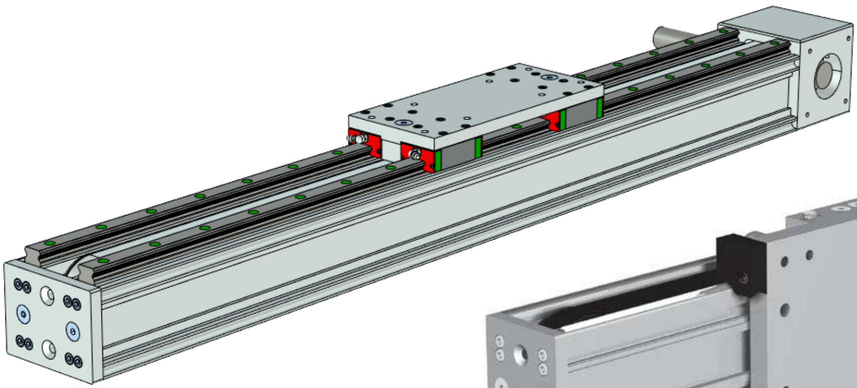
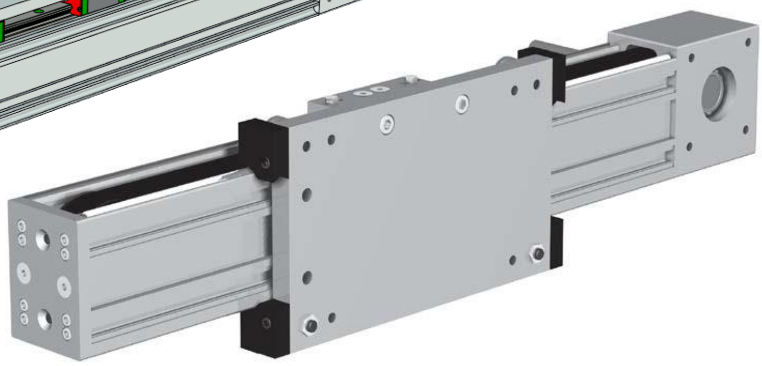
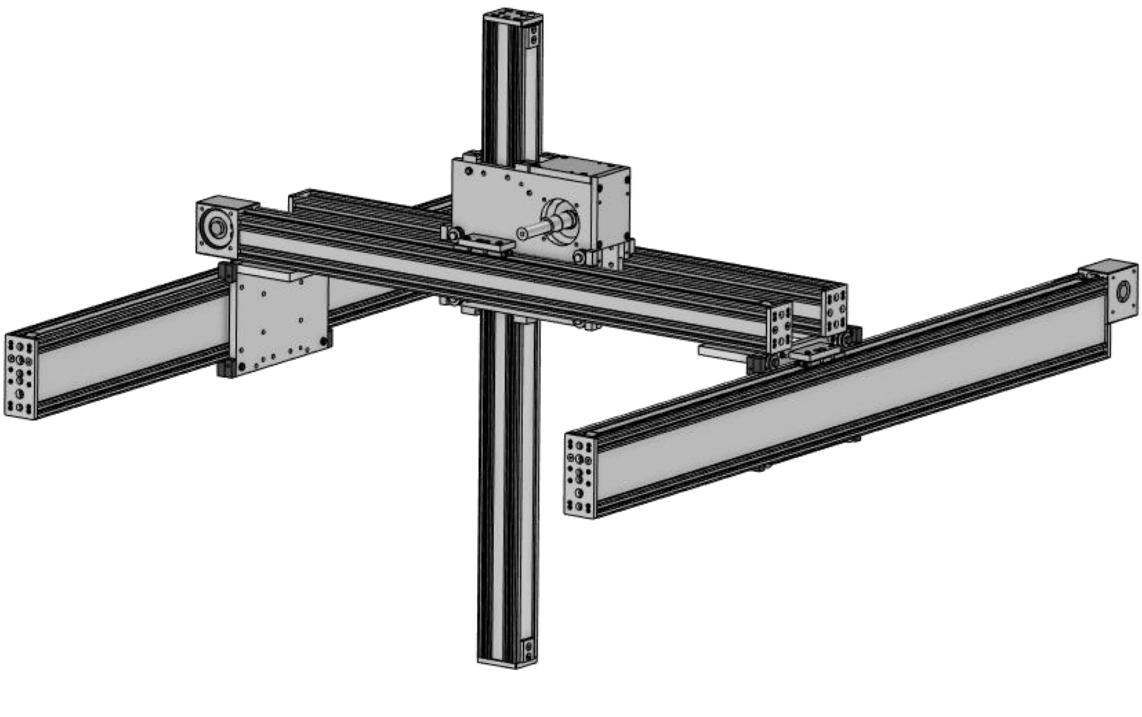
Set your thoughts in motion

Aratrons linear and gantry units, AL/AP –
Instructions for assembly, adjustment and maintenance







Contents

Refer to a separate document for any spare parts.

For other accessories and products:

Aratron's webbsite:
https://www.aratron.se/

AL/AP-catalog:
https://www.aratron.se/wp-content/uploads/2016/01/ALAP-2022-v.3_sv.pdf

Generel instructions for assembly och adjustments

These are written based on a balanced 3-axis gantry, type AP530, but apply in selected parts also to linear gantry if X-movement is omitted and for linear units where the document is mainly used for motor/gear assembly, belt tension, care and maintenance points.

