

Build a Guitar or Ukulele Body

- **Glue Top + Install Rosette**
 - Glue top and back
 - Install Rosette
 - Final thickness sanding
 - Cut sound hole and fill rosette
- **Brace Top + Back**
 - Prepare the soundboard and back
 - Prepare the brace wood
 - Glue top braces
 - Glue back braces
 - Trim braces to voice top and back

Prepare Sides + Head/Tail Blocks

- - Bend Sides
 - Glue head and tail blocks
 - Glue kerfing
 - Sand top and back of body
- **Glue Up Body**
 - Cut kerfing slots for back
 - Glue back to body
 - Dremel kerfing slots for sound board
 - Glue sound board to body
 - Trim and sand
- **Mortise Joint + Bindings**
 - Route mortise for neck joint
 - Cut channels and install bindings
- **Making a Ukulele Bridge**
 - Prepare material
 - Route slots
 - Drill string holes
 - Cut the wings

Build the Neck

- **Prepare Mortise + Tenon Joint**
 - Layout
 - Neck angle
 - Cut side profile
 - Fit neck joint to body
- **Route Slot(s) in Neck**
 - Ukulele
 - Guitar
- **Bolt-on Hardware and Heel**
 - Cut heel to length
 - Ukulele
 - Guitar
 - Glue Heel Cap
- **Peghead Work**
 - Peghead angle
 - Final sand neck/fretboard joint
 - Glue and trim peghead overlay
 - Cut peghead to thickness
 - Drill tuner holes
 - Install peghead inlay
- **Cut Neck to Width**
 - Final Fitting of Neck to Body
- **Shape neck**
 - Optional peghead binding
 - Rough shape neck
- **Prepare fingerboard**
 - Attach fingerboard
 - Install and level frets

Finishing and Set Up

- **Finishing Prep**
 - General sanding and prep
 - Optionally tape off bridge location
 - Pore fill
 - Apply finish
- **Post Finish Set Up**
 - Bridge location
 - Glue on bridge
 - Attach neck
 - Nut, saddle and set up

Build the Neck

Prepare Mortise and Tenon Joint

- **Layout**
 - I make necks from a solid block of wood. Each solid neck block yields two necks.
 - You can glue together two narrower boards with a center strip if you do not have a wide enough block.
 - A laminated blank is actually stronger and more stable than solid piece of wood.
 - Make sure the neck blank is square and straight. This is critical.
 - Draw side of neck on the blank. Be sure to include the tenon for the mortise and tenon joint.
 - Trace fingerboard outline on the neck block. Mark the nut and 14th fret.
 - Draw rough outline of peg head on top of neck
 - Mark centerline of neck block.



Laminated neck blank with layout.

- Guitar: In a perfect world you will have a 88.5° joint between the sides and soundboard at the neck joint and the proper curvature across the body to achieve correct string height at the saddle. However, in the real world you may have to make slight adjustments to your neck angle to get the correct string height at the saddle while also taking into account string clearance over the frets.
 - Measure angle of top/side at the neck/body joint
 - Measure height of tangent line at the saddle location.
 - Use neck angle formula to determine the proper neck angle
 - [To be added]
 - Cut off the cheeks using the bandsaw and fence.
 - Do not cut too deep on band saw or faults may show at heel
 - When starting with a new neck blank, make the table saw cuts in both ends of neck blank even if you don't the extra neck now
 - It is difficult to make the table saw cuts once the neck blank has been separated into two necks.
- **Cut the side profile**
 - Cut using band saw
 - Do not cut peg head angle yet
 - ***Do not cut neck to width at this point!*** Need to be able to clamp neck in vise and to route straight slots.
 - **Fit neck joint to body**
 - It is much easier to trim tenon while the sides of the neck block are still rectangular.
 - I like to use a rabbet plane to trim the tenon. Sharp chisel can also be used.
 - Cut tenon to length - be sure it isn't hitting bottom of joint.
 - At this point, get a good tenon fit with the **neck axis aligned with centerline of body**.
 - Final seating of neck onto body comes later

Route Slot(s) in Neck

- **Uke:** I like to include a 1/8 wide by 3/8 inch deep carbon fiber bar in the neck for strength and fingerboard alignment. You can also use a hardwood insert instead of carbon for easy fingerboard alignment.
 - Rout slot for graphite bar leaving 1/64 - 1/32 of bar above neck for fingerboard alignment
 - Also rout slot in center of fingerboard of 1/64 – 1/32 depth
- **Guitar:** Rout slot for truss rod and two 4 inch carbon fiber bars. The carbon fiber reinforces the neck in the area that is under maximum stress.
 - One graphite bar should protrude 1/64 above neck/soundboard interface for fingerboard alignment. The other rod should be at or slightly below neck surface. Route a corresponding slot in fingerboard of 1/64 – 1/32 depth.
 - If truss rod will be adjustable from peghead, rout the channel slightly wider above the nut so that the hex bolt will fit (for Hot Rot truss rod)
 - If truss will be adjustable from inside the body, rout (or chisel) channel slightly wider at tenon. This is where the hex head will sit. The brass body of the truss rod should reside in the neck (above the 14th fret) for strength (see pictures below)
 - Finalize truss rod fitting



Ukulele neck with center slot for carbon fiber bar and bolt-on connection.



