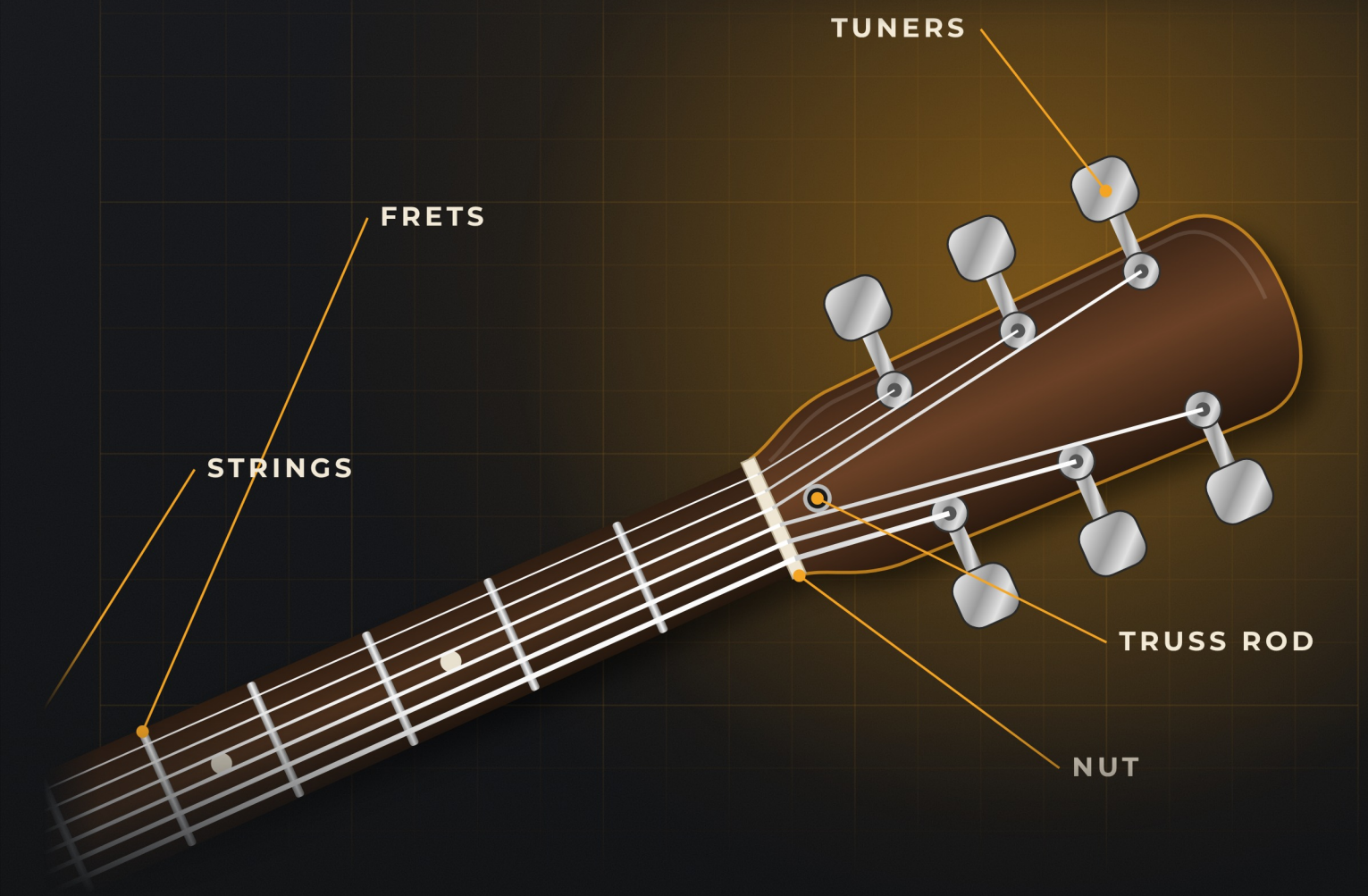
SECOND EDITION - ILLUSTRATED

A PLAIN-SPEAK GUIDE

GUITAR CARE AND MAINTENANCE

Cleaning, Stringing, and Keeping Your Guitar Playing Right



CLEAN | RESTRING | HUMIDITY | SETUP | FRET BUZZ

ANDREW DOMINGUEZ

FROM THE BENCH AT TRINFINITY GUITARS

TRINFINITY Enterprises

Guitar Care and Maintenance

A Plain-Speak Guide to Cleaning, Stringing, and Keeping Your Guitar Playing Right

Second Edition, Illustrated

Andrew Dominguez

Guitar Care and Maintenance: A Plain-Speak Guide to Cleaning, Stringing, and Keeping Your Guitar Playing Right

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The care, setup and repair steps in this book are general guidance. Every guitar is different. Follow the maker of your guitar and of any product you use, test any cleaner or polish on a hidden spot first, wear eye protection when you file, sand or solder, and take your guitar to a qualified repair technician when a job is beyond your comfort level. The author is not responsible for damage or injury that results from using the information in this book.

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Guitar work notice. A soldering iron is hot enough to burn you and start a fire, solder and flux fumes should not be breathed, and lead solder is toxic. Work where there is good air flow, wear eye protection, wash your hands after, and keep tools and chemicals away from children. Never open or work inside an amplifier or anything that plugs into the wall. Amplifiers can hold a deadly charge even when unplugged. Take that work to a qualified technician. Changes to an instrument can affect its value and its warranty.

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Introduction

Most guitars that come across a repair bench aren't broken. They're neglected. The strings are dead, the fretboard is dry, the action has crept up, and the owner thinks the guitar has gone bad. In most cases a little care would have kept that guitar playing right the whole time.

In more than 20 years of working on guitars, I have seen a lot of damage that a few minutes of care would have prevented. Here in the dry Nevada air, a fretboard can dry out and crack. Electronics corrode, and a neck left out of adjustment can turn buzz into real fret wear. I wrote this book to give players simple habits that keep an instrument playing right for decades.

This book is about that care. I build, repair and modify guitars, and I wrote it for the player who wants to look after their own instrument without guessing. You don't need a workshop or a pile of special tools. You need a few good habits, the right supplies, and a clear idea of what you can safely do yourself and what belongs with a tech.

Who this book is for

If you own a steel-string acoustic or an electric guitar and you want it to stay clean, stable and easy to play, this book is for you. It works for the beginner who just bought a first guitar and for the player who has owned guitars for years but never learned to change strings the right way or read a hygrometer.

Classical (nylon-string) guitars and basses get short side notes where the care is different. Most of what you'll read here applies to them too, but they have a few quirks of their own, and I'll point those out when they matter.

You might ask, "Do I really need a whole book for this?" Not all at once. You can read the chapter you need when you need it. But a guitar is made of wood, glue, metal and finish, and each of those reacts to your hands, your house and your climate. Knowing a little about each one saves you money and keeps you from making the mistakes that send guitars to my bench.

