A Quick & Simple Angle Plate for Accurate Machining

It is often necessary to machine a specific angle accurately. Sine bars and plates have their place for such work, but are often unwieldy for small parts. A simple way to produce an angled cut in a small part is to make an angle plate that will guide its position in your mill vise. The practice of this technique is simple and requires a minimum investment of time and materials.

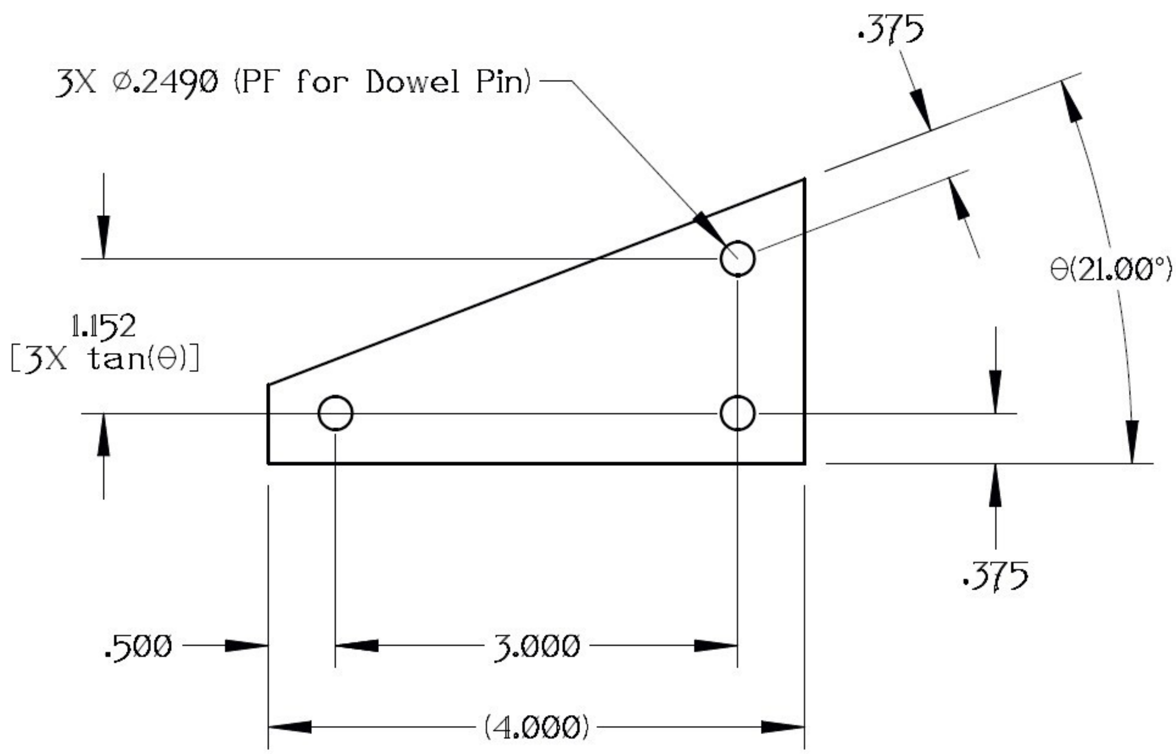

Figure 1: General Layout of a 21° Angle Plate.

The sketch above shows the general approach I use when I need an accurate angle plate. I often use $^3/_8$" X 4" aluminum bar stock. I keep sections of bar dressed to have parallel faces so I can make an angle plate. They generally run about .300" thick. I can cut off a length appropriate to the angle plate I wish to make, drill and ream the dowel pins holes quickly (thank God for DRO technology!), insert dowel pins into each pair of important holes at a time, mill the edges, and have a very accurate angle plate in about a quarter of an hour! Remember that your vise jaws are rarely parallel to the table of your mill. I use a parallel that is an $^1/_8$" taller than my jaws to rest the dowel pins on for milling. Steel stamp the angle on the plate and you can reuse it!

The question then arises what to do if you need to make several parts. The reason I use $^3/_8$" thick bar for my angle plates is that this thickness allows me to press in an $^1/_8$" dowel pin into the face of the bar to use as an index. This approach is shown below.

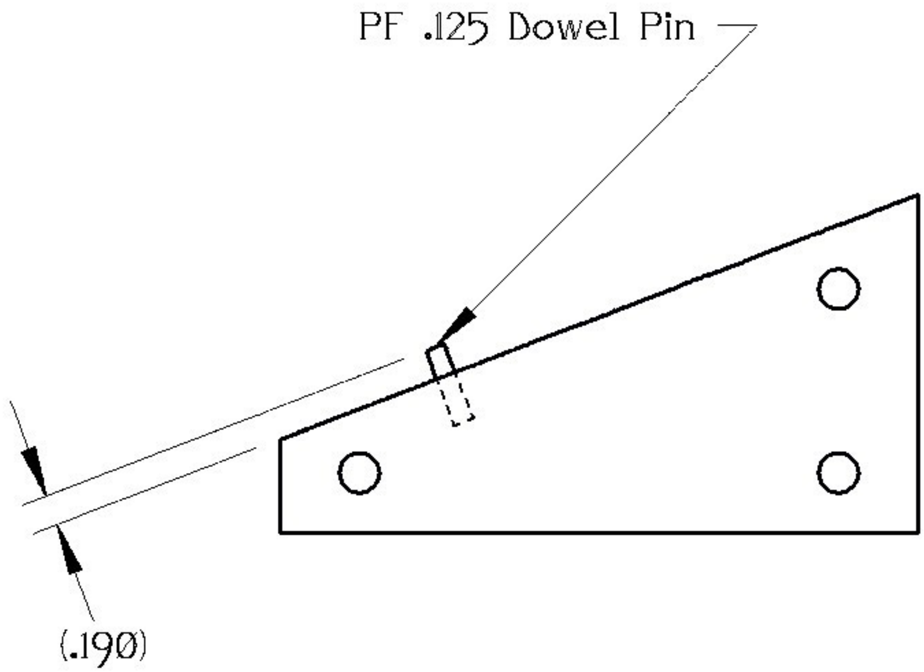

Figure 2: A Dowel Pin Index in an Angle Plate.

