

Berea Hardwoods Co., Inc.  
Pen Instructions

## Cambridge Hybrid Roller Ball and Fountain Pen (Berea #N7106AM/x-xxx-x)



Needed: Mandrel-B  
Bushing-16B  
Drills- 31/64", 33/64"  
Wood Size- 3/4" x 3/4"

### Preparing the Material Blanks

This is a very large diameter pen. Extreme care must be taken when drilling the blanks. Because the bits are very large there is a high probability that the blank will split if the bit is allowed to exit the material. For that reason we recommend that the blank length should be the length of the tube plus 3/4". This will allow you to drill the hole in the blank without piercing through the bottom of the blank with the drill bit thus preventing the blowout or splitting of the blank. Some pen makers will drill both blanks with the 31/64" bit and then enlarge the hole in the short blank with the 33/64" bit.

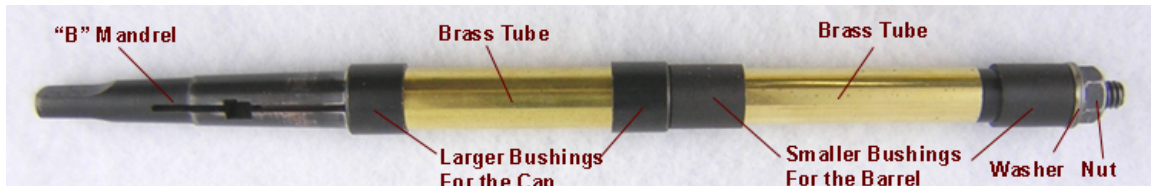
1. Mark each blank the length of each tube plus 3/4". Mark the place on the outside of the blank where the tube end will be when completed.
2. Drill the short blank with the 33/64" bit. Place the blank in your centering vise or other holder. Move the vise to a position where it is possible to lower the bit in front of the blank.
3. Place the bit in the drill press and lower it until the end of the bevel on the bit is just below the mark made in step 1.
4. Mark this position so that you can return to it easily and exactly. A drill press stop is perfect for this operation.
5. Retract the drill bit.
6. Move the blank until it is perfectly centered under the bit. Marking an X from corner to corner on the end of the blank will establish its center.
7. Drill the hole slowly and deliberately to the depth stop.
8. Remove the blank and trim it off a little longer than the line marked in step 1.

9. Drill the long blank with the 31/64" bit. Place the blank in your centering vise or other holder. Move the vise to a position where it is possible to lower the bit in front of the blank.
10. Place the bit in the drill press and lower it until the bevel on the bit is just below the mark made in step 1.
11. Mark this position so that you can return to it easily and exactly. A drill press stop is perfect for this operation.
12. Retract the drill bit.
13. Move the blank until it is perfectly centered under the bit.
14. Drill the hole slowly and deliberately to the depth stop.
15. Remove the blank and trim off a little longer than the line marked in step 1.
16. Polish the brass tubes with sandpaper. This can be done by hand or on a power machine such as a belt sander. The purpose of the sanding is to clean off the oxidation and roughen the tube so that the glue will have a better adhesion surface.
17. Plug the ends of the tubes with the material of your choice. Some use base wax or Play Dough or even a slice of potato. Just push the ends of the tubes into a thin section of the material. This will form a plug to keep the glue from getting into the tube.
18. Clean the tube, after plugging, with acetone or alcohol on a rag.
19. Prepare your glue. We recommend two part epoxy glue that is available in all hardware stores. Use a fast drying type, one hour or less. Be sure to mix it thoroughly. (A Post-it Note Pad makes an excellent mixing place. When you are finished just tear it off and throw it away.) Polyurethanes and thick flexible CA's can be used, but they each have their drawbacks.
20. Place some of the epoxy into the blank using a small piece of dowel or other small stick.
21. Roll the appropriate tube in the epoxy.
22. Insert the tube with a twisting motion until it is almost in the material blank. Then use the dowel to push it until the end is flush with the blank. Use the stick to rake off the excess glue even with the blank and the tube.
23. Push the brass tube through the blank until the other end is flush with the blank. Then rake the glue flush with that end. Now push the tube back into the blank until the tube is equidistant between both ends of the blank.
24. Move it aside for 60 minutes until the epoxy has had time to reach its maximum strength.
25. If you are using CA glue, the wait is much shorter. When using polyurethane the wait will be about 24 hours.
26. When the glue has cured use a hobby knife to remove the plugs from the ends. It is also a good idea to clean the tubes with a brass gun cleaning brush to remove any glue that may have gotten into the tubes.
27. Not cleaning out all glue from the tubes is the most common cause of pen failure. **BE CERTAIN** that all dried glue is removed from inside the tubes before proceeding.
28. Using a barrel trimmer of the proper size, face off the ends of the blanks until you can just see the bright brass end of the tube. **STOP** facing at this point. Your pen's proper operation is dependent on having the proper length tubes. This facing operation can also be done with the proper jig and a disk or belt sander.
29. Not having the proper tube length is the #2 cause of pen failure. Sanding, on a disk sander, using a jig to hold the tube square with the disk, is a more sure way