How to use this book

The chapters build on each other, but you can jump around. Chapter 1 helps you figure out what kind of guitar, wood and finish you have. That matters because a cleaner that's perfect for one finish can ruin another. Chapter 2 covers the tools and supplies, from a small starter kit to a fuller bench setup. Chapter 3 is about everyday care and storage, which is where most of the real protection happens.

From there the book moves into cleaning the body (Chapter 4), the fretboard (Chapter 5) and the frets (Chapter 6). Chapter 7 is all about humidity and temperature, which is the biggest single threat to an acoustic guitar. Chapter 8 covers hardware and electronics. Chapters 9 through 11 are about strings: choosing them and putting them on acoustic and electric guitars. Chapters 12 and 13 cover basic setup checks and tracking down fret buzz. Chapter 14 is about travel and shipping, and Chapter 15 pulls it all together into a schedule you can follow, along with the signs that it's time to see a pro. Those fifteen chapters are Part 1. Part 2, Bench Jobs (Chapters 16 through 21), is new in this edition. It takes six repairs a careful owner can learn, smoothing sharp fret ends, fixing a high fret, lowering nut slots, replacing a pot, jack or switch, shielding a control cavity, and checking neck alignment and scale length, and shows each one step by step with the tools you need and the point where you should stop and see a tech.

A few things are set apart in the text so you can find them fast. Drawings show the parts and the steps, so you can see what the text describes. In Part 2, each job opens with a list of what you'll need and ends with a box that tells you when to stop and see a tech. Tips are short ideas that make a job easier. Cautions are warnings about damage to the guitar or harm to you, and you should read every one of them. Tables give you numbers and comparisons in one place. Most numbers I give you, like a humidity range or a string height, come from a guitar maker, a string or care-product maker, or another reliable source. Where a number is my own, I say so. Where the makers disagree, I'll say so and give you a safe middle ground. Keep in mind that some of these companies sell the products they advise on.

The basic idea

Guitar care boils down to four things. Do these and you've done most of the job.

First, keep it clean. Sweat, skin oil and dust build up on the strings, frets, fretboard and finish. A quick wipe after you play stops most of that before it starts.

Second, keep the humidity stable. Wood takes on and gives off moisture all the time. When the air gets too dry or too damp, the wood shrinks or swells, and that's when you see sharp fret ends, cracks, lifting bridges and action that won't stay put. Chapter 7 covers this in detail.

Third, keep fresh strings on it. Old strings sound dull, won't stay in tune and are harder to play in tune up the neck. They also wear your frets faster when they're corroded.

Fourth, check the setup now and then. The setup is how the guitar is adjusted to play: how high the strings sit, how much the neck bows, and whether notes play in tune up the neck. A guitar can drift out of adjustment with the seasons. You don't have to make every adjustment yourself, but you should know how to check it, and Chapter 12 shows you how.

Safety basics

Guitar care is not dangerous work, but a few things deserve respect.

> **Caution:** String ends are sharp, and a string under tension can whip when it breaks or slips off a tuner. Keep your face back from the headstock when you tune up new strings, and consider wearing safety glasses when you cut or wind them.

- Use cleaners, polishes and contact cleaners in a room with good airflow, and keep them away from kids and pets.
- Read the label before you use any product, and test it on a small hidden spot first if you're not sure it's safe for your finish.
- Keep steel wool and metal filings away from electric guitar pickups. The magnets grab the fibers, and they're hard to get back out. Chapter 6 explains safer ways to polish frets.
- Unplug the guitar from the amp before you work on the electronics, and take the battery out of an acoustic preamp if you're going to be in there for a while.
- Use the right size screwdriver or wrench. A tool that's too small slips, strips the screw and can scratch the finish on the way out.

What you can do yourself, and what to leave to a tech

Most of what keeps a guitar healthy is owner work. Cleaning, oiling a fretboard, polishing frets, changing strings, watching humidity and checking your setup are all things you can learn. This book will walk you through each one.

Some jobs need a trained hand and the right tools. Cracks, a bridge that's lifting off the top, loose braces, frets that need leveling or replacing, nut work, a neck reset, and wiring problems are all jobs for a qualified tech. Truss rod adjustments can be too. Martin, for one, says outright that truss rod work belongs with an authorized service center, so check your maker's advice and your warranty before you put a wrench on it. If you're not comfortable turning a truss rod, take it to a tech. There's no shame in that.

> **Tip:** When in doubt, stop. A guitar that waits a week for a tech is better off than a guitar that got a rushed repair at the kitchen table.

Two companion books

This book sticks to care, cleaning, strings and basic setup. If you want to know why a guitar sounds the way it does, *Chasing Tone: Guitar Myths Put to the Test* looks at the common tone claims and what the evidence says about them. If you want the numbers behind every part of an electric guitar, *Inside the Electric Guitar* goes through it part by part. The setup numbers in all three books come from the same maker sources, so they agree.

A note about products and brand names

Throughout this book I name real products as examples so you know what to look for in a store. MusicNomad makes a full line of care products, so you'll see their names often. D'Addario, Dunlop, Taylor, Martin and others make similar products, and I'll name alternatives where I can. No company sponsored, reviewed or endorsed this book, and no brand is the only right choice. Use what works for your guitar and your finish.

All product names, brand names and trademarks mentioned in this book belong to their owners.

Quick checklist

- Find out what finish and fretboard your guitar has before you clean it (Chapter 1).
- Put together a small starter kit of care supplies (Chapter 2).
- Wipe the guitar and strings down after every session (Chapter 3).
- Get a hygrometer and keep the humidity steady (Chapter 7).
- Change strings before they go dull and corroded (Chapters 9 to 11).
- Check the setup twice a year, in fall and spring, and know when to call a tech (Chapters 12 and 15).

Chapter 1: Know Your Guitar

Before you clean, oil or adjust anything, you need to know what you're working on. A guitar is a mix of wood, glue, metal and finish, and each part has its own needs. The polish that makes one guitar shine can leave another one cloudy. The oil that brings a rosewood fretboard back to life does nothing for a finished maple board except make a mess.

This chapter walks through the parts of acoustic and electric guitars, the woods they're made from, the finishes that cover them, and the difference between a finished and an unfinished fretboard. By the end you should be able to look at your own guitar and say what it is, so the rest of the book makes sense for your instrument.

The parts every guitar shares

Acoustic and electric guitars look different, but they share most of their parts. Let's start at the top and work down.

The **headstock** is the flat piece at the end of the neck. It holds the **tuners** (also called tuning machines or tuning pegs), the geared posts you turn to bring each string up to pitch. Some headstocks are solid with the tuners poking through from the back. Others are slotted, with open windows and rollers running sideways, which you see on many classical guitars and some steel-strings.

