

Native Pens

Making a Custom Carbon Fibre Pen

The method to follow shows the process Native Pens uses to make a Custom Carbon Fibre Pen. The pen kit used for this was the Sierra kit, however this method is not limited to this pen kit. The pen kit parts are shown in the diagram below.



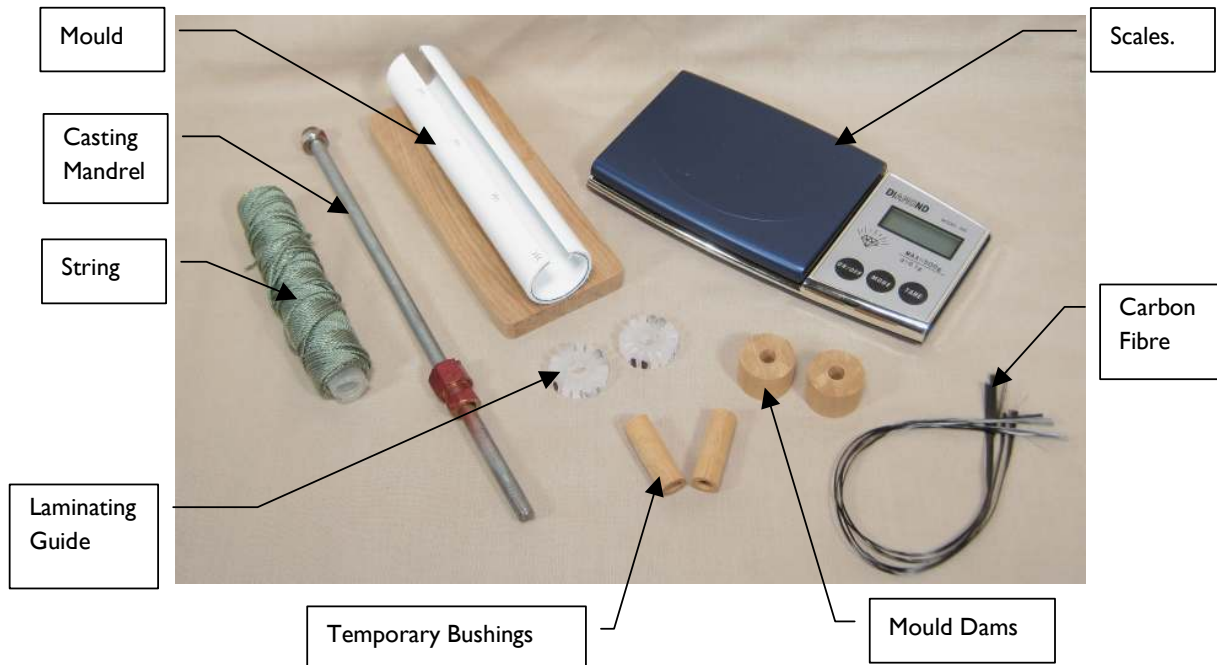
Required Accessories and Materials.

Normal Pen Making Equipment.

- 1 x Sierra Pen Kit.
- 1 x Sierra Bushings set.
- 1 x 1/4" Collet Mandrel.
- Micro Mesh Polishing Pad Set.
- 6 x Slimline Bushings.
- 1 x 1/4" Drill bit.
- Wet and Dry Sand Paper.

Special Equipment.

- 1 x Casting Mandrel.
- 2 x Laminating Guides.
- Carbon Fibre Strands.
- 500g x 0.1g Scales.
- String.
- PVC Plastic Casting Mould.
- Casting Resin
- Paint
- Double Sided sticky tape
- Hot Glue
- Temporary Wooden Bushings and Casting Dams



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Mould:

The mould is simply a piece of 25mm or 1" PVC plastic tube cut to length with a 6mm or ¼" slot cut along it. This is then hot glued to a timber backing to keep it stable.

Casting Mandrel:

This is a ¼" steel rod threaded one end with a nut wound and locked onto it. The other end is secured with a brass Collet ferrule.