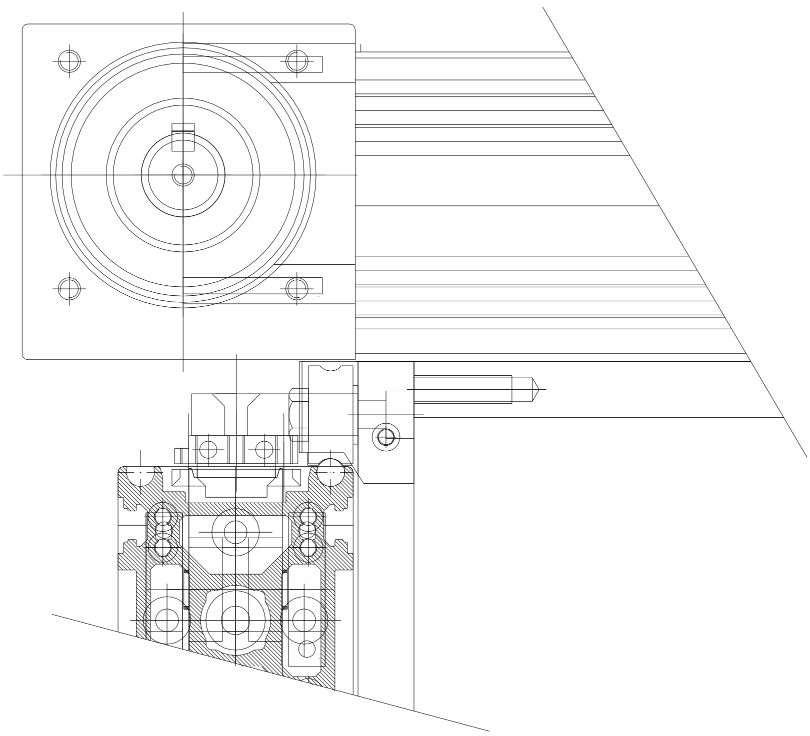
In case of questions or uncertainty, please contact Aratron AB.

Assembly

Assembly of multi-axis units

A. 3-axis gantry (for 2-axis go to B):
   Mount the X-linear units on the framework.
   Adjust parallelism and distance between these; the distance itself is not so important as the crossing Y-units allow a smaller distance due to the mounting method.
   Parallelism is important to avoid extra loads on the bearing rollers.

B. Mount the driven Y-unit on the X-sliding plates (for 2-axis gantries on the framework) and loosely fit the screws. Make sure the Y-units profile overlaps the X-sliding plates as shown in the image below.



C. Lift up Z-unit and hook it onto the linear axis of the Y-unit.
   Hold it in position and put up the second Y-unit, then the Z-unit can rest on the Y-units.
   Mount the Y-unit on the X-sliding plates and loosely fit the screws. In this way, it becomes easier to adjust the distance between the two Y-units.

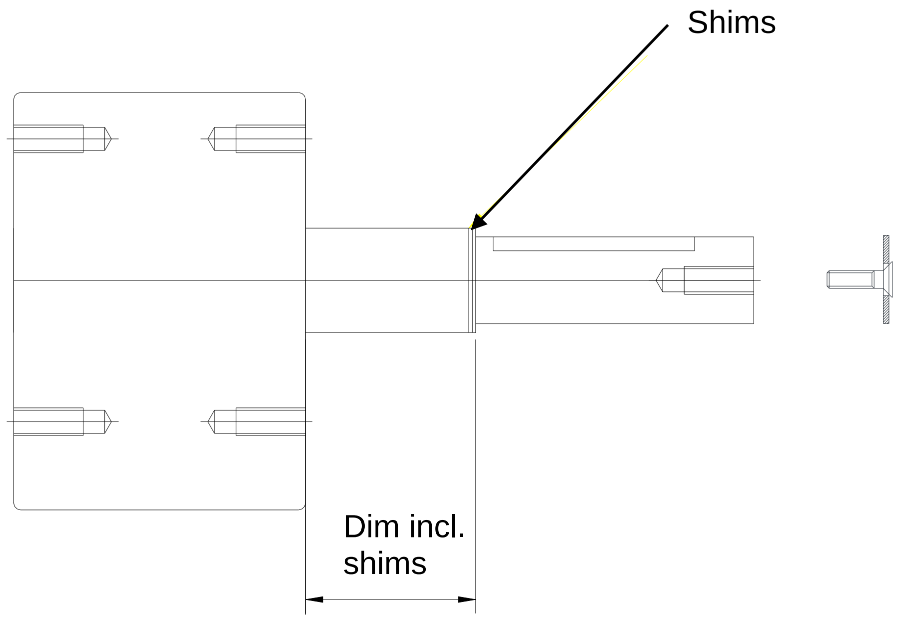
   See also ”Adjustments of parallellity and distance between profiles”.

Assembly of hollow shaft gearbox (A-side)

A. Measure according to picture. Measure the hollow shaft edge on the shaft or, where there is none, the total length of the shaft.
   Note! Make sure the drive shaft is mounted all the way into the pulley box.

B. Measure the current xxx depth of the gear from the flange to the hollow shaft edge, alternative, in cases where the hollow shaft has an internal retaining ring, the measurement to this from the installation surface of the flange.

C. Use the supplied shims to get a correct setting.



   Note!
   Be careful not to get a tight montage i.e. The measurement according to the picture including shims should be a little less than the measured measurement of the gear.

D. Mount the gear on the pulley box. Check that the pulley and belt exit the pulley box in the middle.
   Note! Don´t forget the axial screw in the shaft (except where the gear has a clamping element).

Note! For some gears with a retaining ring and washer inside the hollow shaft, this is done with spacers between the end of the drive shaft and the retaining ring before the axial screw is fitted.

Assembly on the B-side, contact Aratron.