The **nut** is the small strip of bone, plastic or other material where the headstock meets the fretboard. It has a slot for each string. The nut sets the spacing of the strings and how high they sit at the first fret. If a nut slot is cut too low the open string buzzes, and if it's too high the strings are hard to press down near the first frets and the guitar can have trouble playing in tune there.

The **neck** is the long piece you hold. On its face is the **fretboard** (also called the fingerboard), a strip of wood glued on top of the neck. The **frets** are the metal wires set across the fretboard. When you press a string down, it touches a fret and that fret sets the note. Most fretboards also have **position markers**: dots or inlays on the face and small side dots on the edge so you can see where you are.

Inside most steel-string necks is a **truss rod**, a metal rod that runs the length of the neck and can be tightened or loosened with a wrench. String tension pulls the neck forward into a slight bow. The truss rod pushes back. The small amount of forward bow that's left is called **relief**, and it gives the strings room to vibrate without buzzing. Too much relief and the strings sit high in the middle of the neck. Too little, or a neck bowed the other way (called back bow), and you get buzz, mostly on the open strings and the lower frets. Chapter 12 covers checking relief, and when to leave the truss rod alone.

The truss rod adjusts from one of two places on most guitars: at the headstock, often under a small cover plate, or at the body end of the neck. On many acoustics the body-end adjustment is reached through the soundhole. The wrench size varies from maker to maker, which is why Chapter 2 spends some time on truss rod wrenches.

At the other end of the strings is the **bridge**, which anchors the strings to the body, and the **saddle**, the part the strings actually rest on at the bridge end. The distance from the saddle to the frets controls **intonation**, which is whether the guitar plays in tune as you go up the neck. The saddle also helps set **action**, which is how high the strings sit above the frets.

Finally there are **strap buttons** (or strap pins), the small posts where your strap attaches. Most electrics have two. Many acoustics have one at the tail end of the body, sometimes doubling as the output jack for a pickup, and some have a second on the neck heel.

Parts of an acoustic guitar

An acoustic guitar is a hollow wooden box, and almost everything about its care comes from that fact. The box is thin, it's held together with glue, and it moves with the weather.

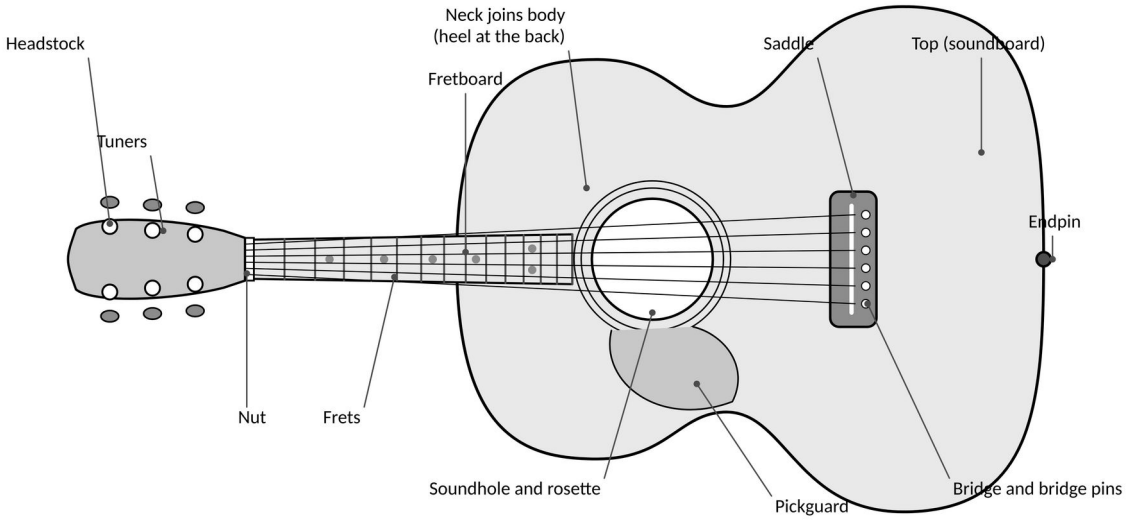


Figure 1-1. The main parts of a steel-string acoustic guitar.

The **top** (or soundboard) is the face of the guitar. It's the most important part for sound. The strings push on the bridge, the bridge moves the top, and the top moves the air. Because the top has to vibrate, it's thin, and that's why it's the first part to show damage from dry air or heat.

Glued to the underside of the top are **braces**, thin strips of wood that keep the top from collapsing under string tension and help shape the sound. The back has braces too. You can see some of them if you look through the soundhole with a small mirror and a light.

The **back** and **sides** make up the rest of the box. The sides are bent into shape and joined to the top and back with thin strips of wood inside called linings. On the outside, the edges are often covered with **binding**, a strip of plastic or wood that seals and protects the joint.

The **soundhole** is the opening in the top, usually round, that lets the sound project. The decorative ring around it is the **rosette**, which also reinforces the edge of the hole. Near the soundhole you'll often find a **pickguard**, a thin plastic or wood sheet that protects the top from your pick.

On a steel-string acoustic the strings usually anchor with **bridge pins**. Each string's ball end goes into a hole in the bridge, and a tapered pin holds it in place. The ball end actually catches on a hardwood plate glued under the top, called the bridge plate. Some acoustics use a pinless bridge, where the strings thread through from behind. Classical guitars use a tie-block bridge, where each string is tied in a loop. Chapter 10 covers all three.

The **heel** is the curved block at the base of the neck where it meets the body. Inside the body, the neck joins a block of wood called the neck block. At the opposite end, the **endpin** (or end pin) is the button at the bottom of the guitar, often used as a strap button.

> **Tip:** Get a small inspection mirror and a flashlight. Looking inside your acoustic once in a while is the easiest way to spot a loose brace or a crack starting from the inside.

Solid wood and layered wood

You'll hear players talk about "solid top" and "all solid" guitars. A solid top is cut from a single thickness of wood (usually two matched pieces joined down the middle). A layered or laminated top is made of thin sheets glued together, like plywood.

Taylor's own line is a good example: solid-wood tops on every model, with layered backs and sides on the 200 Series and below. Taylor's layered wood is a poplar core with a thin veneer on each face, and the company draws a line between that and laminates that might use non-wood materials. Other makers use the terms differently, so check your maker's spec sheet if it matters to you.

Why does this matter for care? Solid wood moves more with humidity than layered wood does. A guitar with solid wood all around needs more attention to humidity, and it's the one most likely to crack if you ignore it. Layered wood is tougher, but it isn't immune, and it still sits on a solid top or neck in many guitars.

Parts of an electric guitar

An electric guitar has a neck, headstock, nut, frets and fretboard just like an acoustic, but the body works differently. Most electrics are **solid-body** guitars: a solid slab of wood (or a few pieces glued together) with no soundhole. The sound comes from the pickups and the amp, not from a vibrating top.

