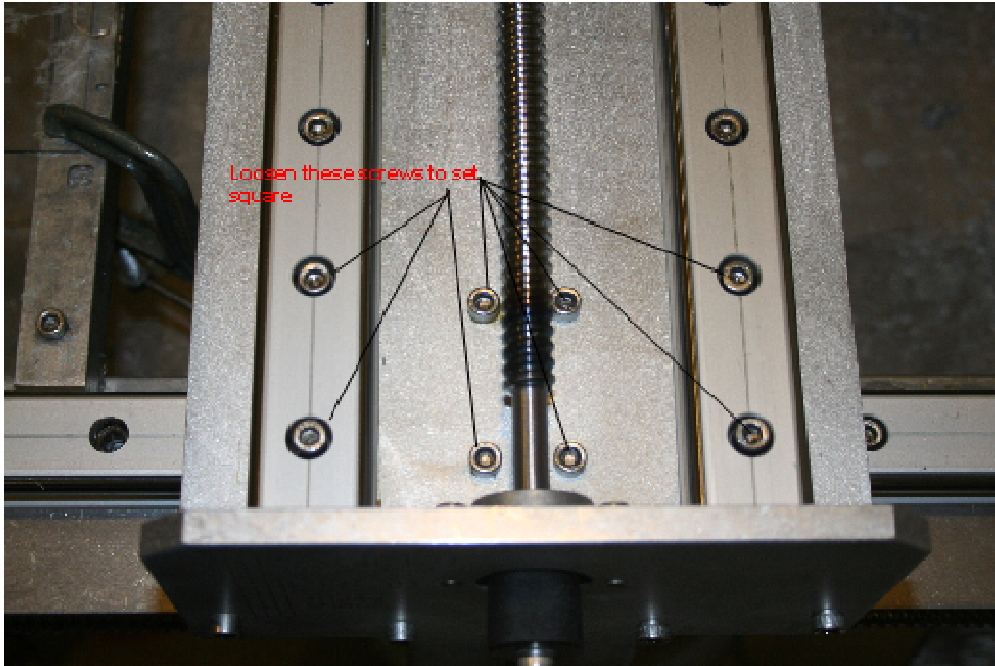


X AXIS LINEAR BEARING CHANGE



The X axis linear bearings consist of 4 pairs of bearings on an aluminum extrusion. The assembly is called a carriage. There are 2 right carriages and 2 left carriages.

The bearings may be replaced as complete carriages or just the bearings on the carriage. They must be adjusted in either case, and the bearing only replacement is less expensive.

Please read this entire procedure before starting. If you have questions please call.

Shown above are the 2 carriages on the near side of the Y axis. To change out the bearings, you will loosen the 8 screws on the near side and the same 8 screws on the far side (near the stepper motor). You will remove one carriage at a time so that the Y and Z axis is still supported.

To remove a carriage, remove the 4 6mm socket head screws that attach that carriage. Slide the carriage out the left or right side. Note the screw lengths and washer locations. If a screw is used that is too long, it will not tighten. If a screw is used that is too short, it may strip out the threads.

The bearings are adjusted for zero backlash and should never be removed or installed on the bearing rail without loosening the bearing attach screws shown below. The bearing balls are lightly retained by a plastic carrier and will pop out if installed or removed under pressure. They can be popped back in place, but they are easy to lose. One or 2 missing balls is not an issue but do not tolerate more.



Remove the 4 screws noted as fixed and adjustable bearing attachment screws. These are low head screws, so make sure you clean out any debris or corrosion in the socket area. Use a sharp 5mm allen wrench, engage it fully and squarely. Remove both individual bearings of the bearing pair. Clean the aluminum carriage with scotch brite. Note that there is a lip on the fixed edge of the carriage block.

The normal failure mode is that cutting debris sticks onto a bearing rail which gets tracked into the bearing

return track and eventually binds up and blows out the plastic bearing retainers. If the ends of the bearings are intact and the balls are all present, it is frequently possible to rehabilitate a bearing by generous application of wd40 and rotating the bearings around with finger pressure until clean. If there is significant corrosion, it should be replaced.

There are 2 bearings (1 pair) on a carriage. It is very important that the machined side of the bearing is mated to the carriage. The picture above shows the machined side on the left, and the rougher inaccurate side on the right.

The fixed side can be firmly pressed against the reference lip of the carriage and the screws tightened. Maintain firm finger pressure on the bearing so it bears against the reference lip while tightening the screws. Back out the adjustment screws a couple turns. Make sure the washers on the adjustment screws are fully against the screw head so they don't get pinched between the top edge of the bearing. This will cause a serious alignment issue.

