VINTAGE YAMAHA NECK RESET PROCEDURE

V2020.8

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8/10/2020

The diary of a Yamaha madman.

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1.0 VINTAGE YAMAHA FG NECK RESET PROCEDURE v2020.8 by Dave Fengler

A neck reset is not a trivial repair; it requires a precise plan, the right tools, accurate measurements and calculations, attention to detail, and flawless execution. And a certain amount of interest in the unknown. A neck reset on a 40+ year old guitar brings a whole new level of unknown - the method and glue they used to attach the neck.

I've found until 1976 they used hide glue. In 1976 they changed to the fabled EPOXY! Epoxy is not water soluble and only softens slightly with heat. The one 1976 model I've taken apart had LOTS of epoxy in the joint, as they did with hide glue. The few 1977 to 1981 models I've taken apart only had a small amount of epoxy in the bottom of the dovetail. But, Yamaha is known for exceptions to the rule. You never know what you're going to find until you get in there.

I originally created this document for myself to record the steps I took to do neck resets on a few vintage Yamaha FG's, based on what I've read and watched online and a few discussions with luthiers. It is not the only way to do it. I sometimes overcomplicate things. If you have a better method feel free to share it in the forum **https://yamahavintagefg.boards.net/** *or send me an email at* ***YamahaVintageFG@gmail.com****. I'm always looking to learn new ways to do things. I typically update this document after every neck reset as I get ideas, learn from the one I just did, or get new information.*

1.1 Tools required for neck angle and setup evaluation:

1. ***A precision steel 6" scale graduated in 64ths to check the action.*** Optionally feeler gages can be used.
2. ***A 24" straight edge****: to check the neck projection to the bridge.* I use a 25" aluminum straight edge, made from a 36" ruler. This must be straight or you will get wrong readings.

1.2 Tools required for the neck removal:

1. ***A Heat Shield****:* made from a U shaped piece of corrugated cardboard covered with aluminum foil to go around the fretboard to protect the top from heat.
2. ***A 75W halogen light*** (in a swing arm lamp): as a heat source, suspended 1" to 1.5" from the fretboard. An iron is optional.
3. ***A long thin spatula*** (mine is 1-1/4" x 6"): works best to get under the fretboard. Make a mark on the blade at the distance required to go to the 15th fret. A regular spatula or putty knife will work but it must be thin and flexible or it will cut into the wood under the fretboard, making the fretboard removal much more difficult. An offset spatula would be best, but it must be thin to get between the woods without forcing them apart too much. Taper the top edge of the spatula and leave the bottom edge flat. That will reduce the digging into the top. Polish the bottom of the spatula and you won't have to use the tape on the top.
4. ***2" wide painters tape***: wrapped around the spatula blade about 1/2" farther away from the depth line, that will prevent the edge of the blade from damaging the finish at the bridge side of the sound hole. Also, putting tape on the top of the bridge can prevent the bridge pin holes from taking a chunk out of your knuckles as you work the spatula under the fretboard extension. Otherwise, ¾" wide painters tape makes a decent Band-Aid to cover the torn knuckle while you work on the rest of the neck reset.
5. ***Small chisel***: To get under the edge of the 15th fret. I assume Yamaha used a press to install the frets. Most frets are below the surface of the wood and fret pullers can't get under them without chewing the fret up.
6. ***Fret removal tool****:* can be purchased or you can modify end cutting cutters. The front face needs to be ground back and the inner edges need to have the angle steepened. This thins the cutting edge, making it easier to get it under the fret. I use https://www.stewmac.com/Luthier_Tools/Tools_by_Job/Tools_for_Fretting/Pullers_nippers_sizing/StewMac_Precision_Fret_Pullers.html
7. ***Soldering iron with a modified tip****:* I use a 30W soldering iron with a tip that has a groove filed in it so it will stay on the fret and not slip off and burn the fretboard. I haven't been using this lately. It's only needed if the frets are glued in.

8. ***A sharp blade***: such as a scalpel or X-Acto knife, to cut the finish where the heel meets the guitar body. **THIS IS VERY IMPORTANT!!**
9. ***Measuring device and pencil***: to mark the location for the holes to inject steam into the neck joint.
10. ***Drill bit and drill:*** I use a 3/32" drill bit. Drill a test hole in a piece of scrap wood to see what size drill you need for your tip.
11. ***As source of steam***: I use a Mr. Coffee Steam Espresso & Cappuccino Maker model BVMC-ECM260, with a 2 foot piece of reinforced rubber automotive fuel line and a ball inflator tip, held in place with automotive worm drive clamps. This model has a very rough control to adjust the amount of steam, very important to the outcome of the neck removal. The ball inflator tip is only about 1" long, The 3" long Stew Mac tip is good if the neck pocket is straight it, but there's no advantage with an angled hole. I've added a **Steam Trap** to my setup to reduce the amount of water getting into the joint.
12. ***Water***: as the steam medium. Tap water will work fine but the minerals in the water will be left behind and harden on the steam chamber, I assume eventually reducing heat transfer. Probably not a big deal with the small amount of use this machine will get.
13. ***A bucket to hang the steam hose in while it's warming up***: I use a Home Depot 5 gallon bucket. It will contain the spitting and swirling steam and collect the condensation.
14. ***A heat & steam proof glove***: **STEAM BURNS!!** You do not want to contact it at any time! It's also very helpful for handling the hot hose.
15. ***2 hand towels***: One for inside the guitar (steam may leak into there), and one for wiping up the steam and water that leaks out of the fretboard and heel.
16. ***Neck removal jig***: clamps to the guitar and has a screw for putting pressure on the heel to push it out. You can buy one from Stew Mac or build one yourself. Possibly not necessary for some neck resets, it can get in the way of steam cleanup, but I think it is **absolutely necessary** for these over glued Yamaha's. I also put two 1 foot long pieces of 2x4 under the jig to balance it, and two 12 inch clamps to hold the guitar and jig to the table. Then the wiggling motion required to loosen the neck isn't lost while trying to hold the guitar steady. Here is my **Neck Removal Jig**.
17. ***Small clamp***: used in the sound hole to hold the fretboard down, which reduces the amount of steam leaking out onto the top and causing blushing.
18. ***Scraper or chisel***: to remove the wet glue from the neck and pocket. Hide glue has the consistency of sticky Jell-O when heated. It's much easier to scrape it off just after the neck has been removed than after it rehardens.
19. ***A hair dryer***: removes some or all of the blushing in the finish from the steam heating and getting into it. My theory is heat put it there, heat will take it out.
20. ***Meguiar's M2 Mirror Glaze Fine Cut cleaner***: to buff out the remainder of the blushing.
21. ***Optional:*** I designed and built a hanger the hold the separated guitar body and neck.