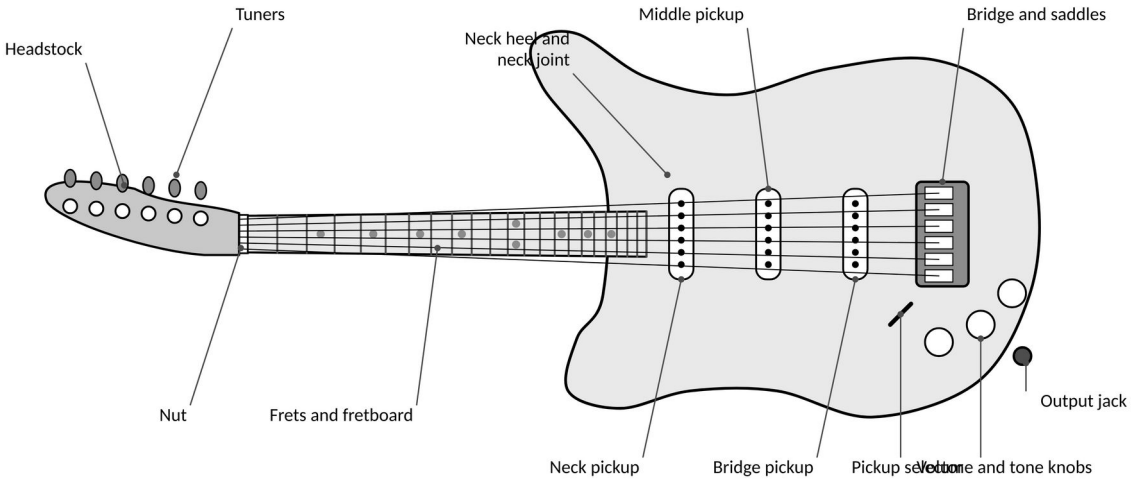


Figure 1-2. The main parts of a solid-body electric guitar.

There are also **hollow-body** and **semi-hollow** electrics. A hollow-body is built like an acoustic box with pickups added, usually with f-shaped soundholes. A semi-hollow has a solid center block running through a hollow body. If you own one of these, treat the body more like an acoustic when it comes to humidity.

The **pickups** are the magnetic units under the strings. Each pickup is a coil of fine wire around one or more magnets. When a steel string vibrates over it, the pickup turns that motion into an electrical signal. That's why electric guitars need steel strings (nylon won't work), and it's also why you have to keep steel wool and metal dust away from them.

The **controls** are the knobs and switches. Most guitars have at least one volume knob and one tone knob, and a pickup selector switch that picks which pickup (or combination) you hear. Behind the knobs are small parts called potentiometers, or pots. The **output jack** is where you plug in your cable. Scratchy knobs and crackling jacks are covered in Chapter 8.

Electric guitar bridges come in more styles than acoustic bridges. A **hardtail** bridge is fixed to the body and doesn't move. A **Tune-o-matic** bridge is a metal bridge on two posts, often paired with a separate **stopbar** tailpiece that anchors the strings behind it. A **tremolo** (or vibrato) bridge pivots so you can bend the pitch with a bar. Each style restrings a little differently, and Chapter 11 takes them one at a time. Most electric bridges have an adjustable **saddle** for each string, so you can fine-tune height and intonation.

The neck attaches to the body in one of three ways. A **bolt-on** neck is held on with screws through the back of the body, common on Fender-style guitars. A **set neck** is glued into a pocket in the body, common on Gibson-style guitars. A **neck-through** design runs one piece of neck wood all the way through the body, with the body wings glued to its sides. You don't need to do anything special for each, but it helps to know which you have before anyone suggests "just pull the neck off."

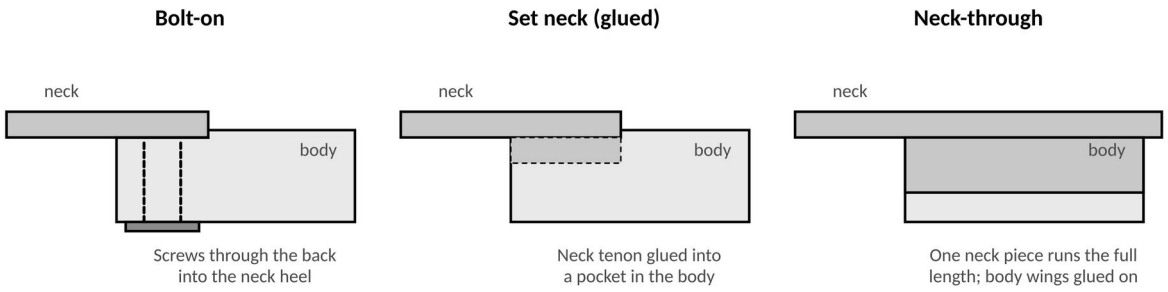


Figure 1-3. The three common ways a neck joins the body, seen from the side.

Woods you'll run into

You don't need to be a wood expert to care for a guitar. Knowing the main woods just helps you understand why one guitar needs more humidity care than another, and why one fretboard drinks up oil while another doesn't need any.

Tops

Spruce is the most common acoustic top wood, and Sitka spruce is the most common spruce of all. It has a wide dynamic range that suits most styles. Western red cedar is another common top, softer and warmer, and it dents more easily, so be careful with picks and belt buckles. Mahogany and koa also show up as tops, especially on all-hardwood guitars.

Backs and sides

Rosewood (Indian rosewood is the most common), mahogany, maple, sapele and koa are all common back and side woods. These are hardwoods. They're tougher than a spruce top, but they still shrink and swell with humidity, and they can crack if they dry out.

Electric bodies

Solid-body electrics are made from many woods. Alder, ash, mahogany and basswood are common, and many bodies have a maple cap glued on top. For care purposes the wood under the finish matters less on a solid body than the finish itself, since the finish is what you touch and clean.

Necks and fretboards

Necks are most often maple or mahogany. Fretboards come in more variety. The common unfinished fretboard woods are rosewood, ebony, granadillo, pau ferro (also sold as morado), walnut, purpleheart, jatoba and panga panga. Maple fretboards are the big exception: most are finished, which means they're sealed under a clear coat.

Roasted maple (sometimes called baked or torrefied maple) is maple that has been heated in a controlled way to darken it and make it more stable. Fender's own claim for its roasted maple necks is that they resist humidity changes. Here's the catch: roasted maple fretboards can be finished or unfinished. Some Fender, Charvel and Ibanez models have unfinished roasted maple boards, while some Fender roasted maple necks come with a gloss urethane finish on the fretboard. Check your model's spec before you decide how to care for it.