Assembly of Z-hollow shaft gear, balanced gantry serie 200 och 500

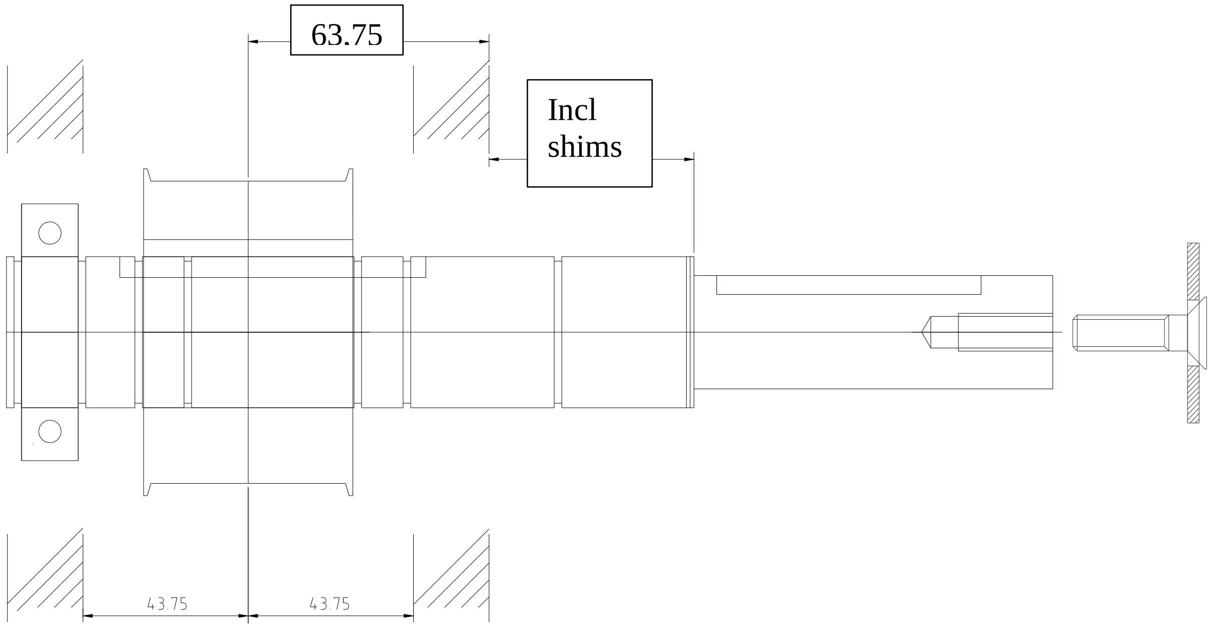
Note! Below we specify the theoretical measurements exacly. The dimensions are almost impossible to measure, but the important thing is that the pulley should guide the belt as close to the center of the Y–Z-box as possible.

Mount the drive shaft into the gear. Measure the distance from the contact surface of the flange to the center of the pulley, it should be 63,75 mm nominal. Adjust with the shims so that +/- 0,5 is obtained i.e., the distance will be 63,25 and 64,25. Tighten the axial screw.

Note! Don´t forget the axial screw in the shaft (except when the gear has a clamping element).

Mount the motor/gear/drive shaft on the Y–Z-box.
Check that the gear flange is mounted flat against the mounting surface so that no tension occurs. Also check that the ball bearing (w=15) on the opposite side is within the thickness of the plate, i.e., has an axial floating position.

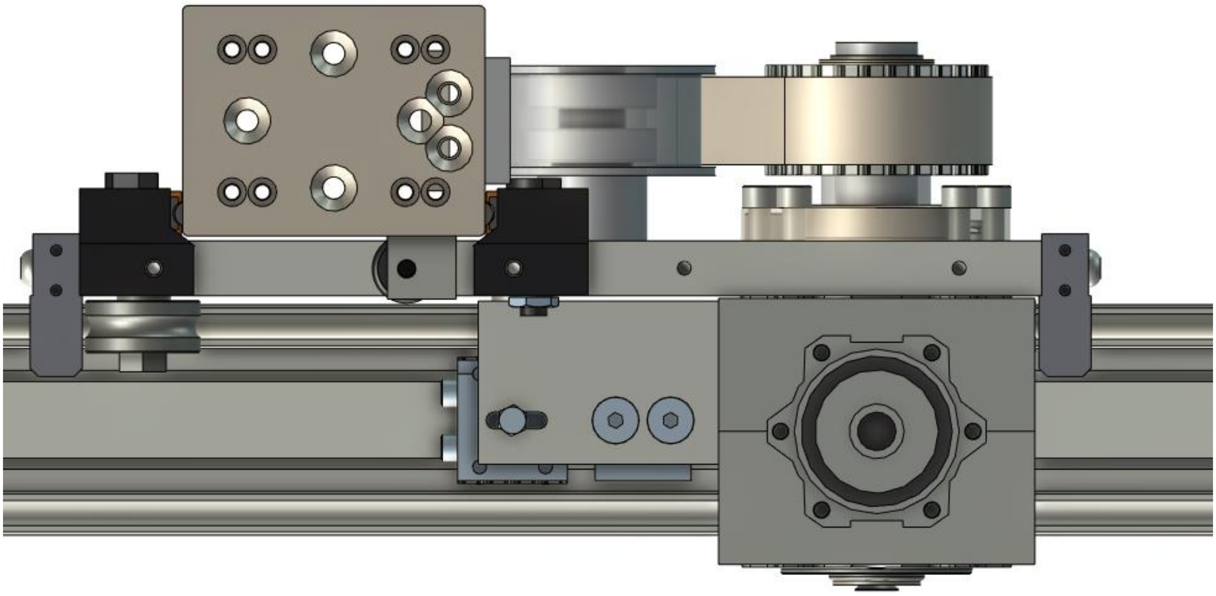
Slightly tension the belt which is up on Z. Possibly the belt tensioner may need to be re-toothed to be properly tensioned.



Assembly of Z-motor, AP100-gantries

The approach is the same as the previous one and can therefore be followed in principle.