1.3 Tools required to reset the neck angle:

1. ***Dremel with 1/8" dia. burr bit***: for undercutting the heel. Sharp chisel optional.
2. ***¾" painters tape***: for marking the depth to be removed on the heel. Scribe & feeler gages optional. Also to protect the sides of the guitar while pull sanding the heel.
3. ***Fine point black marker***: for marking the center positions of the neck and bridge (on ¾" painters tape).
4. ***Dial/digital calipers***: to measure the amount of material to be taken off of the heel. Feeler gages optional.
5. ***1" wide x 1 foot longs strips of emery paper***: 120 grit. Backed with 1" wide fiberglass reinforced strapping tape. For sanding the contour of the heel. The tape provides a slick surface to not scrape the finish on the guitar body.
6. ***A small sanding block***: to smooth the angled surfaces of the dovetails. I designed and built one that will clean the whole surface of the internal and external dovetails.
7. ***A leather work glove***: for the hand you will be pulling the emery paper with. The rolling motion will slowly destroy your pinky knuckle. I recently found work gloves with thick rubber knuckle guards. **Mechanix M-PACT** gloves.

8. ***A neck clamping jig (optional)***: to allow the guitar to be partial strung up to see how the changes you've made affect the guitar setup. I built one out of 2x2's, sheet cork and a cut off 6" bar clamp. Anything that allows you to clamp the heel to the guitar while testing the alignment will help. Here is my **Neck Clamping Jig**.
9. ***The same 6" & 24" scales used in the neck evaluation***. Feeler gages optional.

1.4 Parts required to complete the neck reset:

1. ***Hardwood shims***: to take up the space in the dovetail after sanding material off of the heel. I use maple veneer sheets (.020" thick) I bought at Woodcraft. Some people use mahogany. Any hardwood that will not compress under pressure will work. *Paper and cardboard are not good shim material!*
2. ***Carbon paper***: to check the contact area of the dovetail. Some people use chalk.
3. ***A new saddle***: fit to the slot and the bottom sanded to have the top of the saddle .150 to .170 off of the bridge. I leave it about .050 higher to allow a little extra sanding it to the final dimension after the reset is finished, or in case you set the neck a little too far back, but be sure to figure that in your calculations when checking your progress.

1.5 Tools required to complete the neck reset:

1. ***Superglue*** (to glue in dovetail shims).
2. ***Small sanding block*** (to sand shims).
3. ***Dial or digital caliper***.
4. ***Feeler gages***.
5. ***Fret slot cleaning saw***, .015-.016 thick (optional).
6. ***Plastic to fit fret slot*** (.018" thick).
7. ***Plastic Tip hammer***.
8. ***Channel-lock pliers with sacrificial wood hardwood scraps***.
9. ***Rosewood dust***.
10. ***Water thin super glue***.
11. ***Toothpick***.
12. ***Razor blade***.
13. ***Wood glue***. Hot hide glue or fish glue preferred.
14. ***Clamps***.

2.0 PREPARATION:

2.0.1 FRETS:

The measurements for a neck reset are taken from the frets. Any divoted, flat, or low frets should be replaced, and all of them levelled **BEFORE** starting a neck reset. You'll get more accurate measurements from a flat fret plane. And doing a complete refret, replacing the low (previously levelled) frets with new ones, will decrease your action. Also, lowering the neck angle (and action) will expose the "rocks" of low/high frets, causing buzzing or dead notes. This is my **Refretting a Vintage Yamaha procedure**.

2.0.2 MEASUREMENTS:

Before starting the neck reset you need to measure many parameters to know where you're starting, and to calculate what to change to get to where you want to be. Before doing this you must have the neck relief set properly (see separate Setup guide). And you must have all 6 strings at the tuning where the guitar will be played.

Check and record:

Action at 12th fret (both E's, with string pressed at 1st fret to take the nut action out of the equation).

Bridge height above the top (between D & G strings).

Saddle height above the bridge (both E's).

Neck projection at the bridge (between the D & G strings). A guitar needing a neck reset will always have the neck projecting below the bridge.

It would also be good to record these settings with only both E's on the guitar, for when you are removing material on the heel and have the guitar clamped in the neck jig. Less tension means less force required in clamping the neck jig, means less possible distortion of the guitar, affecting the measurements. After removing the middle 4 strings retune the E's and let the guitar sit for an hour or 2, and tune them again before checking the measurements.

2.0.3 REMOVE & SAVE THE PARTS:

Label a gallon size zip lock bag with the year made, manufacturer and model number of the guitar. Remove the strings from the guitar and put them, the bridge pins, and the saddle in it. *Optional - Remove the tuners & screws and put them in a zip lock bag.* This will make handling the neck much easier.

You've probably already removed the truss rod cover. Put the screws and cover in separate snack size zip lock bags, and put them in the gallon bag. Stuff the bag into the guitar sound hole.

Use the 24" straight edge to ***check and record the neck projection after*** the strings have been removed.

2.1 THE PROCEDURE:

2.1.1 CUT THE HEEL CORNER FINISH:

The first, and ***very important*** step, is to use a NEW sharp blade to cut the finish where the heel meets the guitar body. Check the fretboard extension and see if there's any finish connecting it to the top. Unlike most modern guitars, that are built in 2 pieces and assembled after finishing, vintage Yamaha's were assembled and lacquered as a unit, resulting in a radius of lacquer in the corners where the neck meets the body. The 60's & early 70's models don't have much lacquer in the corners. The late 70's, and later, have a lot.

Skipping this step can result in the finish being pulled away when separating the fretboard extension and steaming off the neck, or more than likely not coming off at all. If you're having a tough time getting the neck to come off, stop and revisit this step.

I put (3) layers of 3/4" masking tape on both sides of the heel inside corners. This protects the finish from most slips when cutting the corner, and gives you a visual reference for cutting.

