Maintaining Your ShopBot Mechanicals: A Trouble Shooting Perspective

ShopBot

We make the tools for making the future.

How you know it's really time to do a little ShopBot maintenance

- Circles are not round
- Square/rectangular parts cut correctly on 3 sides, but the 4th side is wonky
- Parts don't cut all the way through, even though the correct Z depth was set in the cutting file
- The Z axis does not seem to be holding position, or was properly zeroed before the cut, but not after the cut
- The bits are breaking, even when machining at feeds and speeds and pass depths that are reasonable
- Inconsistent moves in the Z axis: Uneven step down or slop/ slanted step down
- ShopBot does not seem to be "square"

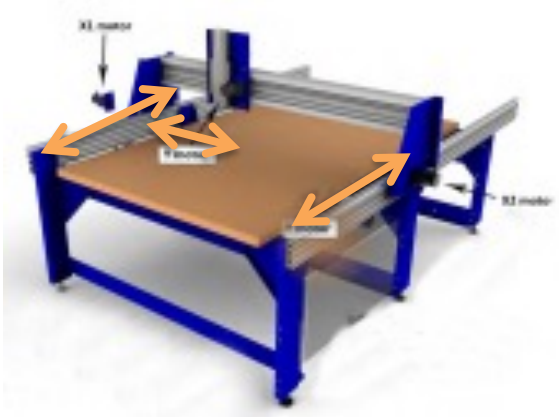
Circles are Not Round

"Rack and Pinion" Tools

Are the Pinion Gears Engaged in the Rack?
Are the Set Screws Tight on the Motor Shaft?
Are the Pinion Gears Worn?

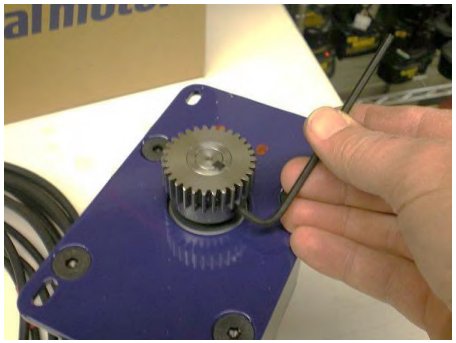
With the Control Box on and the Drivers reset, stand by each motor and try to move the gantry (X Motors) or YZ-Car (Y motor) side to side.

If there is play or side-to-side motion, take the following steps:



Circles are Not Round

"Rack and Pinion" Tools

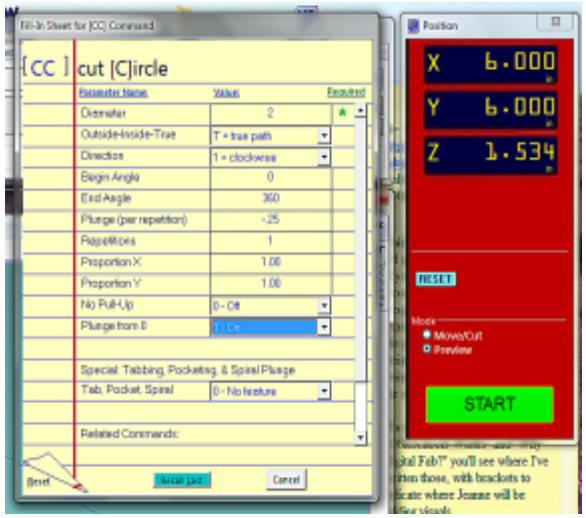


To Do:

- Drop Motors out of rack and reset into rack (every month)
- Tighten set screws on Motor Shaft (as needed)
- Replace Pinion Gears (6 months to 1 year)