Use shims for the drive shaft to make sure that the pulley stays correctly in axial direction. It shall be in the middle of the belt.



Note! Don´t forget the axial screw in the shaft (except when the gear has a clamping element).

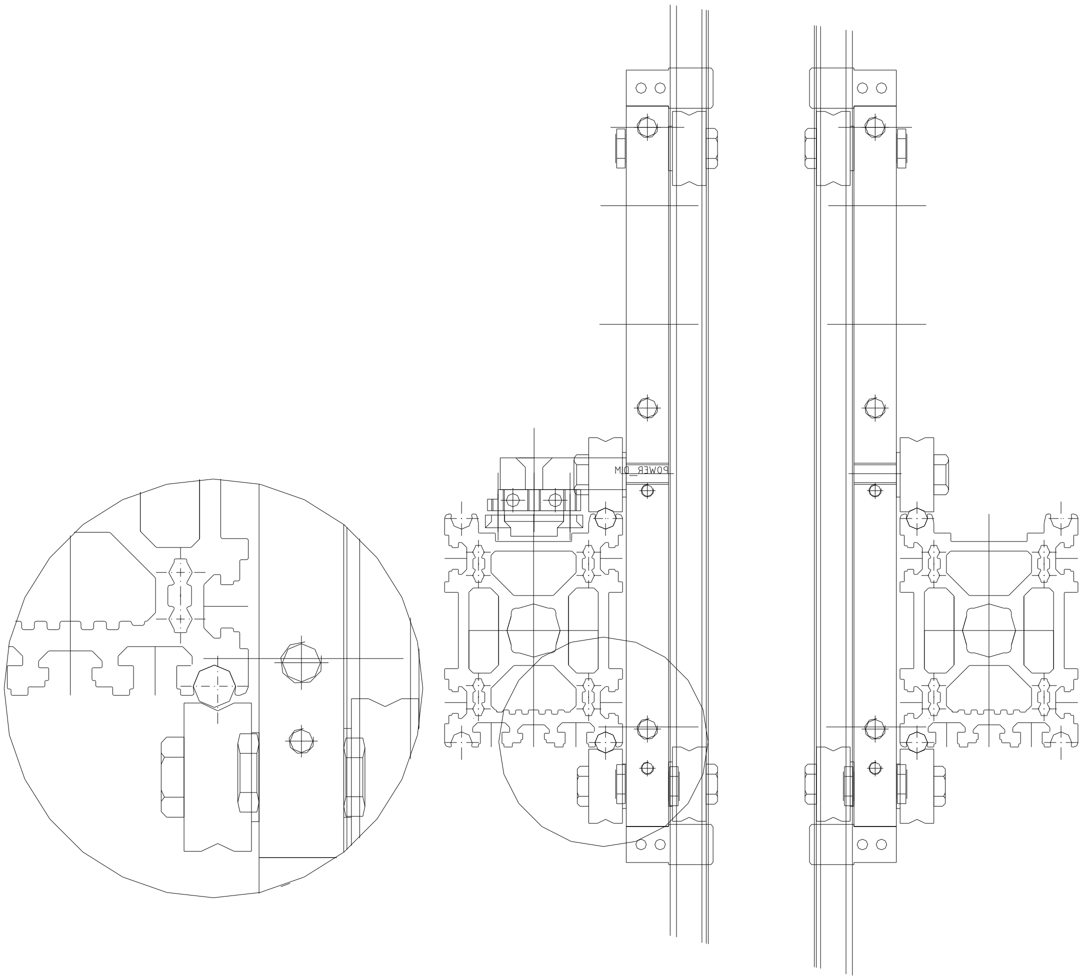
Adjustments

Adjustments of parallellity and distance between profiles

A. Mount the excentric rollers to the Y–Z-box and adjust position of Y-profiles according to picture below.

B. The easiest way to do this is to have the excentric rollers loose and without the wipers mounted. It can easily be seen from the side if the roller tends to roll at an off-center position on the shaft. Adjustment of the distance between profiles needs to be done until the rollers have a correct geometry/position, on the shaft.

For adjusting the excentric rollers further info is available under “adjustment of linear bearing rollers”.



Adjustment of linear bearing rollers

Each linear motion has centric and eccentric bolts.

The concentric bolts should be tightened to 45-50 Nm.
Adjust the eccentric bolts to achieve a play-free bearing (keep the eccentric pin stationary during nut tightening). The locknuts of the eccentric should be tightened to 45–50 Nm.
In applications with vibrations, it is advisable to use a drop of Loctite No. 243.

Check: All rollers should rotate during motion. Note that the motion should be smooth; excessive preloading decreases the lifespan of the bearing.

Normal adjustment on an unloaded roller is achieved by securely holding the roller with your hand, preferably pinching it between your thumb and index finger, so that you can feel a slight resistance against the shaft when the block is moved back and forth; this is usually a suitable setting.

Applications with high acceleration can be in need of a little bit higher resistance against the shaft.

Adjustment of belt tension

The belt tension should be adjusted so that the non-driving part does not become too loose during acceleration/retardation. This, of course, depends on the choice of drives (gears, motors, and ramps).

For most applications, a belt can be adjusted in two steps;

1. *Install the belt and adjust it to a ”streched” position (this means not tight, just that the belt is ”streched”).*
2. *Tension the belt by 1 mm <u>per meter of belt length,</u> which can be a suitable starting value.*

The easiest way to check this in the specific application is to observe the belt at the motor end. During acceleration, the belt may exhibit a small bump from the motor end, but there should be no continuous "wave motion." Conversely, during braking into the motor end, the belt should "not be pushed towards the belt pulley" as there is a risk of over-engagement.