Hold the blade at the lowest angle possible with the side of the scalpel rubbing on the tape on the guitar body, cutting the finish in the corner and into the wood to be sure you're thru the lacquer, and if the heel is glued to the side of the guitar it reduces the chance of tear out being visible. Don't forget to cut the finish at the heel end. Some of the Yamaha FG's have a piece of black purfling at the bottom of the heel. This will separate with the steam, so cutting down there isn't really important but it can't hurt.

*** If the guitar has a white plastic heel cap, it needs to be cut at the body, otherwise the steam will not separate it from the binding (like it does the black purfling) and pushing/pulling the neck off will damage the binding. Been there done that. It gets ugly. Use a thin sharp blade or saw to cut where it meets the body.

2.1.2 SEPARATING THE FREBOARD EXTENSION:

Start by putting pieces of 2" painters tape on both sides of the top next to the fretboard, around the edges of the sound hole to prevent the spatula from scraping it, and over the bridge (to prevent scraping the bridge and the pin holes from ripping up your knuckles). If you polish the bottom of your spatula you should be able to not use the tape on the sides of the fretboard, which will reduce the chance of it digging into the top.

Place the heat shield around the fretboard, and use the 75W halogen light to heat the end of the fretboard, with the center of the light placed about 1" to 1-1/2" above and 1" from the end. Let the light do the work. If the fretboard has binding put the light about 2" to 3" away to not melt it.

After 5-10 minutes remove the light and heat shield. Try to push the spatula under the end of the fretboard. It may go in slightly, but probably not. If it's heated properly the spatula should take moderate force and wiggle to push it under, as the glue softens. If it isn't hot enough the spatula will cut the bond between the fretboard and top, causing splinters, gouging or dig into the top or fretboard. This happens often since the glue doesn't seem to soften much.

Be careful to push straight in to reduce the chance of digging into the wood under the fretboard or possibly catching the rosette parts. I mostly push it in from the sound hole end of the fretboard. You can push in a little from the sides, just to free up the edges to reduce tear out, but don't go too far and come out the other side, it can result in tear out of the top on the sides of the fretboard. Look closely to be sure you're going between the 2 woods, not into the fretboard or the top.

If it's not ready, reapply the heat shield and light. Check every 5 minutes. Once a section is loose, move the guitar farther under the light and repeat the process until you've loosened up close to the 15th fret. Don't worry about the last 1/2" to 3/4", that's where the neck dovetail is.

Separating the fretboard from the top isn't easy. It takes time and muscle. Let the heat do the work. This part is a 20 to 120 minute job, with most of that waiting for the heat to do its work. And don't overheat the fretboard, too much heat can loosen the glue between the top and neck block.

2.2 REMOVING THE NECK:

Once the fretboard is separated from the top, the neck needs to be separated from the guitar body. The glue holding the dovetail joint must be loosened. This is done with steam. You want the heat and moisture from the steam to soften the glue, but too much heat and steam (and water) will damage the finish on the guitar or loosen other joints.

2.2.1 REMOVING THE 15TH FRET:

The first step is to remove the 15th fret (for a 14 fret guitar) that is almost directly above the gap in the neck joint. I say almost because the gap in a vintage Yamaha FG is off set 1/8" to 3/16" towards the heel. I start with a small chisel to get under the fret at the treble end. Then use a sharpened end cutting cutter is required to pry up the fret. This can be bought or you can make one. You can apply heat to the fret with a soldering iron to reduce the amount of fretboard chipping when removing the fret, and soften any glue if it was retained with glue, although I've never seen a vintage Yamaha fret glued in. Adding a little water to the fret will generate some steam, softening the wood, further reducing the chance of chipping. Stew Mac's Chip Stoppers also work well, and may eliminate the need to use the soldering iron. I rarely use the soldering iron or chip stoppers. Don't try to remove the fret too quickly or you'll distort the curvature of the fret, making re-installation difficult.

Put the fret in a snack size zip-lock bag and put it in the gallon size bag with the other guitar parts and strings.

2.2.2 DRILLING THE HOLES:

The next part can be kind of a mystery. Drilling 2 holes thru the 15th fret slot into the small space between the neck and the neck pocket. It's somewhere below the 15th fret but isn't always lined up with it. In the case of vintage Yamaha FG's, it isn't. The pocket is 1/8" to 3/16" toward the heel. The (2) 3/32" holes are drilled 3/4" left and right from the center of the fretboard, into a narrow pocket typically 1/16" to 1/8" wide. I've seen a gap less than 1/32", so there's not a lot of room for error.

The holes need to be drilled angled slightly back towards the heel to hit this pocket. Start with drilling straight in, then angle towards the heel about 10 degrees. Drill until you feel the drill break into the pocket. Don't drill any further after you hit the pocket, the needle will fall into it and block the flow of steam. Most of the glue in the joint will be at the bottom (pushed down at assembly), so it's important to get the steam down there. But it's important to know that you're actually in the pocket between the neck and neck block, not just drilling a hole into solid wood.

Once you've broken into the pocket you can walk the drill side to side a little to make it easier to get the steam tip in.

Verify your steam tip fits in the hole before turning on the steam!

2.2.3 NECK REMOVAL JIG:

Most people use some kind of neck removal jig. It holds the guitar securely and has a screw with a large knob that presses on the heel to push the neck out of the dovetail. The problem with the jig is it covers parts of the top and bottom. Steam can escape from between the fretboard and top, and between the neck heel and guitar body. The high temperature of the steam will cause the lacquer finish to "blush", turn cloudy or white, due to softening the finish and letting moisture in. I've found a hair dryer can get most of it out, but not always all of it. Wiping the hot condensed steam quickly can help, but the neck jig can make that difficult. Here is my **Neck Removal Jig**.

Some people are able to put the steam in, wiggle the neck and get it to release. While I'd like to remove the neck without a neck jig, I've found the vintage Yamaha FG's have a very tight joint and have too much glue in the joint and heel area to do it without it. You **absolutely** need to use a neck removal jig if you want a chance to remove the neck of a vintage Yamaha. Don't skip this step.

Be sure to firmly clamp the guitar in the jig. Any slack with cause the guitar to be pushed up and the screw will run out of travel. Position the guitar in the jig so the screw is central to the heel and ¼" behind the joint. I use (2) 12" bar clamps to clamp the jig and guitar to the table, with 2 pieces of 2x2 under the jig to lift it off of the table to allow clamping. This method makes it much easier to wiggle the neck without struggling to hold the guitar too. Use a small clamp at the end of the fretboard to hold it down so the steam doesn't escape at the sides of the fretboard. This helps reduces possible blushing on the top.