of getting the proper length. It should be tried if you have any doubt as to your abilities to square the material with the barrel trimmer.

- Another good method of squaring the ends of the blank is to turn the blank until it is just round. Using a miter gauge to maintain the blank perpendicular to the sanding disk, just touch the ends to the disk. Once the blanks are square and you can see the ends of the tubes brighten, then return the blanks to the mandrel and finish the turning until the desired contour is accomplished.

### Turning the Material Blanks



- Assemble the blanks on the mandrel with the right bushings in the right place. The right bushing can be found by comparing the diameter of the bushing to the piece of hardware that will be placed in that place. For instance, the bushing that is the same size as the clip will fit on the end of the blank that will eventually become the top of the cap.
- Tighten the tailstock before tightening the blanks on the mandrel. This will center the mandrel first. Then tighten the nut that holds the blanks.
- Turn the blanks to the desired contour making sure that the area next to the bushing is turned to the size of the adjacent bushing.
- After turning the blank, sand the surface in progressive steps until you get to 400 or 500 grit.
- If a higher polish finish is desired continue sanding with Micro Mesh through 12000 grit.
- Apply the finish of your choice and polish.
- Remove the blanks from the mandrel.



### Assembling the Pen

Please refer to the Pen Parts diagram above.

The third most common error resulting in a non-functional or damaged pen is the misalignment of the parts when pressing them in place. The use of a good pen press or small arbor press is recommended, but it can be accomplished with a good “C” clamp and much care. When pressing in the various parts, by any means, BE SURE that the parts are straight and in line with the blanks. If the part is cocked or otherwise misaligned, at the very least, a poor fitting pen will result. At the worst, you may have a pen that is not usable. Exercise caution here!

One other word about pen parts. Occasionally, you will encounter parts that are a little loose fitting. This can be corrected by using a SMALL spot of glue, usually CA, on these parts before pressing them home.

1. Press the nib holder into one end of the lower tube (this is the longest tube). Make sure you choose the appropriate end of the tube to preserve the pattern or grain match on your pen.
2. Press the decorative receiver holder into the other end of the lower tube. This is a 3 piece assembly. Slide the Sterling Silver ring on first and then the gold accent ring.
3. Screw in the gold receiver.
4. Drop the spring, small end up, into the lower tube if making a roller ball.
5. Remove cap from refill and drop it in with the point sticking out of the tube.
6. **Note: If making the fountain pen replace steps #4 and #5 with this:** Insert refill cartridge or converter pump on the writing nib.
7. Screw on the nib.
8. Lay this assembly aside for a minute.
9. Assemble the 3 piece center band as follows:
10. Slide the gold center band base onto the black threaded insert from the small end of the insert. The large end of the base should face the large end of the insert.
11. Using a wooden push block on top of the gold base, with a 33/64" hole drilled in it, that's the one you used to drill the short blank with, press the gold base flush with the large end of the threaded insert.
12. Place the Sterling Silver ring on next and then the gold accent ring.
13. Press this assembly into the end of the large brass tube observing good pattern and grain matching techniques.
14. Press the clip bushing brass insert into the other end of the same tube with the threaded in up. Press it in until the shoulder is flush with the blank. This will leave the threads sticking out.
15. Place the decorative clip over the threaded part of the brass clip insert.
16. Place the clip ring over the clip with the notch over the clip.
17. Screw on the finial.
18. If the clip is not quite tight you can disassemble the clip and press the threaded insert into the tube just slightly more.
19. One other adjustment. If your pen looks like this



when finished, with the nib holder showing below the center band, then place the cap on the pen and push downward slightly to hide the nib holder.

20. Place the cap on the pen.

Your Cambridge Hybrid is now finished. Isn't it beautiful?

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