Guitar neck with slots for carbon fiber reinforcing bars and truss rod.



Guitar neck with truss rod.



Rough fit of guitar neck to body.

Bolt-on Hardware and Heel

- **Cut heel to final length taking into account thickness of heel cap**
- **Ukulele**
 - drill holes into the neck tenon and corresponding holes into body for bolt-on hardware
 - Drill 15/64" diameter holes 1" deep into neck tenon for 8-32 hardware insert from Ace.
 - Holes are located 13/16 and 1 11/16 from top of body/neck blank
 - Chamfer the holes and inset the hardware 1/16-1/8".
 - Drill corresponding holes into head block
 - When marking the location of the holes into neck block, be sure to take the top thickness into consideration if top is not yet attached to the body if drilling holes before the body is assembled.
- **Guitar**
 - Make brass rod hardware with two 1/4-20 threaded holes.
 - Flatten lengthwise portion of 1/2 brass rod. Hammer starter dots. Drill two holes into flat portion and thread in drill press.
 - Drill holes into neck mortise and head block for connecting bolts
 - Drill hole into heel for brass rod
 - May need to complete hole with hand drill due to depth limitation of drill press
 - Install brass rod in heel and glue in place, preferably with flexible epoxy. Leave screws in while gluing to keep screw holes aligned.
- **Glue heel cap**
 - Make sure heel cap is perfectly flush with heel on surface that touches the body.

Peghead Work

- **Cut peg head angle on band saw**
 - Be sure the nut width is properly marked on the neck block, so you know where the peghead stops and nut begins.
 - You can temporarily tape a wedge to neck so that the peghead is cut straight.
 - Flatten string-side of peghead using hand plane.
 - If you need to add "wings" to the peghead to make it wider, now is a good time to do it. Add wings and then flatten string side of peghead.
 - Sand or plane the peghead until you are just a bit past the back line for the nut.
- **Final sand neck/fretboard joint**
 - Do this now before the peghead overlay is glued.
- **Glue and trim peghead overlay**
 - Peghead overlay should slightly overhang nut slot so that nut in full contact with overlay after final trimming.
 - Shape nut edge of peg head overlay as shown in photos. Fit with actual nut and fingerboard to ensure all is square.
 - Do this before cutting side of peghead! Peghead can be clamped and edge tear out won't matter.



Taping wedge to neck to cut peghead angle on bandsaw.



Cutting peghead angle with wedge in place.



Trimming the edge of the peghead.



Nut (not shown) fits between edge of peghead overlay and end of fingerboard.

• Cut peghead to thickness

- Use belt sander to achieve final thickness of peg head and overlay
 - Do this before rough cutting neck to fingerboard width so you have a flat surface against bandsaw/sander table.
 - Carefully flatten back to uniform thickness
 - This is also a good time to sand the volute and heel curves since the side of the neck is not yet cut to fingerboard width.
- Grover regular post Uke tuners
 - 3/8 - 7/16 peghead thickness
 - 3/8 - 1/32 diameter holes in peg head.
 - 1/16 diameter holes for tuner screws on back of peghead.
- Grover long post Uke tuners
 - 1/2 - 9/16 peghead thickness
 - 3/8 - 1/32 diameter holes in peg head.
 - 1/16 diameter holes for tuner screws on back of peghead.
- Gotoh mini tuners
 - 7/16 - 9/16 peghead thickness
 - 3/8 holes for tuning posts.
 - 1/16 diameter holes for screws on back of peghead.
- Grover guitar tuners
 - 9/16 +/- 1/32 peghead thickness
 - 25/64 diameter holes.
 - 1/16 diameter holes for tuner screws on back of peghead.

• Drill tuners holes

- Grover Uke tuners
 - 11/32 diameter holes in peg head.
 - 1/16 diameter holes for tuner screws on back of peghead.
- Gotoh mini tuners - 3/8 diameter holes
- Grover guitar tuners - 25/64 diameter holes
- Gotoh guitar tuners - 3/8 diameter holes in peg head
- For Grover ukulele tuners, use template to mark screw holes on back of peghead.