2.2.4 STEAMING:

Fill the water reservoir in your steam generator about half full, that reduces bubbling too much water into the joint.

I built a **Steam Trap** to reduce the amount of water getting into the joint. The needle valve allows precise adjustment of the amount of steam. I warm up the steam generator with the valve ½ turn open, when it mostly stops spitting water I close the valve and open it 1/8 turn.

Turn the control knob of the steam generator to the full on position. Hang the steam hose into a 5 gallon bucket while it's heating up. It will spit hot water at first, then becoming more steam than water. It will be ready to use when it is fully spewing steam with the rare spit of water. Without a steam trap you will have to turn the steam generator control as low as possible but still allow enough steam. On mine it's a fine line between nearly full steam and nothing. That's why I designed and built the **Steam Trap**.

Put on your glove! Turn the control down to where there is still a noticeable flow of steam (half or less than full flow). Insert the nozzle into one of the holes for a minute and see that there is steam escaping from the other hole. Then insert the needle into the other hole for a minute, observing that there is steam coming out of the first hole. It's possible you've drilled the holes into solid wood or the hole went thru the pocket into solid wood.

Watch the flow of steam out of the other hole and be sure steam is always flowing. Pull the needle out slightly if the steam stops when the needle is fully inserted.

Alternate holes every minute. Be sure to watch where the steam is escaping and wipe it up quickly with a soft towel.

After a minute or 2 of steaming, steam should be escaping at the bottom of the heel. Then tighten the screw on the jig every minute, even if there is no movement.

After about 4 minutes remove the clamp on the end of the fretboard and wiggle the neck with a combination side to side & up down motion, 2 or 3 revolutions, and see if the there is any movement in the neck joint.

If there is no vertical joint movement, tighten the neck jig screw more and let the steam work for another 30-60 seconds and wiggle it again. The wiggling will help expose areas that haven't been touched by the steam and get it to release sooner.

Repeat until you see a slight gap on the sides of the heel and under the fretboard. If there is no movement after 6 minutes turn off the steam and verify you've completely cut thru the lacquer all the way around the heel.

Once the neck has released enough to see a slight gap under the fretboard; turn off the steam, remove the needle, and hang it in the bucket. Continue to wiggle, and tighten the neck jig screw if necessary, until the neck comes off.

Don't force it. It is possible a little of the neck dovetail will tear off and remain in the internal dovetail. It is **very possible** some of the side of the guitar will remain attached to the face of the heel, the steam can't get in there. They used a lot of glue in the construction, they probably didn't want it coming apart too easily.

Too much heat and steam can cause the heel to crack or delaminate (separate into 2 pieces) where it was glued together. It's also possible the heel could break and separate if the top of the heel releases and the bottom doesn't. Getting the piece of broken heel out of the guitar is much harder, multiple holes will need to be drilled into the joint to get steam into more areas. **A LOT** of pressure from the screw with be required with the neck jig. It's also possible the fretboard can separate from the neck.

2.2.5 CLEANING UP THE GLUE IN THE DOVETAIL:

Once the neck is off use a scraper or chisel to scrap off the old glue on the 2 parts of the dovetail. It's much easier to do while the glue is hot and soft.

2.2.6 WAIT:

Set the 2 parts aside for 1 to 2 days for them to dry.

2.2.7 MINOR REPAIRS:

Use Titebond to glue any loose pieces/fibers of the top on the top or under the fretboard. Be sure to get them back tightly and exactly where they were, otherwise it could make reassembly difficult later. Remove any small misplaced fibers. This can be done any time after removing the neck. You can also use a hair dryer to evaporate the water in the wood if it's really wet, just let it cool before gluing.

2.2.8 REMOVE TRANSFERRED WOOD:

Use a spatula or chisel to remove any wood that remained stuck to the wrong side after the neck removal. Be very careful to not remove any of the base wood. Do this ASAP after the neck is removed, it is much easier to do while the wood and glue are hot and wet. Any wood transferred from the sides of the guitar to the face of the dovetail **MUST** be removed. If a piece of the side of the guitar is completely removed, superglue in a piece of wood in the gap and chisel/sand it flush. You won't be able to sand the heel if there's a gap or a bump.

2.2.9 REMOVE THE LACQUER RADIUS:

The radius of lacquer remaining on the sides of the guitar (from cutting the heel joint) **MUST** be carefully scraped flush to be able to pull sand in the next section.

Use ¾" painter's tape to protect the finish next to the ridges.

Use a razor blade to carefully scrape the lacquer flush (or very close) to the existing finish.

It may not be necessary to scrape the radius on the sides of the heel, depending on how much material needs to be sanded off to correct the neck angle.

2.2.10 CLEAN UP THE JOINT:

After the wood has dried, use your sanding stick to smooth the dovetail surfaces, any remaining glue or pieces that remain stuck from the other side of the joint.

2.2.10 REFIT THE JOINT:

After everything has dried, fit the 2 parts together and be sure the neck will go completely back in with the fretboard flush on the top. Remove any high spots in the dovetail or under the fretboard as required. Verify the neck projection you recorded before removing the neck (without strings). Some sanding of the dovetail surfaces will be required to get the joint to fit back together. Be sure the fretboard is flush with the top before continuing.

CONGRATULATIONS!!!!! You've completed the easy part of the neck reset. ***The more critical part is removing material from the heel to change the neck angle and shimming the dovetail to get it to stay there.***

3.0 RESETTING THE NECK ANGLE:

The neck angle is reset by removing a wedge from the heel of the neck. This is calculated using the numbers you recorded in the earlier steps before the neck was taken off. ***Be sure the neck relief is set flat before starting.***

3.0.1 FORMULA:

Material to be removed off of heel = (Optimal Saddle Height – Existing Saddle Height) + (Existing Action – Optimal Action x 2) / 3. Let's say the optimal saddle height is .150, the existing saddle height is .062, the existing action is .125, and the optimal action is .093. The formula is:

(.150 - .062) + (.125 - .093 x 2) / 3 = .051 wedge off of the heel

.088 + .064 / 3 = .051 wedge off of the heel

.152 / 3 = .051 wedge off of the heel
So the wedge off of the heel = change at the saddle + (the change in action x 2) / 3

The change in the action has to be multiplied by 2 because that number needs to be in relation to the saddle height, which would be twice the distance from the 12th fret.