Place the carriage on the rail with just the fixed bearing in place and place the adjustable bearing in place. Install the adjustable bearing with its screws just barely snug.

The linear bearings in the x, y, and z axis must have zero backlash, but over tightening will flat spot the bearings, ruining them.

Shown is the left hand x axis bearing carriage consisting of a fixed bearing, an adjustable bearing, the bearing attachment screws, the adjusting screws and the carriage block. The fixed bearing is referenced against a machined lip. The adjustable bearing sets the preload for the assembly.

Before installing a bearing on a shaft, place a liberal amount of 30 weight oil on the bearings and work it into the tracks by rolling the balls along the tracks with your fingers.

The bearings must be adjusted individually with the shaft that they will be running on before attaching to any other assemblies.

Instructions for x, y and z axis are similar. Remove the z assembly to adjust the y axis bearings. Remove the y axis assembly to adjust the x axis bearings, or loosen the screws and take out one x axis bearing carriage at a time. Do not take the bearings out of one side and leave the Y assembly hanging, putting a lot of pressure on the opposite end bearings.

To adjust each bearing:

Loosen the 4 bearing attachment screws. Back off the 2 adjustment screws $\frac{1}{2}$ to 1 turn.

Carefully place the carriage assembly on the rail it will be running on. Be careful not to back off the adjustable bearing attachment screws so much that the washer on the adjusting screw gets caught between the bearing body and the mount.

With finger pressure, make sure the fixed bearing is against its reference edge. Torque the fixed bearing attachment screws to 50 inch pounds.

Turn the adjustable bearing attachment screws in till barely snug.

As you start adjusting, there will be a noticeable play as you wiggle the carriage. The object is to eliminate all free play and have a moderate preload. Verify the washers on the adjustment screws are free to move and not pinched between the bearing and carriage.

When this procedure is complete, you should have a slight drag when moving the bearing. When moving the bearing back and forth, it should feel smooth and not notchy, although it is normal to have a small variation in drag as you move across the rail.

Gently turn adjusting screws in evenly until a slight increase in rolling force can be felt in the bearing. Tighten the adjustable bearing attachment screws. If you have a heavy or rough rolling force when the mount screws were tightened, back off the adjustment and adjustable bearing attachment screws and repeat the procedure.

As you adjust the 2 adjustment screws, move each adjusting screw only a fraction of a turn while moving the carriage back and forth. If you feel a notchy or rough feel, adjust the opposite adjuster until the feel is smooth. If it does not improve or gets worse, back off the adjusting screws and repeat from the start.

If the 2 bearings are not perfectly parallel, it will feel rough while moving left and right.

When adjustment is complete, torque the adjustable bearing attachment screws to 50 inch pounds. Move the bearing left and right as you tighten the screw and note any change on the tightness of the carriage to rail. If increasing bearing tightness is observed, stop and redo the adjustment procedure.

After the carriage bearings are adjusted, slide the carriage back into place under the Y axis base plate and loosely install the carriage attach screws. The screw holes are fairly tight. If the rest of 16 screws are tight, it may make it difficult to properly start the screws.

Repeat this procedure on each carriage.

After having the X axis bearings loosened or removed, it will be necessary to adjust the X axis to Y axis square.

The easiest field method is to make a test cut and adjust. Use the most accurate square you can find. To adjust, the 8 screws that attach the Y axis assembly to the bearing carriages must be loosened on the operator and the motor end. Make the adjustment as required and retighten.

Maintenance:

Bearings typically fail because of maintenance, usually a combination of debris jamming the balls, and corrosion.

Before cutting, wipe down the bearing rails with a rag or paper towel.

The bearing rails are particularly susceptible to corrosion. To prevent bearing rail and bearing corrosion, a good mixture of formula 78 water soluble coolant must be used. Never use straight water.

When done cutting, wipe the bearing rail to remove cutting debris.

Spray a generous amount of wd40 through the straw on the wd40 can between the carriage extrusion and top of the bearing rail. Spray left and right so the spray gets on each bearing. Jog the x axis left and right about a foot to transfer the oil throughout the bearings. Note that some debris may be transferred from the bearings onto the rails. Wipe the rails again and then spray the rails with LPS2. LPS2 leaves a waxy film on the bearing rails that will inhibit corrosion. This however needs to be wiped off before cutting again because cutting debris will stick to it, transferring it to the bearings.

You can limit the debris transferred to the bearing rails by placing a 2" angle on the material mount bars. This can be ordinary 2 x 2 x 1/16 hardware store aluminum angle. It may simply be laid loose on the material mount rails or clamped to them. This shields that rails from the spray.