Finishes

The finish is the clear (or colored) coating on the wood. It protects the wood from sweat, dirt and moisture, and it's the part of the guitar you clean most often. Different finishes need different care, and the wrong product or the wrong stand can damage some of them.

Nitrocellulose lacquer

Nitrocellulose lacquer, usually just called nitro, is the classic guitar finish. It's a lacquer that dries as its solvents evaporate, and it goes on in thin coats. It ends up thinner than a polyurethane or polyester finish, and many players feel that lets the wood vibrate more freely. (*Chasing Tone*, my book on guitar myths, finds little evidence that nitro itself sounds different from poly at the same thickness. For care, what matters is that nitro is softer.) Fender used nitro as its main finish in the 1950s and 1960s and still uses it on certain series. Martin has used lacquer on its standard lines for decades, and many small builders use it too.

Nitro ages. Over time it can yellow, wear through where your arm and hand rest, and develop fine hairline cracks called **checking**, either from age or from sudden exposure to cold. Many players love that worn-in look. Others don't. Either way, it's normal for nitro and not a defect.

Nitro also stays softer and more reactive than modern finishes. It can be damaged by some rubber, vinyl and foam, by certain solvents, and even by some bug sprays and colognes. The rubber on many guitar stands reacts with it, and Gibson says that kind of damage isn't covered by its warranty. Chapter 3 covers stands and cases in detail.

Caution: If you're not sure whether your guitar has a nitro finish, treat it as if it does. Keep it off rubber and vinyl, and use only products that say they're safe for nitrocellulose lacquer.

Polyurethane and polyester

Polyurethane (often shortened to poly or urethane) and **polyester** are modern finishes that cure into a hard, tough coat. Urethane is harder and more wear-resistant than nitro, and it doesn't check, crack or yellow the way nitro does. Polyester is thick and very hard. Fender has used it on many of its mid-priced lines, and Taylor has used a UV-cured, polyester-based finish since 1995. Most imported steel-string guitars use some type of catalyzed (chemically cured) finish like these.

These finishes are much more forgiving. They hold up to sweat, they don't react with most stand materials, and they take most guitar cleaners and polishes without trouble. That doesn't mean anything goes. Household cleaners and furniture polish are still off the table (Chapter 4 explains why), and these finishes still scratch.

You might also run into **shellac**, an old natural finish used on many classical guitars, often applied by hand in a method called French polish. It's thin, beautiful and easy to damage with alcohol, water and heat. If you own a French-polished guitar, ask the builder what they recommend.

Gloss and satin

Separate from what a finish is made of is how shiny it is. A **gloss** finish is smooth, reflective and polished to a mirror shine. A **satin** or **matte** finish is flat or low-sheen, and it often has a slightly textured feel. Many makers use satin on the back of the neck because it feels less sticky under your hand. Some guitars are satin all over.

Gloss and satin need different care. You can polish a gloss finish. You should not polish a satin finish to a shine, because rubbing it with polish, wax or anything abrasive will leave shiny spots and a blotchy look. Martin says never to polish its satin finishes, and Taylor says to skip wax and heavy polishes and use a lightly damp cloth instead. On any satin finish, use a plain cleaner with no wax and no polishing grit. Chapter 4 has the details.

Oil finishes

Some guitars, mostly electric necks and a few bodies, have an **oil finish**. Instead of a hard coat sitting on top of the wood, an oil finish soaks into the wood and hardens there, often with a thin wax over it. It feels like bare wood, smooth and dry under your hand, with little or no shine.

Oil finishes are easy to touch up, but they don't protect as well as a lacquer or poly coat, so they get dirty and dry faster. Follow the maker's advice for any oil-finished neck. Some sell a specific oil and wax for touch-ups.

Finished and unfinished fretboards

This is one of the most important things to know about your guitar, because it decides how you clean and condition the fretboard.

An **unfinished** fretboard is bare wood. It's been sanded smooth, the frets are pressed in, and that's it. Rosewood, ebony, pau ferro and most other dark fretboards are unfinished, and that's the most common kind

by far. Bare wood can dry out, so it benefits from occasional cleaning and conditioning with a fretboard oil (Chapter 5 covers how and how often).

A **finished** fretboard has a clear coat over it, just like the body. Most maple fretboards are finished. Many Fender guitars have finished maple, and many Rickenbacker models have finished rosewood. Oil can't soak into a finished board, so it doesn't need any. You clean it like you'd clean the finish on the body.

There's a third kind: **painted or stained** fretboards, which show up on some budget and vintage student guitars. The color is only on the surface, so be gentle. Scrubbing can wear right through it.

How to tell which you have

Here's a simple test. Look at the fretboard under a good light and run a fingertip along the wood between two frets.

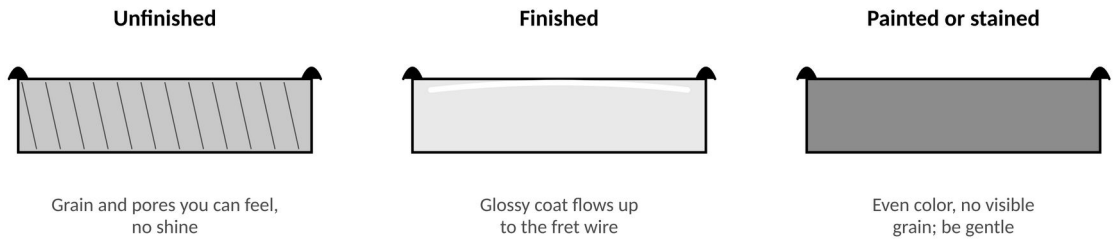


Figure 1-4. Finished, unfinished and painted fretboards in cross section. The dark caps are the frets.

- If you can feel the grain of the wood and the surface is not glossy, it's almost certainly unfinished.
- If it's shiny and smooth like the body finish, and the finish seems to flow up against the sides of the frets, it's finished.
- If the color looks uniform, the board is very dark or black with no visible grain, and the guitar is a budget or student model, it may be painted or stained.

If you still can't tell, look up your model on the maker's website or ask a tech. It's worth the five minutes.

Fretboard	Usually finished?	How it's cared for
Rosewood	No	Clean and condition with fretboard oil (Chapter 5)
Ebony	No	Clean and condition with fretboard oil (Chapter 5)
Pau ferro	No	Clean and condition with fretboard oil (Chapter 5)
Maple	Yes, most	Clean like the body finish, no oil
Roasted maple	Either, check your model	Oil only if unfinished
Painted or stained	Coated surface	Gentle cleaning only, no scrubbing

How to tell what finish you have

You might ask, "Can't I just look at it and tell if it's nitro?" Honestly, not always. A fresh nitro finish and a fresh poly finish can look the same. Here's how I'd go about it.