• Install peghead inlay

- Stick to peghead with double sided tape. Trace with Exacto knife.
- Chalk for dark woods
- Use 1/8, then 1/16, then 1/32 bits
- Use Exacto knife to carve out edges for final fit
- Try to get all of the inlay to sit just a hair below the peghead
- Epoxy in place. Mix sawdust in epoxy for color matching.
- Sand to 180

Bandsaw Neck to Width

- Shape width of neck down to just a tiny bit more than the final thickness
 - Use spokeshave and sanding block
- Be careful not to ding the sides of the neck in the steps below

Final Fitting of Neck to Body

- **This is a very important step.**
 - Neck angle must be correct
 - Centerline of neck must align with centerline of body
 - Tight joint with body
- **Final fitting of neck**
 - Protect edges of neck joint against dings
 - It's a good idea to do this step while the neck is still a bit wide and hasn't been brought to it's final width. That way dings on corners and edges will disappear with sanding to final width.
 - Use a chisel to create an inward sloping angle on face of neck joint.
 - This way there is less neck surface in contact with body and easier to fit.
 - "Floss" the neck joint with 180 grit sandpaper.
 - May need to take handplane passes for larger adjustments
 - For uke, be sure the fingerboard will sit flat on the soundboard.
 - **Double and triple check that the neck angle is correct before moving on.**



Final fitting of neck to guitar body. Neck and heel at final width

Shape Neck

- **Optional Binding on peghead**
 - Peghead binding must be installed now.
 - Blending of peghead/volute/neck area must be finalized before cutting binding channels
 - Flatten sides of neck with peghead flat on sander table – this way the angle of the neck side will be the same as the peghead side when on the router table. If you don't do this, the binding channel will be slightly shallower on the neck (which may be okay since the depth of the binding is not visible).
 - Route using same bit as for body bindings.
 - Keep peghead surface flat on router table at all times.
 - Fit and attach top piece of binding first. Do not bend side pieces until after top piece is glued in place. Otherwise it can be difficult to precisely align both the mitered corners and any bends in side binding.
 - Cut/carve miters with Exacto knife
 - Attach bindings with fish glue and binding tape
- **Rough shape neck**
 - Bandsaw or sand down corner edges of neck as prep for shaping neck with spokeshave and rasp.
 - Shape neck with spokeshave and then rasp.
 - The neck is already at the proper width so be careful to not shave or sand into the width.
 - Random orbital sander with transfer pad is next. Sand with 80 grit.
 - All shaping should be essentially be done at this point.
 - No need to sand further until after fingerboard attaches



Routing channels for bound peghead. Keep peghead flat on router table, even while routing the portion of the channel beyond the peghead.



Binding extends beyond nut to fingerboard



Neck trimmed and sanded to width.



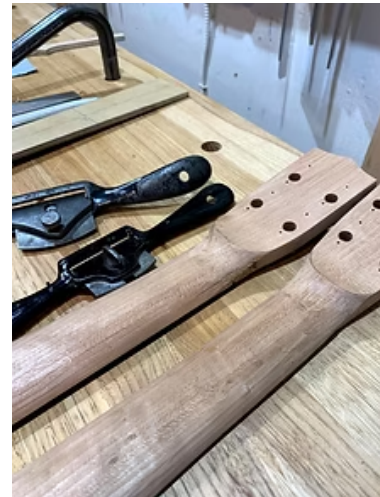
Neck material removed using oscillating spindle sander.



Volute shaped using oscillating spindle sander.



Shaping neck with spokeshave.



Done with spokeshave and ready to use rasp.



Shaping heel with rasp.

Prepare Fingerboard

• Prepare fingerboard

◦ Ukulele

- I generally use pre-slotted fingerboard from LMI.
- Check depth of fretwire tang. May be able to significantly reduce thickness from top of pre-slotted fretboard.
- LMI uke fretwire tang is only 1/16" deep (0.0620)
- Rout slot in center of fingerboard 1/64 depth for alignment with carbon fiber bar in neck (this step was probably done when routing the slot in the neck)

◦ Guitar

- route slot to one side of truss rod slot for alignment with graphite in neck.
- If you need to make the fingerboard thinner, do that now.

◦ Shape fingerboard

- Mark the width of the fingerboard using graphite rod to align fingerboard with neck. Cut fingerboard to rough width on bandsaw.
- Use hand plane to bring fingerboard to width.
- If binding fingerboard - joint down edges of fingerboard to correct width and glue fingerboard binding
- Make sure back of fingerboard is flat - remove any drum sander snipe
- Finalize shape of fretboard at sound hole (much easier to do before fingerboard is glued to neck!). Measure distance from 14th fret to sound hole.

◦ Drill holes for position markers

- Layout and drill holes for position markers on face and side of fretboard. For uke, groove on back of fretboard is centerline. Transfer to front.

after gluing fingerboard and final neck shaping.

- Time to attach fingerboard to neck

- **Attach fingerboard**

- Sand back of fingerboard on flat surface
- Attach fingerboard to neck with epoxy so as not to introduce moisture.
 - Prevent epoxy from getting on truss rod w strip of tape (remove tape just before clamping!)
 - Can epoxy carbon fiber rod at same time or install before attaching fingerboard.
 - For guitar. install truss rod with silicon caulk

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