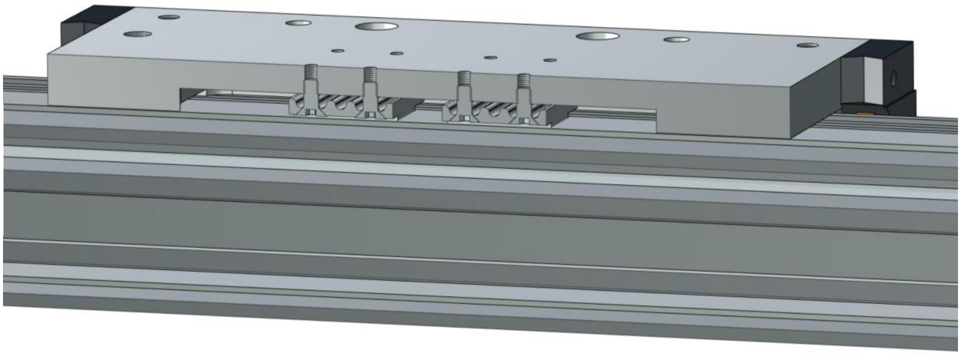
BELT TENSION
ALR23 & ALR26

If the tensioning range is not sufficient, loosen the tensioner half and reposition the belt on the tooth plate.

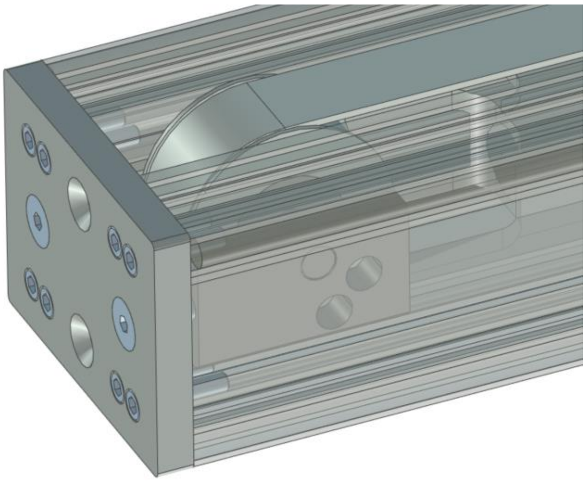
After making necessary adjustments, lock the belt clamp assembly with the two M6 screws located from above. This prevents the belt clamp assembly from scraping against the profile.

Some linear units have the belt ends fixed. These include units with the belt placed under the carriage (ALR 33, 36, 43, 46 och 56) and any special solutions.
In these cases, the belt tensioning is done by tightening the pulley with the two countersunk screws in the end plate. Any need for re-toothing on such a linear unit is done by the belt joint.

BELT MOUNTED
BELOW CARRIAGE



BELT TENSION WITH TWO
CONIC M8 SCREW



Adjustment of belt tension in parallel drive

In the case of parallel drive, it is important that the belt tension is the same and, above all, provides an equal transport length on the right and left units.

Approach:
This can be checked by pulling the carriage to the end where the drive motor shaft is mounted.
Check the tension in the short belt parts so that they feel as equal as possible.
Mark the position, drive as far away as possible - measure the travel distance on both sides so that the transport is the same length on the left and right beam.

Alternative approach (in case of belt drive located on the 84 side of the beam):

– pull the carriage to the end where the drive motor shaft is mounted
– loosen the belt tensioner from the belt holder bracket on one unit
– check that the holes for the two tapered M8 screws match the holes in strap holder ceiling
– put the M8 screws back
– pull or drive the carriage as far as it will go from the motor end, remove the screws and check the holes again
– then put the M8 screws back

Timing belt can be re-toothing on the drive pulley wheel if needed.
Belt clamping set consists in **ALx2x** units of 3 parts to allow full adjustment of parallel drives. If adjustment becomes too short, belt can always be re-teethed in between clamping and toothed plate. The clamping set should after adjustment be locked with the two M6 screws (from top).
It also prevents the set from scratching the profile.

For linear units with the belt placed under the carriage the belt-tensioning is made in the return wheel assy. In these cases, two conical M8 (M10) screws are used. Possible re-teething of belt in these units must be made under the carriage.

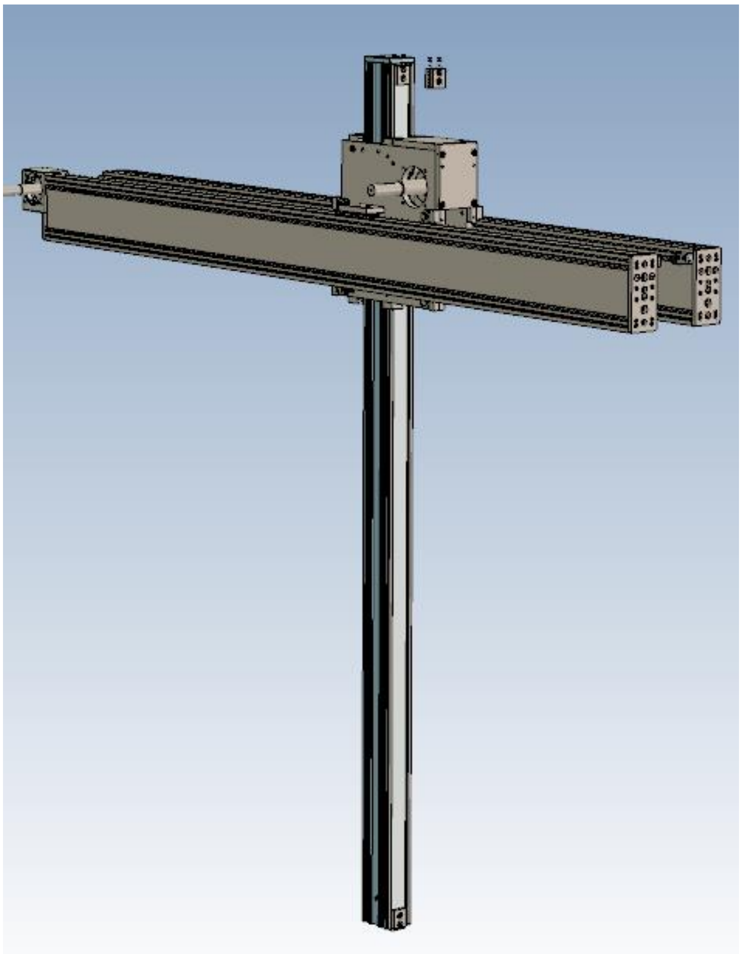
Note!
The above is advantageously done in combination with setting the linear bearing rollers. It should be noted that in case of incorrect adjustment, one belt may pull in one direction and the other in the opposite direction.