Resins:

There are many different casting resins available, both polyester and epoxy based. Each has good and bad points. For this exercise I am using an Epoxy resin that has a long open time, is quite "runny" and has good air release properties. With an epoxy I am able to mix the resin at the beginning of laminating so it can stand for a period of time to allow any air within the resin mix to come to the surface. The resin should be mixed as per the manufactures requirements and all handling procedures as laid out by the manufacturer should be followed.

Laminating Guides:

These are plastic discs with slots cut into them and act as a guide for starting and finishing each fibre when winding them onto the pen tube. Mine are marked with coloured paint at each quarter, which makes it a bit easier to keep track of your turns and fibre positioning.

Carbon Fibre:

For this pen I am using what is known as 3K Carbon Fibre Tow. The "3K" describes the size of the carbon fibre strand. "3K" means 3000 filaments in the strand or Tow. Carbon typically comes in 3K, 6K, 12K, 24K...etc sizes.

Scales:

As the amount of resin required is very small, only 30-40 grams depending on the pen you are making, you will need a fairly accurate set of scales. The ones I am using are 500gram max weight and measure in 0.1gram increments. These are generally known as Jewellers scales.

Laminating Guides:

These are thin plastic discs with 16 slots cut radially around them. They act to hold the fibre in place while winding it onto the pen.

Paint:

For this application I use an Acrylic Lacquer automotive paint as these are designed to adhere to bare metal and are quite stable. I have found that they are also tolerant of any solvents present in the resin.

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Planning.

The most important point to consider here is the thickness or room you have around the pen tube in which to laminate the carbon and cast the resin.

The table below shows some common pen kits and their allowable thickness (usually where the wood would be...)

	Pen Ø [mm]	Tube Ø [mm]	Thickness [mm]
Slimline	8.5	6.8	0.85
Sierra	12	10.5	0.75
Cigar	11.7	9.8	0.95

In this demo I am making a Sierra Pen, which gives me 0.75mm of thickness to work within. The fibre I am using is a 3K fibre which, when wet with resin, has a fibre thickness of about 0.15-0.2mm.

So, if I wrap just one fibre around the pen then the resulting resin thickness over the fibre will be 0.55mm.

However, if I overlap some of the fibres then the thickness of the fibres at the overlap is 0.4mm.....leaving only 0.35mm of resin over the fibres.

This is important for the following reason, if you sand through the resin and touch the fibres with the paper they lose their iridescent qualities and become flat. This cannot be repaired and you will have to re-start the pen.

Of course turning the pen with some shape can help to reduce this risk, however the diameter that matters is at the cap and nib ends where the pen must match in.

Preparation of Tube for Laminating.

1. Start by turning a set of temporary bushings and mould dams from some scrap timber. The bushings are used to hold the pen tube while laminating the carbon. The dams are used to seal the ends of the mould for casting the blank. Cut two blanks 30mm and two blanks 15mm long then drill the centre with a 1/4" drill.



2. Mount the blanks on your mandrel between the bushings for the pen you are making. The temp bushings must fit inside the pen tube so the pen bushings are used as a guide to turn the tube inside diameter. Mount the dam pieces alongside.



3. For the bushings, start by rough turning them round down to about 3mm oversize. Then mark 20mm from the centre along each temporary bush. For the dams, these just need to be turned round to fit inside the mould tube.



4. Next, turn down the ends of the bushings until the diameter matches the tube inside diameter. Use the bushings as a guide and check the size with vernier callipers.



5. With the ends complete you can now turn down the middle section. This must match the outside diameter of the pen tube, check with vernier callipers.



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- Once the temporary bushings are complete, remount them on your mandrel with the pen tube in place. When inserting the bushings into the tube it pays to run a small amount of hot glue around the inside of the tube to push the bushing into. This helps to seal the bushings into the tube and stop any resin leaching into the tube during casting.



- Start the lathe and sand the brass tube with 600 grit.



- Remove the tube and temporary bushings from the lathe mandrel and mount all onto the casting mandrel. Use a pair of Finishing Cones to separate the bushings from the mandrel ends. Carefully mask off the temporary bushing, leaving about 2mm of wood visible at the brass tube.