The division by 3 is actually a ratio of the height of the heel to the distance from the top of the heel to the saddle.

It's possible the additional pull on the neck of the higher saddle (vs. the old saddle that you took the measurements with) will cause additional deflection of the neck, requiring a slightly larger wedge off of the heel. Installing the proper height saddle (.150 above bridge) to get measurements will give more accurate results. Lately I've been using an even higher saddle (.200) assuming that after the neck reset is finished there will be some movement in the guitar and a little of the saddle will need to be removed.

Never remove the whole wedge and assume it will come out perfect. Remove 60-70% of it, clamp the guitar in a neck jig, add some string tension, and check your measurements to see if they agree with what you've done so far. And do the calculations again. More on that later.

Optionally, ***with much less math*****,** remove material off of the heel until the neck projects 5/64" (.08") above the bridge. If you're using a higher saddle (.180" to .200") you'll have to adjust the .08" to .11" & .13" So, if the neck projects .09" below the neck: **(.09** *(WHERE YOU ARE)* **+ .08** (WHERE YOU WANT TO BE)**)/3** = .17"/3, which equals .057" off of the heel. Check the projection by clamping your precision scale to the end of the 24" straight edge. Adjust the

position of the precision scale until it just touches the top of the bridge. This is done because it is difficult to hold the neck firmly against the guitar, while holding the 24" straight edge firmly against the fretboard, and get a precision measurement from the bottom of the straight edge to the top of the bridge. Be sure the heel and fretboard extension are held firmly against the guitar, any gap with affect your numbers.

3.0.2 FRET LEVELING (AND THE 14TH FRET HUMP):

The frets really should be level before starting a neck reset, AFTER the neck has been removed, and BEFORE verifying your neck projection numbers. Any fret can be high or low, resulting in buzzing after the action has been lowered (lowering the water to expose the rocks). Frets with divots should be leveled or replaced. Also, many vintage acoustic guitars will have a rise in the fretboard in the 12th to 16th fret area – the "14th fret hump". Lay your straightedge on the fretboard. If it contacts the 1st & 14th fret area, you have the "14th fret hump". These frets will need to be levelled, crowned and polished or the strings will buzz when playing down the neck. If you'll never play up there you can just level them with a large flat file. Check often to be sure you don't take too much off. You want the 12th fret to be level with the rest of the fretboard for your action measurements. Levelling other frets can be a little more complicated. See my **Refretting A Vintage Yamaha FG** guide for more info.

3.1 REMOVING THE WEDGE:

3.1.1 MARKING THE WEDGE:

Before removing the wedge you'll need to mark the amount to be removed on the end of the heel. Some people place the heel on a flat surface, place the right amount of feeler gages against it, and scribe a line. I don't like that because the scribed line is permanent. Also if you slip you've got a nasty scratch. I prefer to use ¾" painters tape. Use your calipers or feeler gages to get a feel of the distance required. Stick the tape to the bottom of the heel, checking with the calipers that distance is correct. If not, adjust the position of the tape.

3.1.2 UNDERCUTTING THE HEEL:

You don't want to have to sand the whole surface of the heel. If you look closely you'll see the heel has probably already been undercut or tapered to reduce the surface area. Depending on how much of a wedge you're removing, you'll need to undercut this further. I use a Dremel with a 1/8" ball burr bit. You can use a small chisel also. Remove material as required, leaving a 1/16" to 3/32" wide untouched flat. That is the area you will be sanding.

3.1.3 SANDING THE WEDGE:

Before sanding the wedge, it's best to file a flat on the end of the heel to the level of the tape. This prevents the pull sanding from pulling small chunks out of the end of the heel, or if there is a plastic heel cap, prevents it from being popped off the heel.

Even though you're removing a wedge from the heel you can't just mark a straight line to the top of the heel and create a perfect triangle. The wedge needs to follow the contour of the guitar for it to fit and look correct. This will be done by putting the 2 parts loosely back together and inserting the 120 grit 1" wide strip of emery paper (backed with strapping tape) in the heel joint on one side (all the way up to the top), press the neck firmly into the joint, and pulling the emery paper downward. The pulling must be straight down or slightly towards the back of the guitar to prevent rounding of the heel. This is where the glove is used on your pulling hand. The pull is done with a rolling motion on the pinky knuckle. Without a glove this gets painful quickly, and the gripping of the emery paper can tear up your fingers.

Be sure to put a piece of ¾" painter's tape on the side of the guitar at either side of the heel to protect the surface from scratches. Strips of 2" painter's tape on the back of the guitar will protect it from your knuckle and possible contact with the emery paper.

Pulling the emery paper thru the joint will remove more material at the bottom than the top, creating the wedge. It's important to remove the material evenly from both sides of the heel, otherwise the heel with end up rocking. Do 5 strokes on one side, then 5 on the other.

Check your progress often, both the contour of the heel fit and the amount taken off the heel end. At some point you'll notice the heel won't sit flat on the guitar, it's rocking back and forth, and the emery paper pulls out at the bottom without cutting. If you didn't file the end of the heel to the tape, there is a step in the heel because the emery paper can't reach the center of the heel. This will need to be removed by sanding or filing. Do this carefully.

I've found you can't adjust the action of one side and not the other by taking more material off one side. That just results in the heel rocking on one lower corner and the opposite upper corner. You can use the neck jig to clamp the heel flat to the side, but you also risk breaking the heel if it is distorted too much. Pull sanding the heel can **ONLY** adjust the neck angle because the fretboard is pivoting at the edge of the top. It isn't possible to adjust the neck in any other way without distorting the heel and forcing it to twist slightly.

3.1.4 CENTERING THE STRINGS ON THE FRETBOARD:

You need to check that the fretboard is central to the bridge pins holes a few times while you're sanding the heel. This affects the centrality of the strings on the fretboard. It's possible to remove more material on one side than the other and have the strings end up off center. It doesn't take much, .005 extra sanding on one side can result in the fretboard being .028 off center. To adjust the fretboard centering you need to take an equal amount off of the WHOLE heel on the side opposite where the neck centerline is pointing.