Adjustment of belt tension on vertical drive

Shown here for vertical Z beam but the principle is the same for a vertically placed linear unit.

For vertical applications, the belt tension can be made as follows:

Approach:
Set the Z-beam (or the carriage if it´s a linear unit) in a position giving the longest possible length of the loaded belt (normally the lowest position).



Load the gripper with the actual load.

Add load for the acceleration, i.e. if acceleration shall be 3m/s2 in direction lifting 30 % of the total moving weight is added to the slider.
Note! our 110*84 profile incl. belt and shafts have a weight of appr 13 kg per meter + 1 kg basic parts.

Calculation example:
Handling weight 100 kg incl. gripper device.
Profile 2,2 meter = 2,2*13 + 1 = approx. 30 kg
Total 130 kg moving weight incl. the handled part.
Acceleration up (or when breaking at lower end) 3m/s^2 ==> 0,3*130 = 39 kg
Sum pulling force 169 kg (= approx. 1690N)

Check the non-loaded upper part of belt so it still has tension.

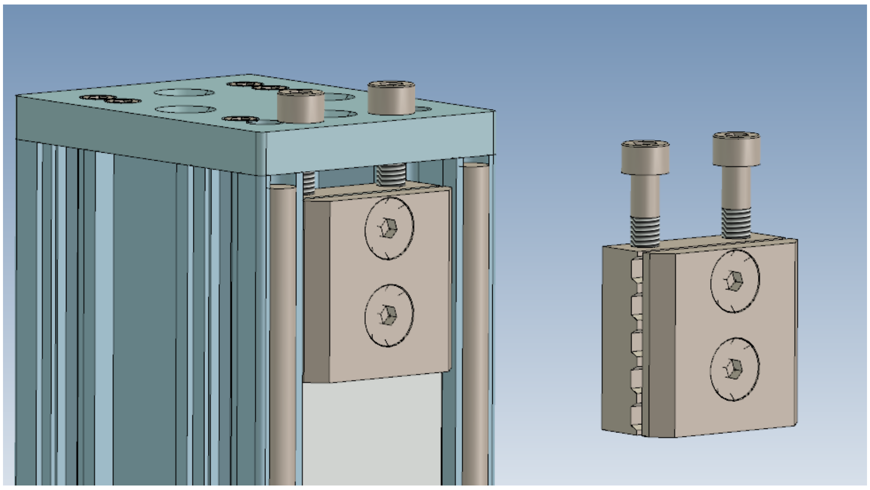
The tensioning screws shall be applied with Loctite securing.

The amount of tension needed are depending on the application.

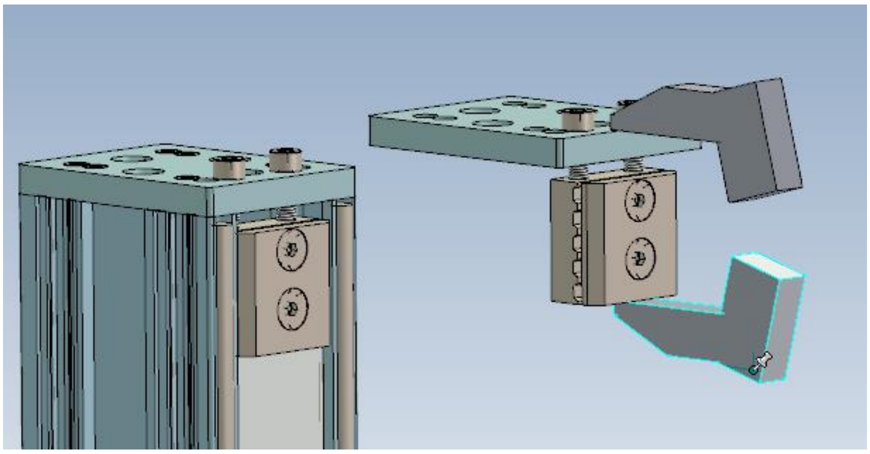
As an indication 200-400N can be a value to secure the belt having a correct running.

Set the tension screws slightly against the surface.

Note! the lower end shall still be loaded according to calculation example.



Suggestion: use a polygrip tool (gap 70-80) and clamp between the belt kit and top late.



Joint method, assembly of long linear units

Long units can´t be delivered assembled for transport or strength reason; it must be built on site. Below is a brief instruction on how this can be done.

The basic rules are that:
– axis joints must be offset from joints in the profile.
– axis joints should not lie in the middle of each other
– there is a stop screw in the end plate that tightens the axis joint.