Circles are Not Round

All Tools



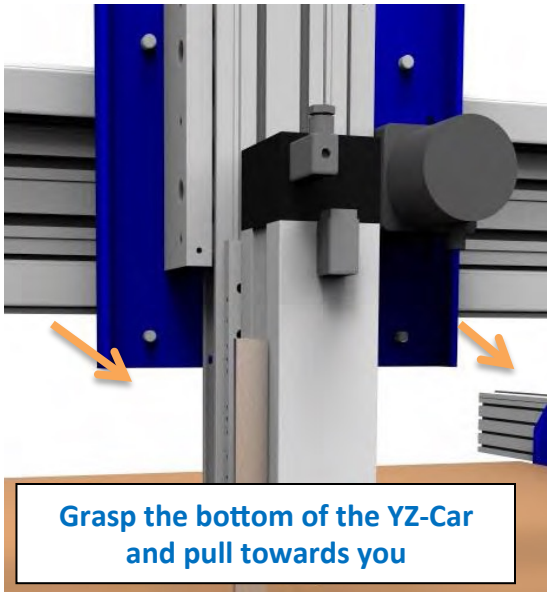
Is it the CAD file?

Use the **C**ut **C**ircle Command in the ShopBot Control Software

If the circle is round using the CC command, perhaps the problem lies in the CAD file

Squares/Rectangular Parts cut correctly on 3 sides, but the 4th side is wonky

"Rack and Pinion" Tools (Buddy and Gantry)



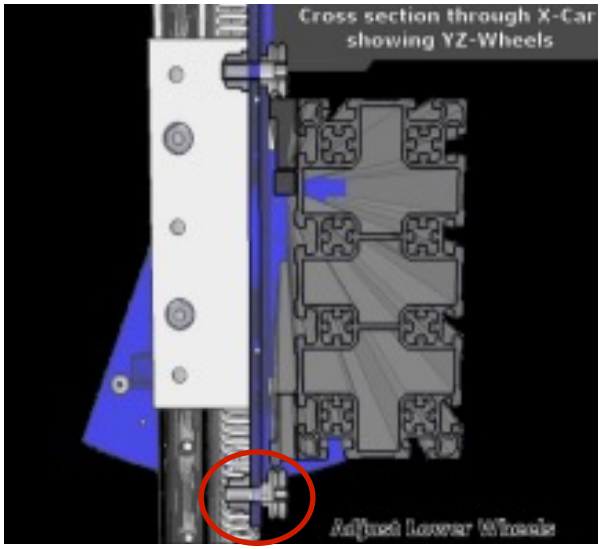
Are the bottom rollers on the YZ-Car engaged correctly with the rail on the Y cross beam?

Grasp the bottom corners of the YZ-Car and pull towards you.

There should be no movement of the YZ-Car away from the cross beam.

Squares/Rectangular Parts cut correctly on 3 sides, but the 4th side is wonky

"Rack and Pinion" Tools



http://www.shopbottools.com/ShopBotDocs/gantry.htm > PRS Gantry Maintenance > Adjusting the Lower Wheels on the YZ-Car

If there is movement away from the Cross Beam:

Refer to document **Adjusting the Lower Wheels on the YZ-Car** found on the ShopBot website for instructions on how to adjust the rollers on the rail.

Hint: Drop the pinion gear out of the rack before adjusting the lower wheels to avoid getting them too tight. YZ-Car should roll freely along beam while still capturing the lower rail. If the wheels are too tight, it can cause the YZ-Car to bind.