- Next, while holding the casting mandrel carefully spray paint the brass tube to the colour you wish. Spray in light coats and build up the colour through a number of coats rather than one heavy coat.

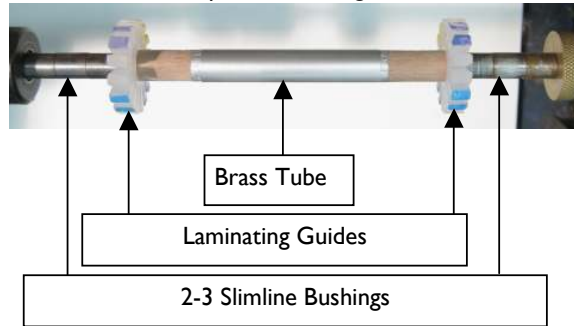


- Remove the masking tape while the paint is still tacky, and then allow the paint to cure.

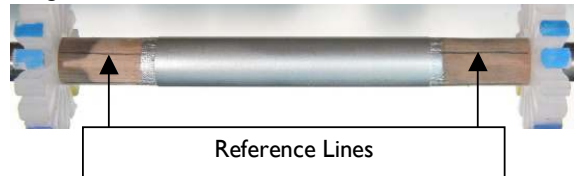


- When the paint is properly cured, remove the tube and temporary bushings from the casting mandrel

and mount on your turning mandrel. At this point the tube is set up for laminating as shown below.



- With this set up, mark reference lines along the temporary bushings from each $\frac{1}{4}$ of the laminating guides.



- Finally, wrap some double-sided tape around the slimline bushings at each end.



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Laminating and Casting.

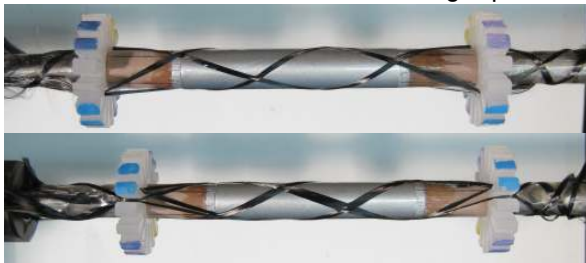
1. Measure out and mix the resin for a minimum of 2min. Then apply a small amount to the pen tube and slightly onto the temporary bushings.



2. Start by applying the first fibre to the pen. Slip it into the laminating guide at one end and stick it to the double-sided tape. Then, using your pencil line as a guide, wind the fibre onto the pen tube. Exit the pen tube at the corresponding guide position at the other end of the tube. Slip the fibre into the laminating guide and stick it to the tape. NOTE: it is important to get the first fibre in the right place, as other fibres will need to be parallel to it.



3. Continue winding on fibres in both directions. Try to ensure the fibres enter and exit the pen tube at corresponding positions and are parallel to each other. At some point you will need to apply more sticky tape to the ends. On this pen I have wound on 8 x fibres, 4 in each direction running as pairs.



4. With all the fibres on now on the pen tube it's time to remove the tube from the mandrel for casting. First, however, the fibres must be secured so they don't move when the ends are cut away. Using your string, wrap this around the fibres on the temporary blanks a couple of times then tie tightly.



5. You can now carefully cut the fibres on the guide side of the sting.



6. Next, remove the pen barrel from the mandrel and assemble on your casting mandrel as shown below with the casting dams. Use hot glue between the temporary blanks and the dams to ensure this joint to be sealed against resin ingress.



Casting Dam

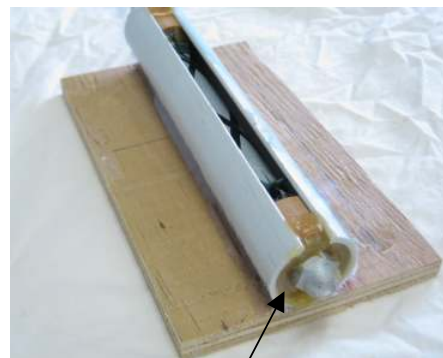
Hot Glue

7. Now carefully slide this assembly into the mould. Seal up the ends of the mould with hot glue.



Hot Glue

Hot Glue



Hot Glue

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8. Once the hot glue has cooled you can start to cast the pen. Pouring should be done from one end over the temporary bushing. The resin should be allowed to flood along the bottom of the mould and gradually work it's way up and around the pen barrel. This way the resin pushes any air up and out of the mould. You may need to stop part way through to let the resin level out. When pouring try to keep the follow continuous, if the resin drips into itself this can introduce air. Keep pouring until the mould is full.