Some tips on how to proceed:

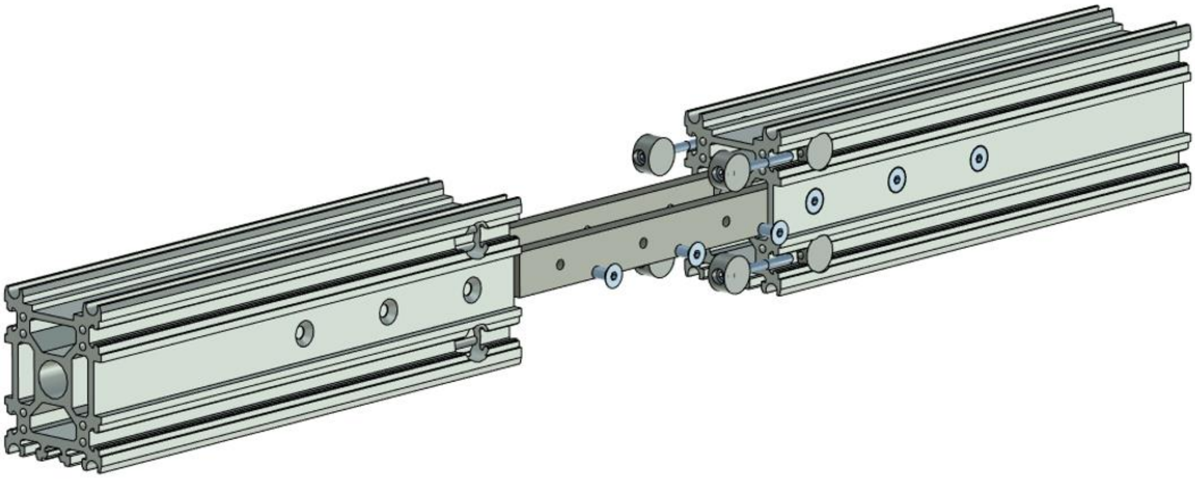
- Mount the profiles in the framework.
- Loosely assemble the details for the contraction of profiles or the method chosen for the joint. Insert the joint plates into the grooves where these should be.
- Assemble details for the contraction of profiles, alternatively the method chosen for the joint. Straighten the profile and pull these together.
- Slide the axis from one end to about 3 mm inside the outer end of the profile.
- Align the beams towards each other by placing clamps over the Ø10 shafts so that they guide the beam parts correctly. Pull the connectors together.
- Note! The sides that are not chamfered on the axis must lie against each other.
- To pull the strap through, it is advantageous to use a tussock with a string that you simply blow through the profile.
- Check carefully that the belt is not twisted inside the profile when the diverter end is mounted.
- Tap the axis lengthwise (at the end where the end cap has tension screws) so that the joint is tight, then fit the stop screws in the end plate to hold/press the axis against each other.

To fix the Ø10 axis, the aluminum profile is stamped with a core tool, see the example of the part we delivered where the axis is stuck into the profile.
This is important at the axle joint so that the bearing rollers have a smooth transition.

The joint for the 110 profiles must have good support in the framework as it has a lower load capacity than the profile itself.

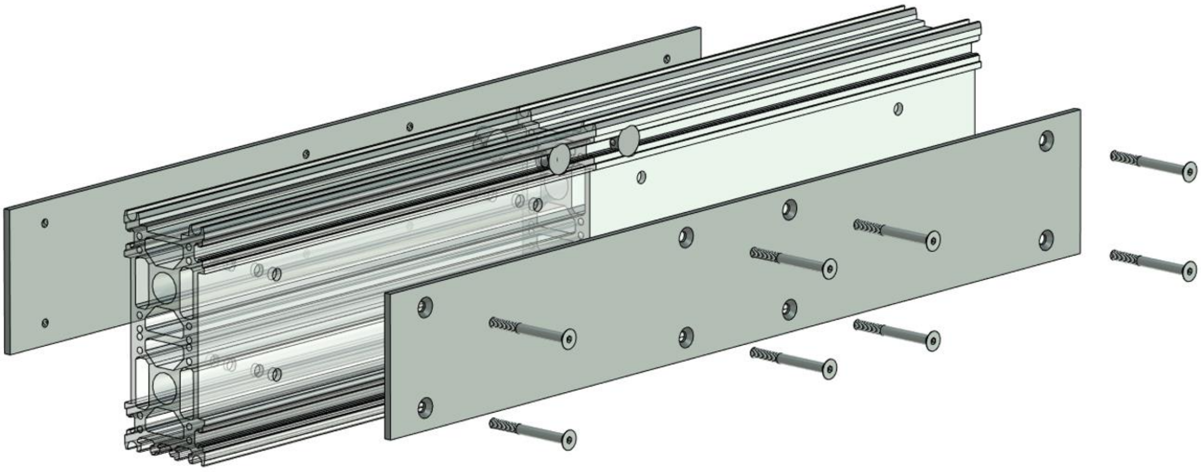
Joint method of 110*84-profile

The profile ends are pulled together by 4 countersink plunge pairs.
As a reinforcement, internal steel can be used. The steel plates are mounted with conical countersunk M8 screws. For ALx2 and ALx4, 2 channels are used and for ALx3 one channel, (the timing belt uses one channel on model 3).



Joint method of 190*84-profile

The profile ends are pulled together by 4 countersink plunge pairs.
As a reinforcement, 800 mm long outer steel plates are used on each side of the profile. The steel plates are mounted with conical countersunk M8 screws. The jointing method is intended for ALx2 units, which basically means all of our gantry solutions.
This joint has in many cases been used as self-supporting without any need of underlying framework.



Maintenance

Lubrication of shafts

This is an essential part of maintenance.

The wipers (939 TL) have a spring-loaded felt that should be oiled as needed. The interval for this should be visually determined, as factors such as temperature, operating time, travel distance, and environment affect the lubrication system.