Parts not cutting all the way through even when Z set correctly in CAD

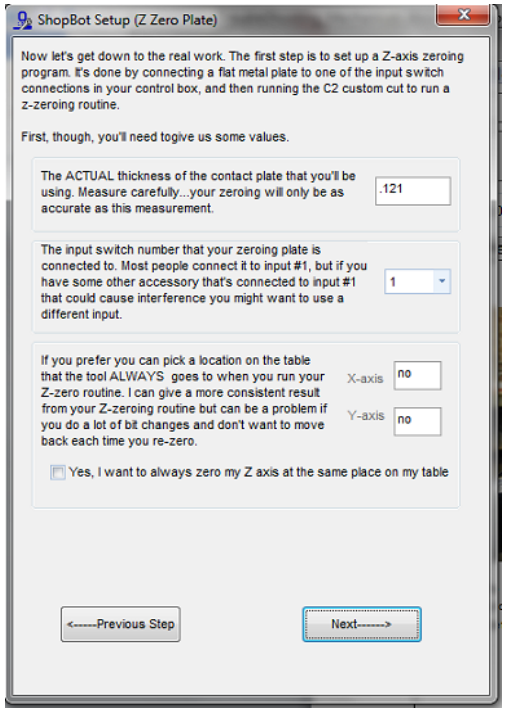
All Tools

Is the Z-Zero Plate the thickness defined in the Z-Zeroing Routine?

After running the Z-Zero routine, use the MZ, 0 command to see if the bit is really at Zero.

Parts not cutting all the way through even when Z set correctly in CAD

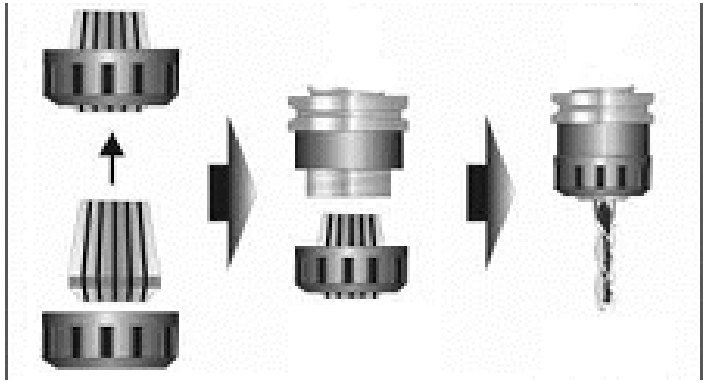
All Tools



Measure the actual thickness of the Z-Zero plate with calipers.

If needed, use **T**ools **S**etup in the ShopBot Control Software to re-define the thickness of the Z-Zero Plate

The Z axis does not seem to be holding position. OR, it WAS zeroed when I started, but not after I make a cut.



Check the collet

Is it clean?
Is it the correct size for the bit?
Is it in good shape?
Is the collet inserted correctly in the collet nut (spindles)?
Is the bit tightened correctly in the collet/nut assembly?
Has there been an event which would damage the collet, like a drop on the floor or a bad bit break?

The Bits are breaking, even when I am machining at feeds and speeds and pass depths that are reasonable

(AKA: the Importance of Using Good Collets)

The Working Life of a Collet is 400 – 700 Hours

If something traumatic has happened, the working life is much shorter!!!!

THROW BAD COLLETS AWAY…they do not spontaneously regenerate

Collet types

www.techniksusa.com

MSC

Porter Cable

Collet Nut

Desktop Spindle ER 20

2.2 or 4HP Spindle ER 25

ATC Spindle ER 32

Feeds and Speeds and Pass Depths

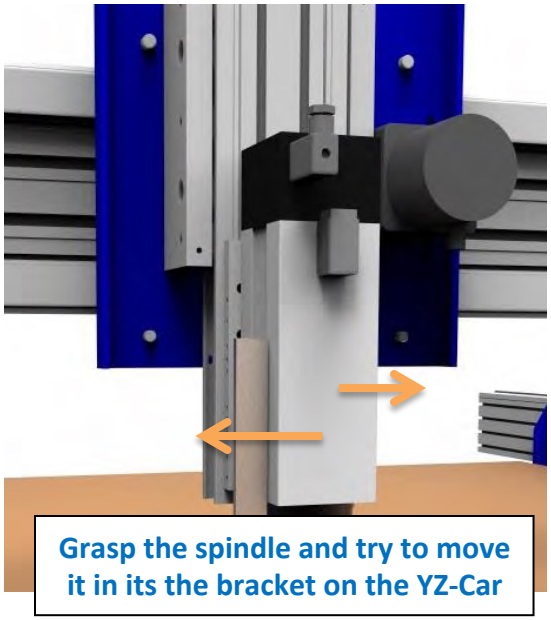
Chip Load Calculator in ShopBot Control Software: **T**ools Chip **L**oad Calculator
(Hint: I use a value in the middle of the range, like .01)