Put a strip of ¾" painters tape on the fretboard between the 1st & 2nd frets, between the 12th & 13th frets, and on the bridge in front of the saddle. Be sure the tape does not sit above the frets or it could cause buzzing/muting later. Use your precision scale and carefully measure the fretboard at the first 2 pieces of tape and make marks in the exact center of the fretboard with the fine tip black marker. Then find the center of the bridge by measuring the distance between the 2 center holes and marking the exact center on the tape.

Assemble the neck into the dovetail and be sure it is seated fully down (fretboard against the top) and against the guitar body (both sides), and hold it there.

Use a 24" straight edge to project the 2 marks on the fretboard to the mark on the bridge. Measure the difference between where the straight edge projects and the actual center mark on the bridge.

If the difference is less than 1/16" don't worry about it, you'll probably never notice it. If it is more you'll have to remove some material off of the WHOLE side of one side of the heel to move the neck over to recenter it.

It doesn't take much. It's a ratio of the width of the heel (2") to the distance from the heel to the bridge (11")**.** About 1:5.5. So removing .010 off one side of the heel will *theoretically* cause .055 movement of the projection to the bridge center. Removing material off of the left side of the heel (the same amount across the whole surface, NOT a wedge) will cause the projection to move right.

Use a black marker to color the whole surface of the side to be removed. Use a sanding block or file to just remove the black marker evenly and all the way up to the fretboard. You'll probably have to do this a few times. Check your progress often.

After removing material from side of the heel you may have to pull sand both sides of the heel a few strokes to get the contours to match again.

Assemble the 2 parts and check the centering with the 24" straight edge again. It doesn't have to be perfect, you'll check it again with strings on in the next step.

3.1.5 CHECKING YOUR PROGRESS:

After removing about 60-70% of your estimated material you need to check the neck angle by either partially stringing up the guitar, or checking the neck projection. Assemble the 2 parts, making sure the fretboard is fully seated against the top and the neck is fully seated against the body (no rocking, see sections 3.1.7 and 3.2.2).

Clamp the guitar lightly in the neck jig. Verify the heel is flush against the guitar body. Use only enough clamping pressure to hold it there, too much can distort the guitar and your measurements.

Check the neck angle (projection) to the bridge (with no string tension), the goal is about .080", but at this point the straight edge should project to about the top of the bridge to slightly below, depending on how bad the neck angle was before starting. If there is more than .02" difference between the (2) E neck projections, see section 3.2.2.

With the proper height saddle in place, install both E strings, tuning them to D (so the strings last longer). Or use your 24" straight edge to project the neck to the top of the bridge.

Check the string centering by visually sighting the strings from the edges of the fretboard. Check with the 6" precision scale if needed. Or check the projection of the 3 marks on the pieces of tape.

Check the action for both E strings at the 12th fret, the goal is to be about .050"/.060", assuming when fully strung the additional 4 strings will result in the action rising another .03"/.04", to .09", but at this point the action should be at least .09", depending on how bad the neck angle was before starting. This is just a guesstimate, some necks with be stiffer or more flexible with full string tension, requiring in slightly different numbers with 2 strings.

Record these values and recalculate the amount of wedge that needs to be removed. Don't forget to take the actual height of the saddle above the bridge into account. Adjust the position of your tape on the heel if necessary.

You can also install all 6 strings and tune them 2 steps down. This will result in action numbers very close to final. Be sure the fretboard is flush to the top and there's enough clamping pressure to hold the heel flush to the side, but not too much to possibly distort the guitar. ***I find this is the best way to check your progress, using the neck projection only for reference.***

3.1.6 FINISHING THE WEDGE:

Go back to *3.1.3 SANDING THE WEDGE* and repeat all steps until the action measures .050"/.060" for both strings (with both E strings tuned to D in the neck jig), or a little more depending on how much above .150 the height of your saddle is. You can clamp the guitar in the neck jig and install all the strings but only use enough pressure to hold the heel flush to the side of the guitar, or it can distort the guitar and possibly throw off the measurements.

3.1.7 POSSIBLY SANDING THE FRONT OF THE HEEL:

You might notice the heel won't sit flush with the body, it rocks on the center of the heel. Depending on how much clearance there was between the front of the heel (at the dovetail) and the back of the neck pocket, there's a chance that sanding the face of the heel will eventually cause the front of the heel to hit the back of the neck pocket. This happens typically after sanding a .06" or greater wedge.

You'll have to take the neck to your belt sander and sand a taper in the front of the heel to add more clearance. Be careful to not hit the side of the fretboard on the sanding belt.

3.2 PROBLEMS:

Assuming you've got the strings centered on the fretboard, possible problems include:

3.2.1 ***Overset the neck:*** The strings are too low on the fretboard because the neck is set back too far. You can put in a taller saddle, but for most guitars you don't want to go too much higher than .200 above the bridge, too

steep of a break angle could split the bridge at the saddle slot. It depends on the depth of the saddle slot and how close to the bridge pins are to the saddle.

The other option is to sand a reverse wedge, taking material off the TOP of the heel to tip the neck forward very slightly. This is difficult to do evenly because you have no way to measure how much you are taking off. Only clamping the guitar in the neck jig and restringing will tell you how you have done. Doing this affects the intonation very slightly because you are shortening the scale length.

3.2.2 ***The action is too high on one side:*** If the before neck reset action was the correct 1/64" higher on the bass side vs. the treble side (assuming the saddle was 1/32" higher on the bass side), and now it isn't, it's possible too much material was taken off of one side of the heel, causing the neck to be tipped back too far only on one side, AND the heel is probably rocking slightly. The neck jig is clamping the heel to the guitar and distorting it, causing the heel to twist, resulting in a possible change of action on one side, or the neck centering to be off.

If the difference wasn't the correct 1/64", it is what it is. We're working on 40+ year old guitars. Over time, and 40+ years of string tension, can cause the guitar to distort. The neck block can tip forward or the top to cave in slightly. This is why a neck reset is required. Uneven movement in the top, or a slight twist in the neck, can cause the action (or neck projection) to be out of the normal range on one side. Since a neck reset can only adjust the neck angle, any abnormal difference in the action on one side will have to be fixed at the saddle.

As mentioned in section 3.1.4, you can adjust the centering of the neck by sanding a very small amount off of one side of the heel. But that can change the intonation, since you're shortening the scale length very slightly.