9. With the pour complete leave the resin to cure as per the manufacturers instructions.

Turning the Pen

1. Once the resin is cured the cast blank can be released from the mould and the ends can be rough trimmed on a band saw.



2. To finish trimming the ends I use a disc sander as described in our Advanced Pen Blank Preparation instruction.



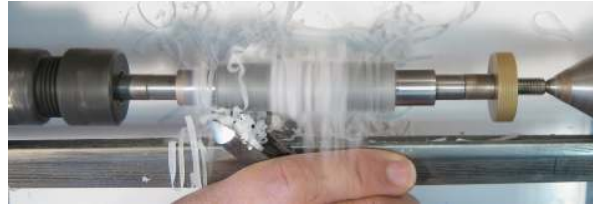
3. The blank can now be mounted on the mandrel and set up on the lathe to turn.



4. Turning is done with normal woodturning chisels. A 13mm bowl gouge works well for removing the bulk of the casting.



5. Then change to a smaller, 10mm, gouge as the turning starts to get close to the bushings. The lathe will need to be stopped regularly to clear away the shavings, as they tend to wrap themselves around the blank.



6. Continue turning until the blank is about 0.25-0.5mm larger than the bushings.



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Finishing the Pen.

1. For sanding the casting I will typically do them wet with Wet and Dry sand paper. This is mainly to keep the heat generated by sanding to a minimum. Start from a grit suitable for removing any turning marks; typically 120grit is a good starting point. If you start to fine the turning marks will just get smoothed out and not removed. Ensure the sandpaper is always moving both side to side and up and down. If the sandpaper is still for even a moment it can leave sanding rings around the pen, which can be very difficult to remove.

As this is a wet process, it pays to protect your lathe from the water. Lay a cloth over the lathe bed and a milk bottle cut in half, length wise, and placed under the mandrel is great for catching most of the water.

I also add a couple of drops of detergent to the water to lubricate the paper.



2. To start sanding, use a fairly hard foam block to finish the shaping of the pen if required. Then, after each grit, use a soft cotton cloth to wipe away the sanding sludge from the previous grit paper.



3. Continue sanding through all the grits to your desired surface level. I normally sand from 120grit then 150, 180, 220, 240, 280, 320 through to 600grit. Cleaning the pen after each grit paper.



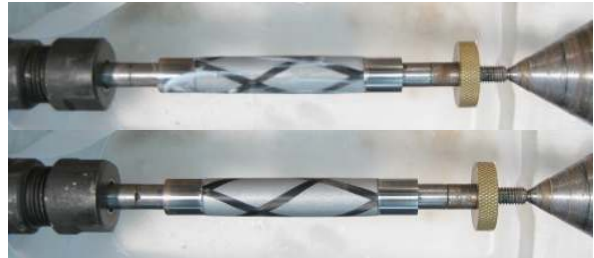
4. At this stage your pen is ready polishing. For polishing I use the Micro Mesh polishing pads again using a wet process. At this point it pays to refresh your water supply with clean water, again with a few drops of detergent in it. Start with the 1500 pad and give the pen a good sand



5. Then work your way through the pads to the 12000 pad. Remember to clean the pen between pads. Once the 12000 pad sanding is complete, your blanks should have a nice high gloss



6. As a final step to really bring out the wet look gloss level, apply a small amount of SuperFine Polishing Paste to the barrel. Then, with the lathe running lightly rub with a soft cloth. Stop the lathe, and then continue rubbing longitudinally to remove the excess paste.



7. Your pen can now be assembled.



NOTE: Remember to clean and dry your lathe bed after the mandrel is removed.