The .190" nominal protrusion of the dowel pin allows me to use a .250" dowel pin to set the height from the square corner. Once you trig out the projection of your surface, you can pick up the dowel pin and raise your spindle that distance.

It's simple, quick, easy, and accurate. Set the angle plate in your vise. Hold the part firmly to the plate as you close your vise. Mill your edge. Try it, you'll like it!

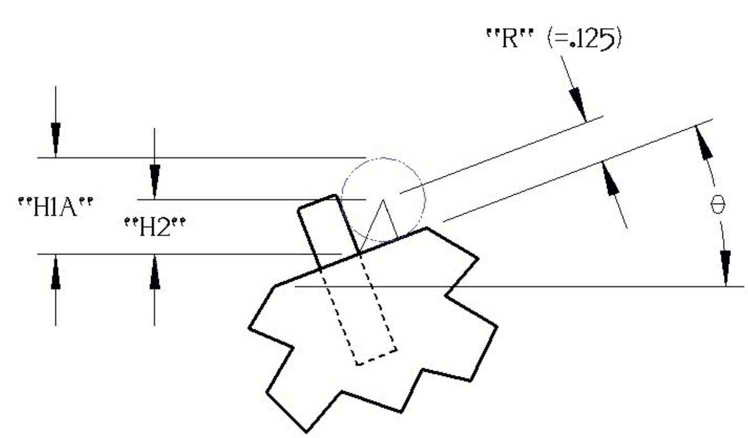

Figure 3: The Trigonometry of a Dowel Pin Height Index.

Figuring the height above a dowel pin in these instances is just basic trigonometry. We know the diameter and radius of the dowel pin we are using (ø.250, R.125 in this case). We know the angle to which we made our angle plate. The solution to Figure 3 is based on the radius of the dowel pin (R_d) and the effective radius from the corner of the angle plate and index pin to the center of the dowel pin (R_e)

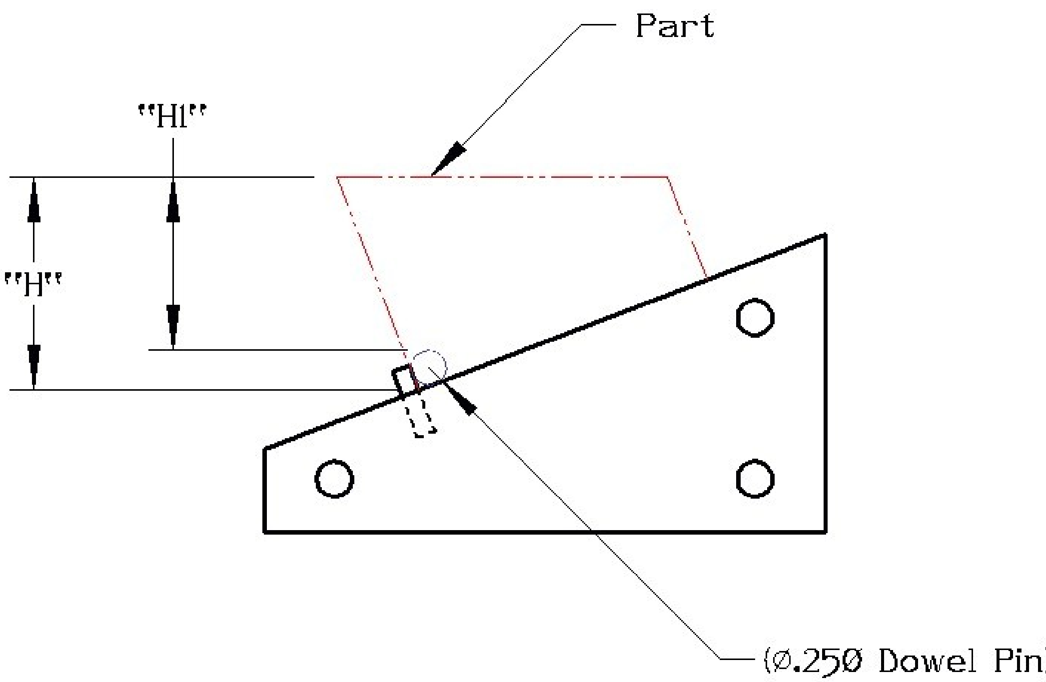

Figure 3: Offset Height for Angle Milling.

and is given by:

$$R_e = [2*R_d^2]^{0.5}.$$

$$H1A = R_e \sin(\Theta + 45°) + R_d.$$

$$H1 = H\text{-}H1A.$$

Which can be figured quickly on any calculator or spreadsheet (just remember that nearly all spreadsheets us radians rather than degrees for trigonometric functions). To get radians from degrees, multiply the angle by π/180. To convert radians back into degrees, multiply the angle by 180/π. 2π radians = 360°. For the case of our 21° angle block using a ø.250 dowel pin, R_d = .125, R_e = .1768, and H1A = .2865.