Tramming A Bridgeport Mill

Tom Davis April 19, 2007

Tramming a Bridgeport mill is a key factor to achieving the precision possible when using this type of machine.

The order of the steps in this procedure is critical to achieving the proper alignment of the total machine. They build on each other to remove sources of variability to make the final adjustments easier.

Comments on placement and mounting of the Bridgeport

There are those that rely on the mass and rigidity of the Bridgeport machine to make leveling a non-issue. This is a discussion beyond the scope of this article. I will assume the leveling and mounting of the machine is complete.

The Bridgeport manuals advise attaching the machine to the floor. For the home shop applications I make, this is not a critical need. In a production setting, or in applications of heavy use, this would likely be the correct approach.

In my home shop application, I am utilizing the as built cement floor of my garage. It is the standard strength, thickness, and flatness of normal tract home construction. It has slope built into it to allow the builder to decide on an enclosed garage or open carport. As I went to mount my machine, I found there is ½ inch of slope in the floor over the length of the base of my machine.

Therefore I have elected to use some surplus machine leveling and vibration isolating machine feet to mount my machine. I chose to use ½" X 6" flat steel plate to mount the leveling feet. The diameter and length of the stems of these feet dictated they be placed immediately outboard of the machine base. The pictures below shows the mount system I used. Some guidelines to follow in the home shop for machine placement are:

1. Do not place the machine in a position that will straddle joints in the cement floor
2. Remember the dividing grooves made in the floor when it was poured are there to control the tendency to crack inherent in concrete slabs. These grooves are the most likely points for the slab to break. Sections of the slab can tend to shift over time making these grooves the boundaries of the shifting sections.
3. If your floor slab has other cracks, try to avoid placing the machine over a crack.
4. Some cement slabs in newer home construction in my local area have pre-stressed reinforcing built into them. I have seen garage floors with the note cast into the cement warning not to drill or cut the floor to avoid cutting these reinforcing members.

In my garage, I also have my air compressor located very near my mill. This or any other source of vibration that could be induced into the floor makes the use of vibration isolating feet a plus.

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Front Mount Detail

The stem of the mounting foot is too large to fit through the pre-drilled hole in the machine base. It is also too short to reach through to the top.

Note the ½" X 6" steel plate extends approx ½" out from the front of the machine base. My logic in this placement is:

1. Cast into the base of my machine are "footpads" that are approx ½" wide and extend around the perimeter of the corner of the machine base approx 6" in each direction. I wanted the steel plate to contact this "footpad" in both directions.
2. I wanted the steel plate to extend across one side of the machine to avoid possible tipping. The placement of the center of the leveling foot at the edge of the machine will tend to introduce a tip to a plate that covers only the bearing surface of one footpad.
3. Note in this front of the machine position I have used a double section of the steel plate. This corrects for the angle cast into my garage floor.
4. The ½" thick steel plate is an arbitrary choice based on my assumption it is strong enough to support the machine with minimal deflection. It sure seems to be working.

A detail of the right front corner leveling foot is shown below. Note the top piece of steel plate does not extend beyond the centerline of the leveling foot stem. This is the result of a design change in the middle of the project.

I had originally planned to re-drill the holes in the machine base to accommodate the stem size of the leveling foot. 3 issues changed my mind.

1. The stem would not be long enough to reach through the machine base.
2. The adjustment length possible with the feet I have is approximately ¾". I did not want to use ½" of this travel just to correct for the slope of the floor.
3. The relief cut around the stem allowed for access to the adjustment stop nut.

Detail of the Right Front Leveling Foot

The detail of a rear leveling foot is shown below. Note there is only one thickness of the ½" X 6" steel plate at the back.

Also note I have mixed hot rolled and cold rolled steel plate in this application. This is because of the home shop mentality of using what's available at least cost.

I have considered through bolts to hold the steel plates to the machine base in the mounting holes provided. That's a hindsight improvement I may do later. I wanted to be done with lifting & moving this machine for a while.

Rear Mount Foot Detail

Note the corners and edges of the steel plate have been rounded. Remember in this method of mounting a machine, these little protrusions can become trip hazards.

The footpads I used were bought on Ebay. They are similar to Sunnex part number OSM-3. Go to Sunnex.com or http://66.112.160.123/mounts/M-series.htm. These mounts are rated for 4000 pounds per mount.. The picture of the mounts I used is below

If you want to check my source for used footpads like these, search Ebay for seller id boyzshop. There were 2 similar listings on Ebay at this writing that end in the next 3 days (by April 22, 2007).

Comments on The Tramming Steps

All the directions in the procedure are written as if you are standing in front of the machine. References to "Right Center" means to the right of Indicator travel at the center of the machine table front to back. Reference to "Front Center" means to the center of indicator travel at the front of the machine table.

A key concept to always keep in mind is the pivot point around which any adjustment movement is made.

1 .If you are making a change around the center point of the deflection measured, make that change equal to ½ of the measured deflection.
2. If you are making the adjustment around a pivot point and at the end of the travel measuring deflection, make the change equal to the deflection measured.
3. If you are making an adjustment around a pivot point distant from the location of the measurement it will take trial & error to see how much change to make.

When loosening the locking nuts or bolts to adjust any portion of the machine, I have used the term "finger tight". It is best to have these fasteners snug and make the fine adjustments by bumping the machine section with the dead blow hammer. This also minimizes the possibility of shifting when the locking fasteners are tightened when the correction has been made.

There are 2 worm-gear adjusting points in the Bridgeport head. When tramming the section of the machine, it is best to have the play in these adjusting screws at the center of the play. This avoids binding as the fine movements are made.

When tramming the X and Y directions of the machine head, the Hi-Neutral-Lo switch on the head must be in neutral. When tramming the ram or the vise, the switch should be in either hi or lo position.

When you use a vise with a swivel base, align the reference marks on the vise and base to zero. Lock the vise to the base. Loosen the mounting bolts on the swivel base and make vise tramming adjustments to this assembly. Then the degree marks in the base are more accurate when moving the vise relative to the swivel base.

When the machine is fully trammed in, it's a good idea to make your own zero position marks on the machine to permit rapid acquisition of the zero position again the next time you are returning the machine from a special setup. The method suggested is to use a sharp punch and make a mark that straddles the mating surfaces at the graduation point.

Have a wonderful time adjusting your machine.