

HOW TO MARK EVENLY-SPACED MIRROR CELL MOUNTING HOLES



The following methodology assumes that you have already determined all of the necessary component spacings that are unique to your telescope project. These spacings include the distance from the primary's face to the secondary mirror, the distance from the focuser hole to the front of telescope tube, the necessary overall length of the telescope tube, etc. These variables will influence the value 'X' in Figure 1 and should be determined BEFORE you mark locations for the mirror cell mounting holes. Although a detailed discussion of how to determine these variables is beyond the scope of this manual, some general rules-of-thumb are offered below that apply only to preparing a telescope tube to receive the *Optical Supports* CMC.

Figure 1.

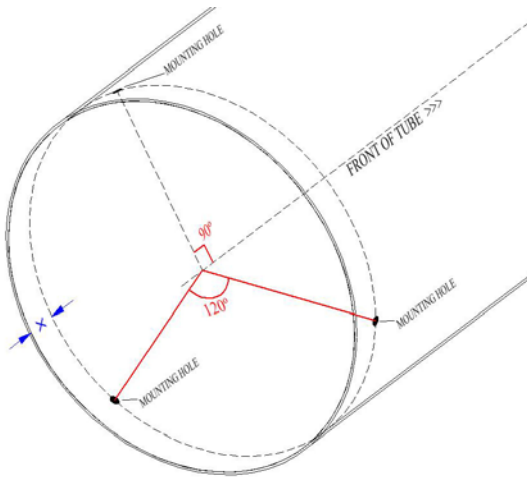


Figure 2.

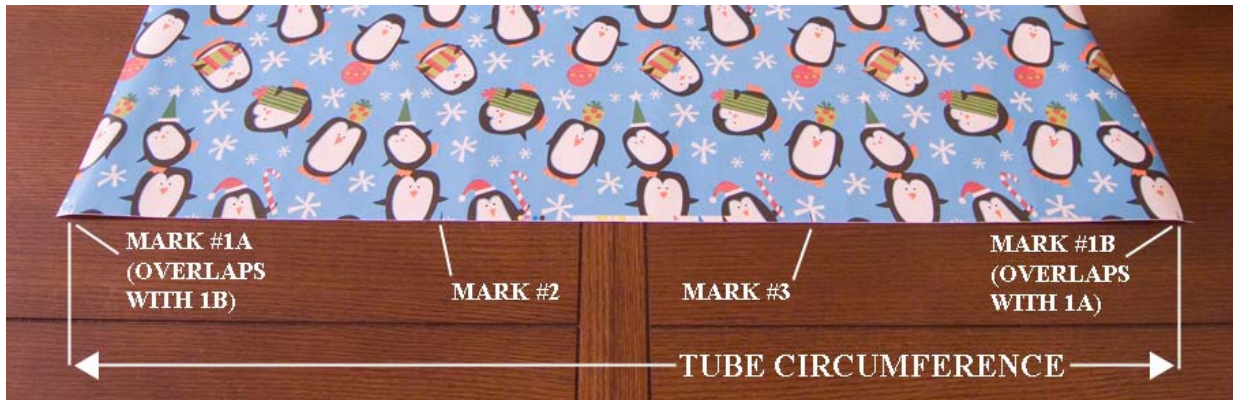


Marking precise locations for each mounting hole can be accomplished with a combination of inexpensive tools and readily available materials. In the following steps I have outlined a method that has been used with great success by many amateur telescope makers including myself. With that said, there exist several methods for doing this and *Optical Supports* does not claim to know the "best" method nor does *Optical Supports* assume any responsibility for mistakes that lead to a damaged telescope tube. Please follow these steps with care and at your own risk.

1. Based on the specifics and considerations of your telescope project, determine a value for 'X' (see Figures 1 & 2).
2. Place a ruler against the outside of your telescope tube and orient it more or less parallel with the tube's long axis (does not need to be perfectly parallel, but as close as possible).
3. Measure X units from the bottom end of your telescope tube and place a mark on the outside of the tube with a pencil. This mark denotes the starting and ending points for the line along which all three mounting holes will be centered.
4. Wrapping paper will be used as a scribing guide for the line mentioned in step #3. Wrapping paper works very well because it does not stretch, comes with perfectly straight edges, and is readily available in large sheets. Start by wrapping your telescope tube one full revolution in wrapping paper. Now overlap the starting edge by several inches and cut the paper from the roll.
5. Choose any spot along where the paper has overlapped onto itself and make two pen marks, one on each overlapping edge of paper (see Figure 2). It is helpful to allow the top-most section of paper to slide downward by a millimeter exposing the section beneath it, then simply mark them both with a single pen stroke.

- Remove the wrapping paper and flatten it out on a table. The distance between the two marks you made in step #5 is the circumference of your telescope tube (see Figure 3).

Figure 3.



- Measure the circumference as accurately as possible. I recommend you use a combination of a yardstick and a set of calipers to measure the circumference to two decimal places at least. Start with the yardstick to get within an inch of the second mark, then switch to the calipers for the remainder (see Figure 4). Record the circumference to at least two decimal places, then measure it again twice more. Take the average of your three measurements and record this as the circumference you will proceed with.

Figure 4.



- Divide the circumference you measured in step #7 by 3, again recording this value to at least two decimal places. Using a yardstick and calipers, measure this distance from one of the marks you placed in step #4 and mark the paper. Now measure again in the same direction starting with the new mark you just placed, and mark the second spot.
- Your paper should now have a total of four marks placed along the same edge (see Figure 3). Wrap it around your telescope tube and take extra care to ensure the following two things:
 - Check where the paper overlaps onto itself and make sure the edges are matched up. Matched edges ensure that the line scribed along them will be perpendicular to the tube's long axis.
 - Make sure the paper's edge runs through the mark you placed on the tube in step #2.
- The two marks you placed in step #8 are the locations of two mounting holes. The third mounting hole is located where the two overlapping marks you placed in step #5 come together.
- Mark each mounting hole with a tool of your choosing. If you are working with a metal tube I recommended applying handheld pressure with a metal punch. The resulting indentations are useful when drilling the holes.