1. Look up the model. Most makers list the finish in the spec sheet. Fender, for example, publishes which of its series get nitro, polyurethane or polyester. If you know the exact model and year, this is the most reliable answer.
2. Look at the age signs. Fine hairline cracks running across the grain, yellowing over a white or blonde finish, or worn-through spots where your arm rests all point to nitro. Poly and polyester rarely do any of these.
3. Consider the maker and price. Vintage American guitars and many high-end and boutique builders use nitro. Most imported and budget guitars use a catalyzed finish. This is a hint, not proof.
4. Ask. If you still don't know, contact the maker or ask a tech.

> **Caution:** Don't test a finish by rubbing solvent on it, even in a hidden spot. If it's nitro, you've just damaged it.

Then note whether it's gloss or satin. That one's easy: if it shines like a mirror, it's gloss. If it's flat or has a soft low sheen, it's satin.

Write down what you find for your guitar: the finish type, gloss or satin, the fretboard wood, and whether the board is finished. Keep it with your maintenance log (Chapter 15). Every cleaning decision in the next few chapters starts from that list.

A note on classical and bass guitars

Classical guitars use nylon strings at much lower tension, and many have no truss rod at all. Their tops are often cedar or spruce, and some have a shellac or French-polish finish that needs very gentle care. Never put steel strings on a classical guitar. The extra tension can damage the bridge and the neck.

Basses have the same parts as an electric guitar, just bigger, with longer necks and heavier strings. Everything in this chapter about woods, finishes and fretboards applies to them.

Quick checklist

- Learn the names of the main parts on your guitar, especially nut, saddle, bridge and truss rod.
- Find out whether your top is solid or layered wood.
- Identify your finish: nitro, poly, polyester, shellac or oil.
- Check whether the finish is gloss or satin.
- Test whether your fretboard is finished, unfinished or painted.
- Write it all down before you buy cleaners or oils.

Chapter 2: Tools and Supplies

You don't need a repair shop to take care of a guitar. A few cloths, the right cleaner, a string winder and a pair of cutters will cover most of what you do week to week. As you take on more of your own maintenance, a few measuring tools and a good place to work make the jobs easier and safer for the guitar.

This chapter lays out two kits. The starter kit covers cleaning, string changes and humidity, which is everything most players need. The full kit adds the tools for checking and adjusting your setup. I name real products as examples, mostly from MusicNomad since they make nearly every item on the list, and I name other brands where I can. No brand is the only right answer. What matters is that each product is safe for your finish and your fretboard.

A lot of guitars come to a bench with chewed screw heads, scratched finishes or a stripped truss rod nut because someone grabbed the closest household tool. The right driver, a notched straightedge and safe cleaning supplies prevent more damage than any repair trick.

Buy for your guitar, not for the shelf

Before you buy anything, pull out the notes you made in Chapter 1. You need to know whether your finish is gloss or satin, whether it might be nitrocellulose lacquer (nitro for short), and whether your fretboard is finished or bare wood. Those three answers decide most of what goes in your kit.

You might ask, "Can't I just buy one all-purpose spray and use it on everything?" It's simple: no. An all-in-one cleaner and polish is great on a gloss finish and wrong for satin, strings and bare fretboards. Read every label for what it's made for, and just as important, what it's not made for.

> **Caution:** Never use household cleaners or furniture polish on a guitar, and that includes glass cleaner on the finish. Many furniture polishes contain silicone, which leaves a film that can make a future finish repair much harder. Stay away from anything with silicone in it.

The starter kit

This is what I'd want every guitar owner to have. It covers wiping down, cleaning the finish, caring for the fretboard and strings, changing strings and keeping an eye on humidity.

Cloths

Get at least two soft cloths and keep them for the guitar only. One stays in the case for wiping down after you play. The other is for applying and buffing cleaner or polish.

Microfiber and soft cotton are the usual choices, and microfiber has the advantage that it won't leave streaks. MusicNomad's low-pile Microfiber Suede Polishing Cloth is made for polishing and its thicker, high-pile Microfiber Guitar Detailing Cloth for cleaning, and it also sells a 100% flannel cloth. Dunlop puts cotton cloths in its System 65 kits.

Wash your cloths now and then. Microfiber goes in cold or warm water with a mild liquid detergent. Skip the bleach and the fabric softener, and air dry or use low heat. Fabric softener leaves a residue you don't want on your guitar.

Tip: Shake out or brush off your cloth before you use it. A single grain of grit dragged across a gloss finish leaves a fine scratch.

Finish cleaner

For the body and neck you want a cleaner that's safe for your finish type. For a satin or matte finish, use a plain cleaner with no wax and no polishing grit. MusicNomad's Guitar Detailer is one example, and it's fine on gloss too. A slightly damp cloth works as well, and Taylor's own guitar polish is safe on its satin finishes.

For a gloss finish you have more options. MusicNomad's Guitar ONE combines a cleaner, polish and wax. Its label clears it for hard nitro and poly gloss finishes and rules out soft or cloudy nitro, satin finishes, strings and bare fretboards. Dunlop's Formula 65 Polish and Cleaner is another common choice. On a gloss Taylor, any brand of guitar polish will do. Chapter 4 covers how to use them.

Fretboard oil

If you have an unfinished fretboard (rosewood, ebony, pau ferro and the like), you'll want a fretboard cleaner and conditioner. MusicNomad's F-ONE Oil is one example. Dunlop's System 65 Fingerboard 02 Deep Conditioner is another. Taylor conditions its fretboards and bridges with boiled linseed oil and also sells its own fretboard oil. If you use boiled linseed oil, read the rag warning in Chapter 5 first.

A little goes a long way. Apply it sparingly, or the neck ends up feeling oily. How often to oil, and the long-running argument about lemon oil, are covered in Chapter 5.

If your fretboard is finished maple, you don't need fretboard oil at all. Your finish cleaner does the job.

String cleaner

A string cleaner wipes off the sweat and skin oil that kill strings early. MusicNomad's String Fuel and Dunlop's Ultraglide 65 String Conditioner are two examples. Use one before and after you play. Chapter 9 covers this in more detail.

String winder, cutter and pin puller

A **string winder** is a small crank that fits over the tuner button so you can wind strings on quickly. A **string cutter** trims the extra string length after you tune up. A **bridge pin puller** helps lift the pins out of an acoustic bridge without prying on the wood.

You can buy these separately or as one tool. MusicNomad's GRIP Winder has a rubber-lined head so it doesn't scratch or clank against the tuners, and a small built-in wrench for snugging tuner bushings. MusicNomad also makes the GRIP Cutter and the GRIP Puller, and the GRIP ONE combines a winder, cutter and puller in one tool. D'Addario's Pro-Winder does the same three jobs: winder, hardened-steel cutter and pin puller. Plain wire clippers will trim string ends, and a good pair from the hardware store works fine.