Bit should be cool or comfortable to touch at end of cut
(Hint: If getting melt back in plastic or aluminum, slow down the RPMs. I use 12000 for wood, 10 – 11k for plastic or aluminum)

Never cut deeper than 1.5x diameter of bit (wood)

Inconsistent moves in the Z axis:

Uneven Step Down or
Slop/Slanted Step Down

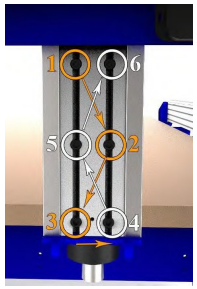


Grasp the spindle and try to move it in its the bracket on the YZ-Car

Is the spindle/router attached firmly to its bracket?

Test by attempting to move the spindle/router in its bracket…it should not move separately from the YZ-Car.

Refer to assembly manual for how to tighten the spindle in the bracket.



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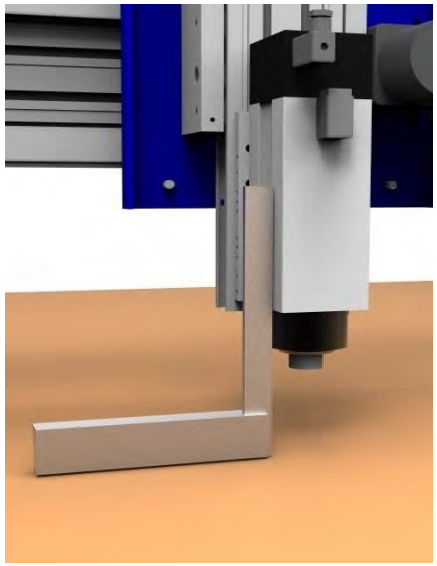


Is the spindle/router square to the table?

You may have to surface a portion of the table to get a flat surface before you put a square on the spindle to test.

Look at the machining marks left by the surfacing bit. If there are definite ridges on one side, the Z is not square to the table.

Inconsistent moves in the Z axis:

Uneven Step Down or Slop/Slanted Step Down

www.shopbottools.com
ShopBot Docs > Gantry> PRS Maintenance > Adjust PRS Z Car Bearings

Rarely: do the Z-Car bearings need to be adjusted (R&P tools)?

Bearings are too loose if:

Top and/or lower bearings spin freely and are not in contact with inner part of the captured rail.
There are lateral inconsistencies in Z-axis, commonly called “slop”.

Bearings are too tight if:

Z-axis loses steps/position, binds or even stops abruptly.
There is premature wear to the inner part of the captured rail.

Parts do not seem to be “Square”

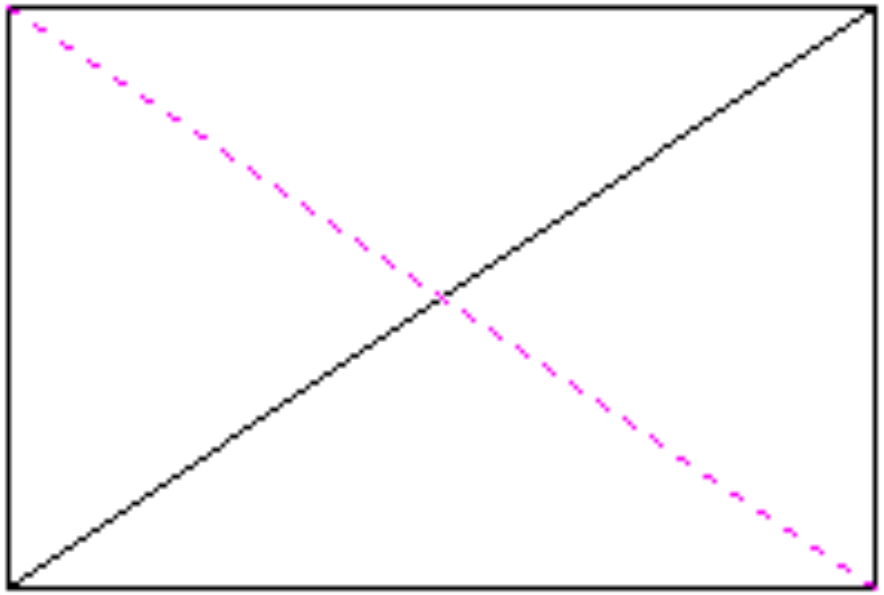
Create as large a rectangle as you can, then measure the diagonals

