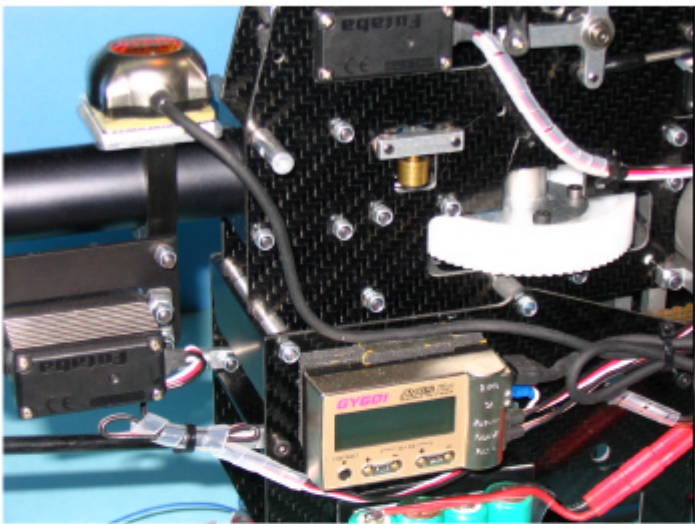
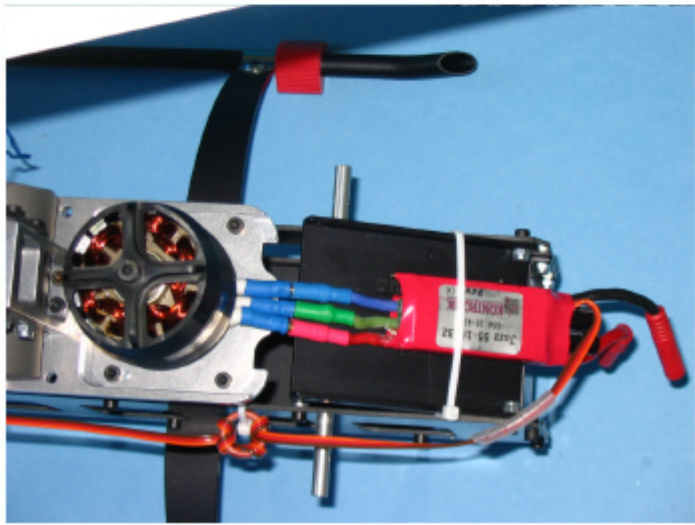
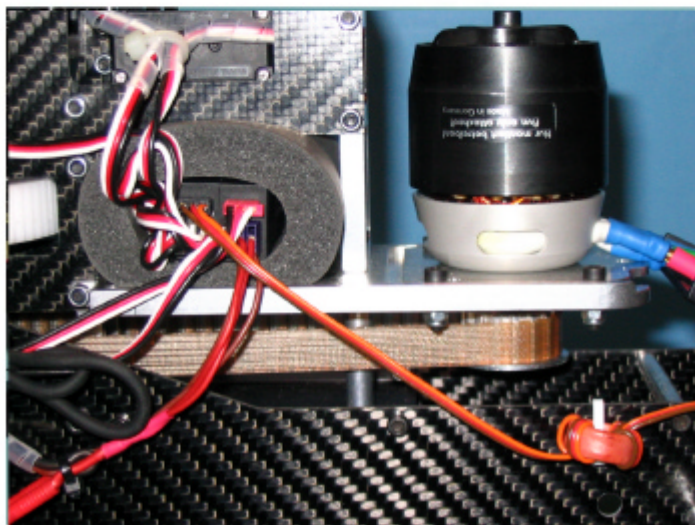
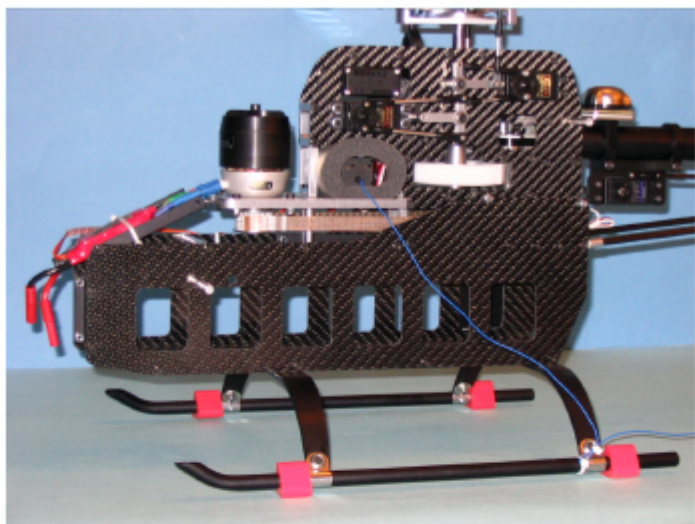
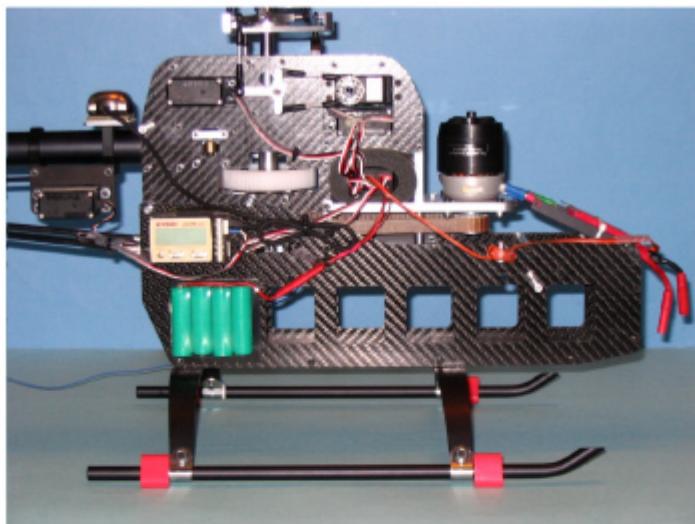
Recommended rotorspeed: 1350 - 1800 1/min

## Deflections:

Elevator:                      Hovering 1350 1/min:                      12° 25% Exponential  
    Forward flight 1350 1/min:                      20° 20% Exponential  
    Aerobatic 1700 1/min:                      20° 15% Exponential

Roll:                              Hovering 1350 1/min:                      15° 20% Exponential  
    Forward flight 1350 1/min:                      20° 10% Exponential  
    Aerobatic 1700 1/min:                      20° 10% Exponential

Tailrotor:                      All Phases:                      +26°/-10°                      30-50% Exponential



*minicopter*