3.2.3 FINAL NOTES ON RESETTING THE NECK ANGLE:

The measurements and calculations are just a best guess. There are too many minute variables that can affect the final neck angle. Some necks are more or less flexible than others and will bend differently under full string tension. The same goes for the guitar top (to a lesser degree), the higher saddle may cause the top to "belly" and lift the bridge slightly higher. The only way to tell is to go through the complete procedure and string it up to see what the final result is. There's a chance you may have to take the neck off and do it again.

3.3 SHIMMING THE DOVETAIL:

After the neck angle has been set, the dovetail must be shimmed to keep it there. Because material that was removed from the heel was done as a wedge, the shims will be tapered also.

3.3.1 APPROXIMATE SHIM THICKNESS:

I've developed a formula to determine an approximate shim thickness, as a starting point. The shims will need to be sanded to get the proper fit. Vintage Yamaha's have a 10 degree dovetail angle. A .040 wedge off of the heel equals a .007 thick shim. If your shim material is .021 thick, it should work with up to a .120 removed heel wedge.

3.3.2 SHIM LENGTH AND WIDTH:

Since the majority of the material removed off of the heel was at the bottom, the shims do not need to be full length. It's OK for the top of the dovetail to be a little loose. Without that, you'd never know when the bottom is tight. Cut the shims about 3/8" wide (to have full contact with the full width of the dovetails) and about 1" long.

3.3.3 ATTACHING THE SHIMS:

I use regular superglue to attach the shims. They should be clamped in place to be sure they don't have any gaps under them. You can use pieces of Popsicle stick and spring clamps. PRACTICE the clamping once or twice before gluing! Let the assembly sit for 10-15 minutes to be sure the glue is set up.

3.4 SANDING THE SHIMS:

3.4.1 CHECK THE FIT:

Be sure the mating dovetail surfaces are smooth, without any bumps or glue residue. Assemble the neck to the guitar. The neck should not go all the way into the dovetail. If it does you need more shims.

I use a strip of carbon paper (approx. 3/8" wide x 8" long) to check were the neck and body dovetail are contacting. Lay the strip of carbon paper, carbon facing in, inside the body dovetail, leaving the excess bent towards the guitar top. That will help hold it in place, it doesn't take anything to blow or knock it out of place.

Insert and remove the neck from the dovetail.

Sand the black patches on the neck dovetail with your small sanding block, removing only the black areas.

Repeat the process until the neck is fully seated, with the fretboard flush to the top. As the process is repeated the black patches should get larger, indicating more contact surface. It needs to be a snug, but not forced fit, with a large amount of contact surface. It's OK to have a little slop if you pull at the top of the dovetail, but the bottom must be snug with no movement (well, .010" max.) and the heel flush to the body all the way around, but no force should be required to fully seat the neck. If the fit is too tight (or forced) the glue will cause the joint to swell slightly causing a heel gap that will probably not close when the glue is dry.

3.4.2 FINAL CHECK:

With the neck fully seated, check the unstrung neck projection. It should be about 5/64" (.08") above the bridge on both sides, depending on the height of your bridge.

Put the guitar in the neck jig and fully string it (2 steps down) with light clamping pressure. The shims should hold the neck in place with no more than a .015" heel gap if the clamping is removed. The glue will fill the very slight gap and make the joint tighter.

Check the action. This should be the final number, or a little more (.025" max) if there is a very slight (.015") heel gap. With the .150 high saddle the numbers should be very close to where you want them. After gluing there may be a very slight change. The heat and glue will cause the joint to swell slightly and the glue will probably keep it there.

4.0 PUTTING IT BACK TOGETHER:

4.0.1 PUTTING THE 15TH FRET BACK IN PLACE:

It's easier to reinstall the existing fret while the neck is off. The bottom edge of the vintage Yamaha frets have grooves crushed in them, unlike modern frets that have bumps crushed in the sides. There's no tapered part to allow the fret to be easily start pushing it back in the slot. The fret must be lined up perfectly and crushed in with great force. If you put it back in with the same orientation as it was originally, the existing grooves should line up.

4.0.2 RESHAPE THE FRET:

Before the putting the fret back in place it needs to be set back to slightly more than the fretboard curvature. You can bend it with a couple pairs of pliers, but be sure to put something around the fret (like a rag) to keep it from getting chewed up by the pliers.

4.0.3 CLEAN AND RESIZE THE FRET SLOT:

Measure the fret tang with calipers. A vintage Yamaha FG fret tang should be .020", except .030" for some models made in 1969 & 1970. Use feeler gages to check the size of the fret slot. Move up .001 at a time until a .020" (or .030") feeler fits all the way across, all the way to the bottom. Optionally, for .020" slots, use a .015"/.016" thick fret

slot resizing saw to clean up the slot quicker, but be sure to check for the proper size with the feeler gages. Or you can make a fret slot resizing saw out of a hacksaw blade; Grind off a 2-1/2" to 3" section of teeth (halfway thru the width of the blade) leaving a 3/8" to ½" length of teeth remaining, sand the width of the teeth on emery paper to reduce the width to .015"-.016". The saw needs cut on the **PULL** stroke, not push.

4.0.4 PLUG THE HOLES IN THE FRETBOARD:

Next the holes you drilled in the fretboard need to be plugged. UNLESS you need to keep the vintage look of the fretboard, then don't plug them and live with the slight hint of the holes. Lay the removed fret upside down over the fret slot, if the drilled holes are barely noticeable don't bother plugging them.

Put a piece of painters tape on the bottom side of the fretboard, below the drilled holes.

I found a translucent water jug that was made from the right thickness (.018") plastic that fit in the fret slot. On a scrap piece, **test that your superglue DOESN'T stick to the plastic**! Cut a ½" wide x 2-1/2" long piece and fit it in the fret slot, all the way to the bottom. If your fret slots are .030" you'll have to fill one side of the hole at a time and back up the plastic strip with a .010" feeler gage.

Put ¾" painters tape on the fretboard on either side of the holes to minimize the amount of superglue that needs to be scraped off later.

Use a toothpick and pack rosewood dust into the holes and drop in water thin super glue. Use the toothpick to quickly poke and pack the mixture. Add another layer as required to be sure the plug extends above the top of the fretboard. Wiping some rosewood dust over the wet super glue typically causes it to set instantly.

Remove the tape from both sides of the fret immediately and then carefully remove the piece of plastic from the slot.

Repeat if filling a .030" slot.

Put 2" painters tape on the adjoining frets to protect them from sanding. Use a razor blade to scrape the surface flush and use fine sandpaper to smooth the surface. Be sure there are no voids.