Cut out a large rectangle

Use a V-bit to inscribe a shallow rectangle on table surface

Drill 4 holes at the corners of a large square or rectangle

In all cases, <u>if the diagonals are equal, your tool is cutting square</u>.



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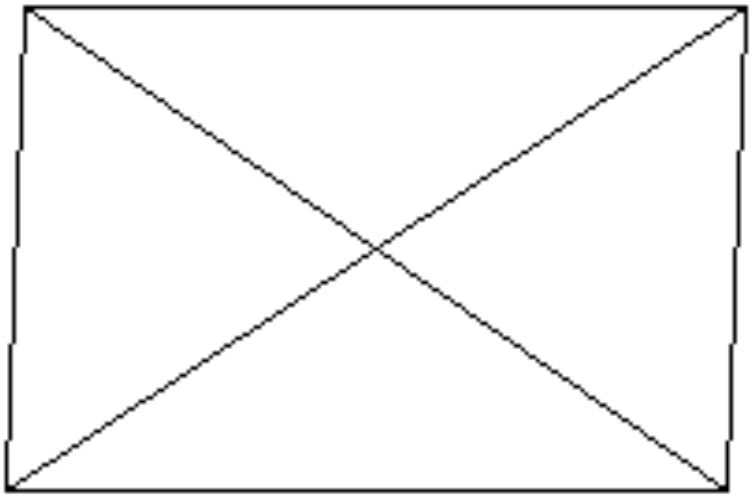


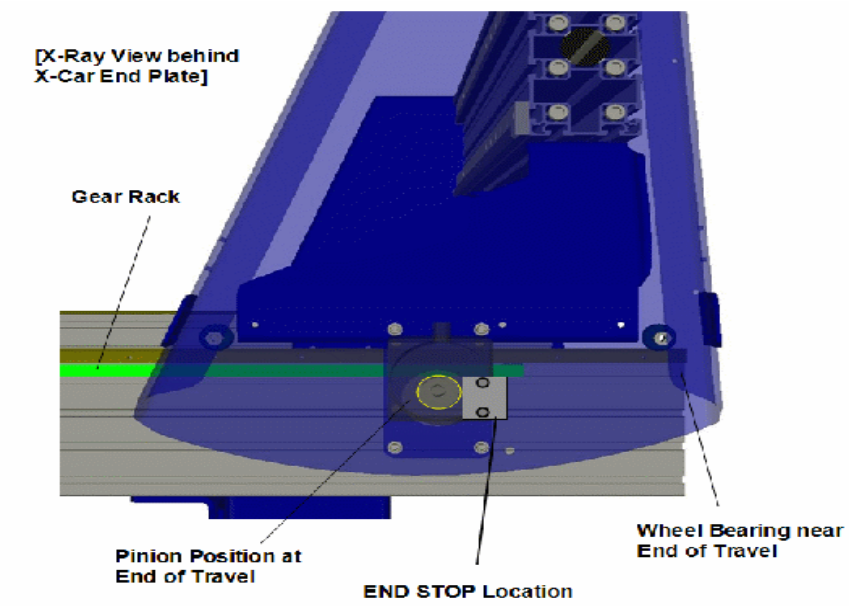
If the diagonals are not equal,

the problem can be as easy as pulling the gantry into square using your end stops before you turn on the Control Box

or as fundamental as making adjustments to your gantry or table.

