

What is Backlash?

Backlash in the machine tool world is defined as lost motion. Lost motion from mechanical problems in the CNC machine tool generally comes from worn or bad "thrust" bearings located in the bearing block which the servo motor is mounted to...or a bad ballscrew which is less common. Generally speaking, you can tell they are going bad when the axis in question howls when running in rapid, and growls in a high feed rate. The axis movement should be relatively quiet, and when you begin to hear a howling sound when one or more axes is in rapid, your bearings or ballscrew is failing...thus first rearing its ugly head as backlash.

If you notice steps when interpolating a circle or arc in the 3, 6, 9 & 12 o'clock quadrants, this is due to backlash or mechanical lost motion when the respective axis is changing directions. Time to make some adjustments!

What to do before adjusting backlash?

The first question you should ask yourself before making an adjustment to your backlash values, is why? Why did it change and where is it coming from. There are 5 major contributors:

- 1) Bad thrust bearings in the bearing block.
DIAGNOSIS: Put an indicator on the opposite side of the ballscrew. Zero. By hand, slightly rotate screw about 180 degrees cw then ccw and note movement on indicator. If you see more than about .0004" you have bad thrust bearings. Replace. If your machine is a VMC 5020 or smaller, use BRG-0024-SET for replacement bearings. If your machine is a 6030 or larger but not a 6535, use BRG-0025-SET. All bearings are in stock at FadalCNC.com. If you have a 6535, use BRG-0156.
- 2) Bad ballscrew in the axis.
DIAGNOSIS: Put an indicator on the opposite side of the ballscrew. Zero. By hand, slightly rotate screw about 180 degrees cw then ccw and note movement on indicator. If you have little to no movement on the indicator but have excessive lost motion in this axis, replace the ballscrew but not before you have properly adjusted gibs and straps. FadalCNC.com carries all ballscrews for all years of machines.
- 3) Loose gib & strap assemblies.
DIAGNOSIS: Properly adjust the gibs and straps and perform check #2 again to be certain you have a bad screw.
- 4) Loose or worn motor coupler.
DIAGNOSIS: Remove what is needed to expose the motor coupler. How you expose the motor coupler and bearing block will differ depending on both the axis in question, model and age of machine. Regardless, get to a position where you can visually check the coupler. With the servo motor on and holding position, and an indicator somewhere zeroed on the table that you can see. Try moving the ballscrew by hand by rotating it with



light force cw and ccw. If your indicator moves more than a couple of tenths, replace your coupler.

5) Lost lubrication.

DIAGNOSIS: Expose the ways and ballscrew of the axis in question and make sure you are getting adequate lubrication on both the ballscrew and ways. If either is dry, you will get excessive backlash from friction of movement, otherwise known as "stiction." Resolve the lubrication problem and once the lube is worked in good, check for lost motion again.

Adjusting Backlash

Now that you have found the source of your lost motion and replaced the bad components, it's time to make a proper backlash adjustment. I suggest you adjust all 3 axes while you are at it rather than only adjusting one axis. DO NOT USE THE HANDWHEEL, as per the procedure in the document below, write a program for checking the backlash and preferably at the same feed rate as the feed rate you are using in your existing program is the tolerance is critical.

For more information on the Backlash Adjustment Procedure, download the tech tip.