Caution: Don't use pliers or a screwdriver to pry bridge pins out. It's easy to chip the bridge or dent the top. Use a proper pin puller, and if a pin is stuck, see Chapter 10.

Tuner

You need a tuner to get your strings to pitch and to check that the guitar stays there. A clip-on tuner that grabs the headstock is the easiest kind to use. When you get to setting intonation, a strobe tuner, such as a clip-on Peterson, is more precise than a typical clip-on.

> **Caution:** A clip-on tuner can damage a nitrocellulose finish. If your guitar might be nitro, don't leave one on the headstock between sessions. Take it off when you're done, or use a pedal or app tuner instead.

Hygrometer and humidifier

A **hygrometer** measures relative humidity (RH), which is how much moisture the air holds compared with the most it could hold at that temperature. For an acoustic guitar this is the most important tool in the kit. Buy a digital one. The old analog needle type is a lot less reliable.

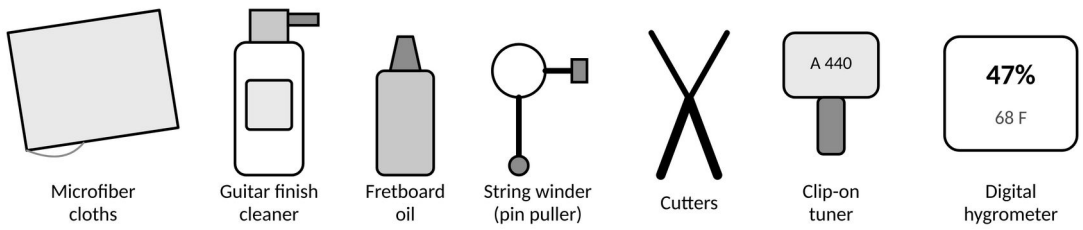
MusicNomad's Hone is a small digital hygrometer that clips to the strings, sits over the soundhole or rides in the case, and records the highest and lowest readings. Taylor and D'Addario also sell digital hygrometers.

A **humidifier** adds moisture when the air is dry. There are a few styles:

- Soundhole humidifiers that hang between the strings over the soundhole, such as MusicNomad's Humitar or the Oasis OH-1.
- Case humidifiers that sit in the case, which also work for electrics and f-hole guitars, such as MusicNomad's Humitar Instrument Case Humidifier.
- Two-way packs that add or absorb moisture to hold a set level, such as D'Addario's Humidipak (designed to hold 45-50% RH) and Boveda's 49% packs.

Chapter 7 explains how to pick one, how to use it, and what the right humidity range is. For now, know that if you live somewhere dry and you own an acoustic, this belongs in your starter kit, not your someday list.

Starter kit at a glance



The starter kit: enough to clean, restring, tune and watch humidity (Chapter 2 lists example products).

Figure 2-1. A starter kit covers cleaning, restringing, tuning and humidity.

Item	What it's for	Example products
Soft cloths (2 or more)	Wiping down, applying and buffing	MusicNomad microfiber or flannel cloths; Dunlop cotton cloths
Finish cleaner	Cleaning the body and neck	MusicNomad Guitar Detailer; Taylor Guitar Polish; Dunlop Formula 65
Gloss polish (gloss only)	Shine and light protection	MusicNomad Guitar ONE; Dunlop Formula 65
Fretboard oil (bare boards only)	Cleaning and conditioning	MusicNomad F-ONE Oil; Dunlop Fingerboard 02; Taylor Fretboard Conditioner
String cleaner	Wiping sweat off strings	MusicNomad String Fuel; Dunlop Ultraglide 65
Winder, cutter, pin puller	String changes	MusicNomad GRIP Winder, GRIP Cutter, GRIP Puller or GRIP ONE; D'Addario Pro-Winder
Tuner	Tuning	Any clip-on, pedal or app tuner
Digital hygrometer	Measuring humidity	MusicNomad Hone; Taylor or D'Addario hygrometers
Humidifier	Adding moisture in dry air	MusicNomad Humitar; Oasis OH-1; D'Addario Humidipak; Boveda 49%

If you'd rather buy a bundle, several brands sell kits. MusicNomad's Premium Guitar Care Kit (5 pc.) holds Guitar ONE, Guitar Polish, F-ONE Oil and two microfiber towels. Dunlop's System 65 Guitar Maintenance Kit holds a polish and cleaner, carnauba cream, a string conditioner, a fingerboard cleaner, a fingerboard oil and two cotton cloths. Check that every item in a kit suits your guitar before you use it.

The full kit

Once you're comfortable with cleaning and string changes, you may want to check your own setup. These tools let you measure what's going on with your guitar, which is useful even if you leave the adjustments to a tech. A player who can say "my relief went up over the winter" gets a better repair than one who says "it feels weird."

Work mat and neck support

Any work on a guitar goes better when the guitar can't slide around or tip over. A **work mat** is a soft, non-slip pad that protects the finish and keeps tools and small parts from rolling away. MusicNomad's Premium Instrument Work Mat is one example. A clean, folded towel on a sturdy table works in a pinch.

A **neck support** (or neck cradle) holds the neck up when the guitar is lying on its back. For acoustic work I'd call it close to a must-have, because a deep acoustic body lying on its back can tip and land on the headstock. MusicNomad's Cradle Cube is a soft gel block with several heights and angles, and MusicNomad also sells a combined work mat and neck support. StewMac and other luthier suppliers sell neck rests too.

> **Caution:** If your guitar is nitro, check what a mat or neck rest is made of before the guitar sits on it for long. Rubber, vinyl and some foams can react with nitro (see Chapter 3). When in doubt, put a soft cotton cloth between the support and the neck.

Screwdrivers and hex keys

Saddle height screws, pickup screws, strap buttons, jack nuts and tuner hardware all need the right size driver. Using the correct bit is what keeps you from stripping or chewing up the screw heads. A guitar tech screwdriver and wrench set, such as MusicNomad's Premium Guitar Tech Screwdriver and Wrench Set, puts the common sizes in one place. A quality set of small screwdrivers and both inch and metric hex keys from a hardware store will also do.

Truss rod wrenches

Truss rods use different nut styles and sizes depending on the maker and the model. Some take a hex (Allen) key, some take a socket or box wrench, and some acoustics need a long wrench that reaches in through the soundhole. MusicNomad sells individual wrenches in sizes including 1/4", 5/16" and 7mm, along with 4mm and 5mm wrenches made for Martin guitars. It also has an 11-piece set and a free online Truss Rod Wrench Finder that covers over 75 brands. Many new guitars come with the right wrench in the case, and that's the one to use. If yours didn't come with one, check the maker's support pages for the size.

> **Caution:** A wrong-size wrench rounds off a truss rod nut, and a stripped truss rod nut is a real repair. Make sure the wrench fits snugly before you turn anything. Chapter 12 covers truss rod safety rules, and some makers, Martin among them, say truss rod adjustments belong with an authorized service center. Check your warranty first.