Remove the painters tape from above and under the fretboard.

Use your fret slot saw and feeler gages to be sure the slot is .020" (or .030"). You will probably have to open the slots slightly.

4.0.5 PUT THE 15TH FRET BACK IN:

Use a small file to make a .015"/.020" x 45° chamfer on the 2 edges of the fret slot. This will make tapping the fret back in easier.

Hold one end of the fret with the fingers in one hand, line up the other end of the fret with the end of the fretboard, and use a plastic tip hammer to tap the fret slightly into the slot. It will not be easy to get it started. Once it is started tap the fret in slowly across the top surface. Don't try to go too deep too fast, you could change the curvature of the fret, or it will fall over and chip the fret slot.

Be sure the fret is centered in the fretboard. If it isn't, carefully remove it, spin the fret 180 degrees, and try again. Obviously you don't get more than 2 tries at this.

Once the fret is partially in the slot and the hammer won't drive it in any further, use the channel-lock pliers and wood scraps (one on the fret and one under the fretboard) to crush it in a little at a time, going evenly.

If one end will go down but won't stay seated, wick water thin super glue into the raised area under both sides of the fret and quickly clamp it down. It should set up in a couple of minutes, hopefully not attaching your clamp to the fret or fretboard. Use a razor blade to scrape the super glue off of the fretboard.

4.0.6 OR REPLACE THE 15TH FRET:

Another possibility is to replace the fret. It's a bit more work but it's easier than putting the old fret back in.

LMII FW-74 is a very close match for the .020" slots.

For .030" slots, the largest fret wire available today is only .024", possibly requiring gluing them in. Dunlop 6260 is very close with a .024 tang, although the tang width is slightly smaller than Yamaha's. All Parts LT-0473-000 is the same as Dunlop 6260. Dunlop 6200 is a slightly softer version of Dunlop's 6260 except the tang width is the same as Yamaha's. I would recommend this fret wire, less chance of it needing to be glued in. For a complete refret for guitars with .030" frets I use LMII's FW75. The crown is wider, it wouldn't look good for individual fret replacement.

Cut the piece of fret wire ½" longer than needed gives you a place to grab it with pliers to hold it straight while tapping it in. Be sure the curvature of the fret wire is slightly more than the fretboard so the ends won't end up sticking up. Don't forget to file a slight chamfer on the fret slot to make it easier to get the fret started.

Tap the fret wire in with the plastic tip hammer. You'll then need to cut and file the ends of the fret, use a file to level the top with the adjoining frets, crown it, and sand/polish it smooth.

4.1 GLUING THE NECK:

Practice your clamping before gluing. I use my neck clamping jig with a spring clamp to hold the fretboard down, and a 6" screw type bar clamp to hold the fretboard down at the heel. Quickly install both E strings to pull the top of the heel into the guitar. Be sure to leave some room to be able to clean up glue squeeze out while it's wet.

4.1.1 THE GLUE:

I recommend hot hide glue. It's what instruments where built with for centuries (although synthetic adhesives have greatly reduced its use recently), is easier to take apart, bonds to other glues, is very stable, and smells awful (it's made from boiled animal hide).

But lately I've been using Fish Glue, which is similar to hot hide glue, with the advantage of longer open time, but can be a little harder to take apart and the squeeze out is very sticky and harder to clean up. It's also less tolerant of high humidity. But the neck joint is fully enclosed and the chance of moisture getting in there is zero.

Titebond will work but it is a little harder to take apart, has longer open time, but tends to "creep" under high loads (such as attaching a bridge) and only glues to wood, not existing glues (surfaces must be free of old glue).

4.1.2 GLUING:

Titebond and Fish Glue just need to be applied, the parts assembled and clamped, and clean up the squeeze out.

Hot hide glue needs to be mixed and heated for it to work properly (see ***Working with Hot Hide Glue*** guide). The areas to be glued (both parts) need to be heated with a hair dryer or an incandescent light. When hide glue gets below 95 degrees it gels and no longer sticks. **The parts must be warm when the glue is applied.**

Before gluing check your neck centering and projection one more time.

When the glue is ready and the parts are warm, ***QUICKLY*** apply the glue with a ½" acid brush to the lower dovetail surfaces and the bottom of the fretboard on the neck. Quickly does not apply if you're using fish glue.

QUICKLY assemble the 2 parts fully, use the spring clamp to hold the fretboard down, install the guitar in the neck jig, add the 6" bar clamp over the dovetail area, install both E strings, and be sure all surfaces are flush. The strings can get tangled and be difficult to separate to be installed quickly. Fish glue makes this part easier, and you can install the A & B strings to have more pull to seat the top of the neck.

It's possible the heat and glue will cause the dovetail surfaces to swell slightly and there may be a very small gap between the heel and the guitar body if the fit was too tight. This will not change when the glue is dry.

Use a wet paper towel, Q-tip or tooth pick to remove any squeeze out before it dries. When hot hide glue gets below 95 degrees it turns into a brown sticky Jell-O-like (gelatin) substance, which greatly reduces its bonding strength. Gelatin is also used in marshmallows and pharmaceutical capsules. So hide glue and Jell-O are basically the same thing, although Jell-O is food grade (more refined). Chew on that.

CHECK the heel gap and BE SURE the heel is flush to the side of the guitar! Check an hour or two later, if possible. The glue can cause the joint to swell. A gap at the heel will throw the neck projection of and increase the action. If there ends up being a .015" heel gap you will want to remove the neck and try again. A .015" heel gap = .045" change at the bridge = .022" increase in the action.

Let the glue dry for at least 12 hours before removing the clamps. Wait at least 1 day before stringing the guitar.

5.0 THE FINAL STEP!!

After installing all 6 strings and tuning to pitch, check the neck projection and action for both E strings. Be sure the neck relief is correct. With the strings pressed at the first fret, for normal action I like to see 5/64" (low E) & 1/16" (high E) at the 12th fret. For low action (fingerstyle & light strumming) 1/16" low E & 3/64" high E.

Let the guitar hang for 1 to 2 weeks before making any adjustment to the saddle. Then sand or replace the saddle to get the numbers you want. The final height of the saddle from the bridge should be between .12" & .18". Up to .20" is OK in some cases. Neck projection should be within 1/32" of each other.

If the numbers are outside that range you should probably take the neck off and do it all again. Nobody said this was going to be easy.