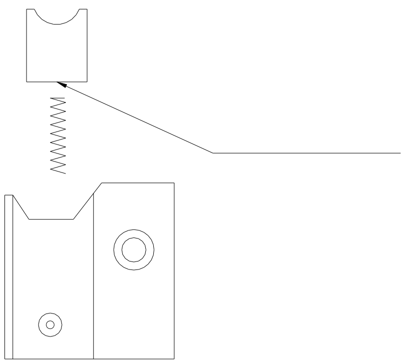
Oiling of the felt can be done either through the nipple located on the side of the wiper or directly onto the felt. Alternatively, the wiper can be unscrewed, and the felt can be immersed in an oil bath.

When reassembling, ensure that the spring is centered on the felt and not positioned along one edge inside the wiper housing.

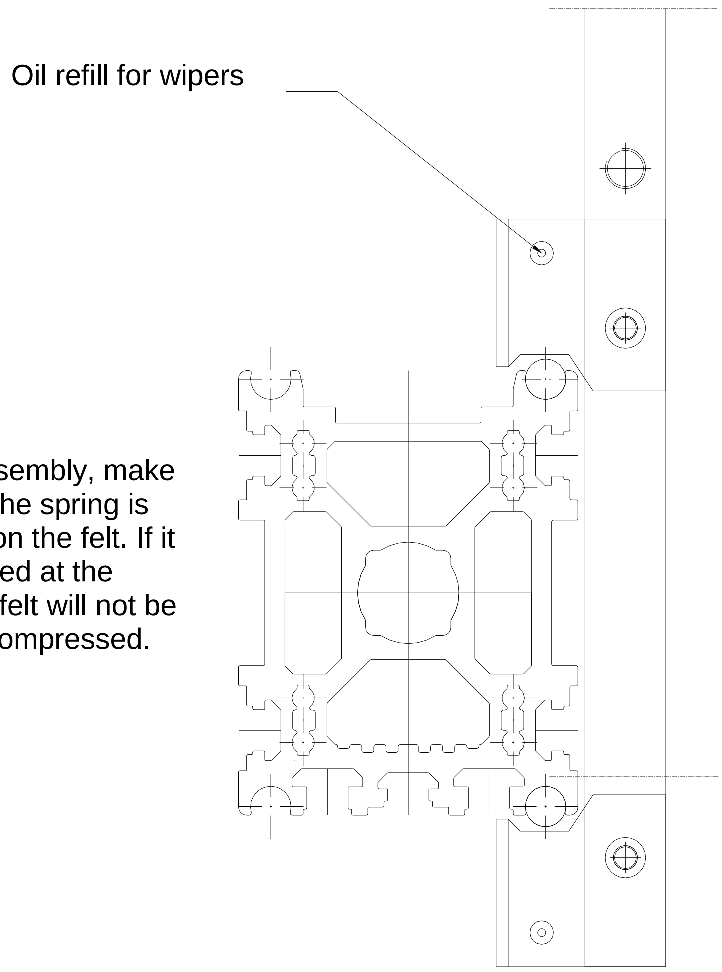
It is possible to install connection nipples in the wipers; in such cases, please contact Aratron for more information.

Suitable oil includes mineral type, gear oil, or similar.

The rollers for linear bearing are lifetime lubricated. All ball bearings are of sealed 2RS type.



Note!
During assembly, make sure that the spring is centered on the felt. If it is positioned at the edge, the felt will not be properly compressed.



Lubrication of linear guideways

Linear guideways require lubrication with grease or oil.

The block should always be lubricated with grease, even for applications where oil lubrication will be used later.

Ensure that these lubricants are compatible with each other.

Recommended suitable greases are:

- Shell Alvania RL2
- Optimol Longtime PD0, PD1, PD2, depending on temperature.
- Klüber Microlube GBO

Like all rolling bearings, Hiwin linear guideways require an adequate amount of lubricant to function properly. Lubrication also provides some corrosion protection.

1. Short stroke lengths

For stroke lengths <2 times the block length, install a grease nipple on both sides of the block. Lubricate both connections.
For stroke lengths <0,5 times the block length, lubricate the ball paths before mounting the block on the rail and install a grease nipple on both sides of the block.
Lubricate both connections.

2. Normal applications

Mount the block with a grease nipple on the appropriate side, lubricate according to the specifications in Table 1. Move the block approximately three block lengths to distribute the grease inside it. Repeat this three times.

Table 1: lubricant quantities

<table>
<tr><td>Size</td><td colspan="2">Initial grease quantities [cm³]
HG block / EG block</td><td colspan="2">Relubrication [cm³]
HG block / EG block</td></tr>
<tr><td>20</td><td>0,5 (3x)</td><td>0,4 (3x)</td><td>0,5</td><td>0,4</td></tr>
<tr><td>25</td><td colspan="2">0,8 (3x)</td><td colspan="2">0,8</td></tr>
<tr><td>30</td><td>1,3 (3x)</td><td>1,1 (3x)</td><td>1,3</td><td>1,1</td></tr>
<tr><td>35</td><td>1,9 (3x)</td><td>1,4 (3x)</td><td>1,9</td><td>1,4</td></tr>
</table>

3. Relubrication

Relubrication depends heavily on operating conditions and load. Vibrations and dirt shorten the intervals between lubrications. For normal operating conditions, specific values are provided in Table 2.

Table 2: Grease relubrication

Size HG/EG	Relubrication interval in km. For load <0,10 C dyn
20	1000
25	1000
30	900
35	700

4. Oil lubrication

Quantities for initial oil lubrication and relubrication are provided in Table 3.
Central lubrication: The oil quantity should not be added in a single impulse but divided into multiple ones. There should be a 10–20 second interval between the impulses.
Short stroke lengths: The same instructions as for grease lubrication apply to short stroke lengths.

Table 3: Oil lubrication

Size HG/EG	Initial (x3) and relubrication [cm^3]
20	0,5
25	0,8
30	1,0
35	1,5

For other types of linear guideways, refer to the separate appendix.