See http://shopbottools.com/ShopBotDocs/gantry.htm> PRS Maintenance > Squaring the PRS Gantry and Table for further information on the following slides.

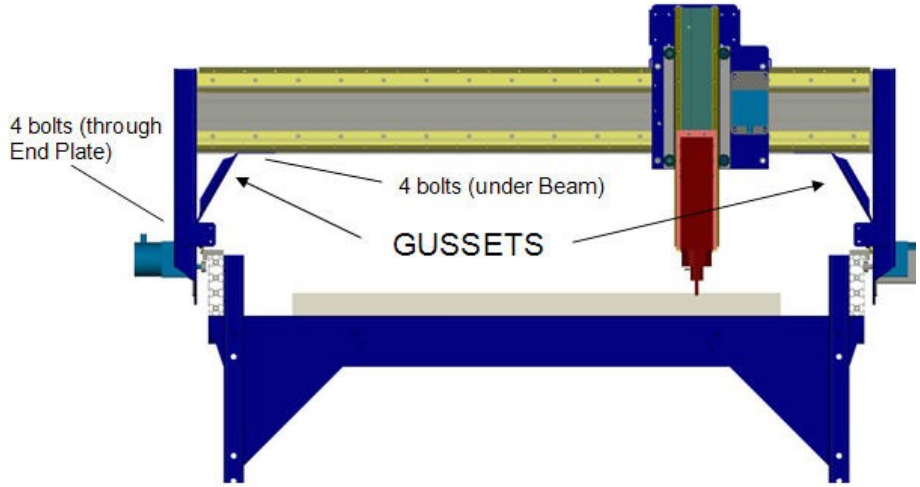
Parts do not seem to be “Square”



When the End Stops are Squared to each other, you can use them to pull the gantry into square before you engage the motors/drivers.

The motors will hold the gantry into square as long as they are engaged.

Parts do not seem to be “Square”

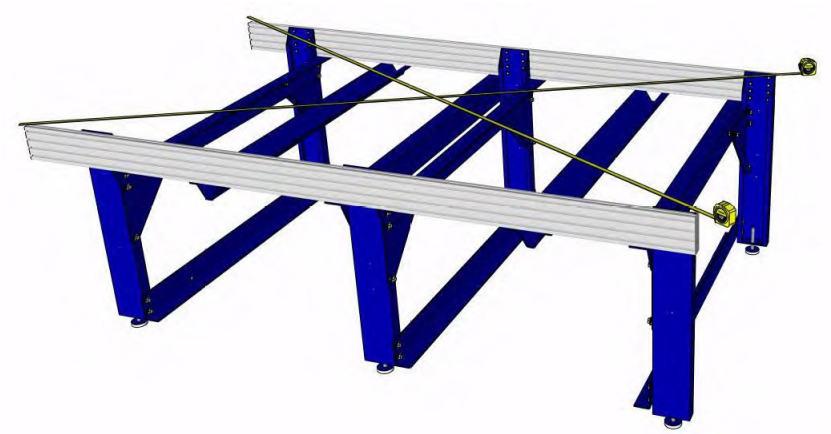


Does the Gantry itself seem to be out of square?

Try dropping the pinion gears out of the rack and rolling the gantry along the rails…do all the wheels roll smoothly all along the rail? Do both sides of the gantry sit at the same location near the end of the rails?

Adjust gantry as needed. Be sure you really need to do this with PRS tools.
Refer to the original assembly manual to square up the gantry of PRT and PR tools.

Parts do not seem to be “Square”



Is the Table Square?

The time to square the table is while assembling/reassembling the tool and before the support board is bolted down.

If the table is already assembled, make sure the rails are parallel and adjust the end stops to be able to pull the gantry square.