Straightedge

A **straightedge** is a precision-flat bar you lay along the frets to see how much the neck bows. A real precision straightedge gives a much more accurate reading than a regular ruler. A **notched straightedge** has cutouts so it rests on the fretboard wood between the frets instead of on the frets themselves, which takes the frets out of the measurement. MusicNomad's Tri-Beam is one example, and StewMac sells several. You can also check relief with a capo and a feeler gauge, which Chapter 12 explains.

Feeler gauges

Feeler gauges are thin metal blades of known thickness. Slipped under a string, they measure very small gaps, such as neck relief or the space between the string and the first fret when you're checking nut height. Any automotive feeler gauge set from a parts store works, as long as the blades are clean and flat.

String action gauge or ruler

To measure **action** (string height above the frets), you need a fine ruler. A plain six-inch steel rule works well. A string action gauge is more convenient, because it has the measurements printed right on it. MusicNomad's Precision String Action Gauge and its Precision Setup Gauge Set (six gauges for relief, action, radius, nut height and pickup height) are examples.

Radius gauges

Most fretboards are slightly curved from side to side. That curve is the **radius**. **Radius gauges** are curved templates you lay across the board, or slide under the strings at the saddles, to match the string curve to the fretboard curve. StewMac's understring radius gauges and MusicNomad's Precision Radius Gauge Set are two

examples. MusicNomad also has a free online Fretboard Radius Finder that lists the radius for many models. You'll use these mostly on electrics with adjustable saddles (Chapter 12).

Capo

A capo is handy for more than playing. During a setup check you clamp one at the first fret so the nut height doesn't throw off your measurements. Any capo that clamps evenly will do. MusicNomad sells a truss rod gauge that includes a pick-sized capo.

Fret polish and fret guards

Frets dull and tarnish over time. A fret polish and a set of **fret guards** (thin shields that cover the fretboard wood so only the fret is exposed) let you shine them up without scratching or staining the board. MusicNomad's FRINE Fret Polish, GRIP Guards and Fret Shield are examples. Taylor uses 0000 steel wool on its frets, but steel wool and electric guitar pickups don't mix, and Chapter 6 explains when steel wool is and isn't a good idea.

Contact cleaner

For scratchy pots, noisy switches and crackly output jacks, a contact cleaner made for electronics is the tool. MusicNomad's JackPot Music Gear Contact Cleaner is made with DeoxIT. Chapter 8 covers how to use it.

Light and mirror

A bright flashlight and a small inspection mirror let you look inside an acoustic for loose braces, cracks and glue problems. They're cheap and they'll show you more than you'd expect.

Full kit at a glance

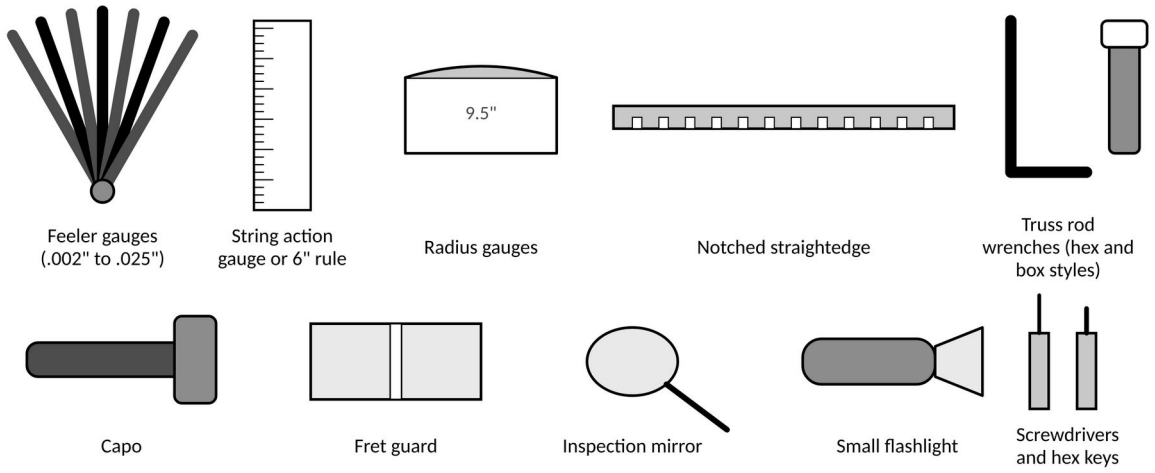


Figure 2-2. The full kit adds measuring tools for setup work.

Tool	What it's for	Example products
Work mat	Protecting the guitar and keeping parts in place	MusicNomad Premium Instrument Work Mat; a folded towel

Tool	What it's for	Example products
Neck support	Holding the neck steady	MusicNomad Cradle Cube; StewMac neck rests
Screwdriver and hex key set	Saddles, pickups, hardware	MusicNomad Premium Guitar Tech Screwdriver and Wrench Set; quality hardware-store set
Truss rod wrench	Adjusting neck relief	Wrench supplied with your guitar; MusicNomad wrenches or 11-piece set
Straightedge	Checking neck bow and fret level	MusicNomad Tri-Beam; StewMac straightedges
Feeler gauges	Measuring relief and nut height	Any automotive feeler gauge set
Action gauge or 6-inch rule	Measuring string height	MusicNomad Precision String Action Gauge; steel rule
Radius gauges	Matching string curve to fretboard	MusicNomad Precision Radius Gauge Set; StewMac understring radius gauges
Capo	Setup measurements	Any even-clamping capo
Fret polish and guards	Shining frets safely	MusicNomad FRINE Fret Polish and GRIP Guards
Contact cleaner	Scratchy pots, jacks and switches	MusicNomad JackPot (with DeoxIT)
Flashlight and mirror	Looking inside an acoustic	Any small inspection mirror

Tools I'd leave to a tech

Some tools you can buy but shouldn't use until you've been trained, or at least practiced on a cheap guitar. Nut files, fret leveling beams, fret crowning files and fret end files all fall in that group. Used well, they fix real problems. Used badly, they create expensive ones. A nut slot filed too deep can't be filed back up, and frets leveled wrong may need replacing.

If you're curious about this kind of work, practice on a junk guitar first. On your good guitar, take it to a tech. There's no shame in that.

Keeping your kit together

Keep your care supplies in one box or bag so they're there when you need them. Store bottles upright, at room temperature, with the caps tight. On a MusicNomad bottle the stamped date is the fill date, not an expiration date, and the shelf life runs about three years at room temperature. A product that smells off or has separated in a way that won't shake back together should go.

Keep your cleaning cloths separate from your fret polishing and oiling cloths. A cloth with fret polish or oil in it doesn't belong on a gloss finish.

A note on classical and bass guitars

Most of these tools work on classical guitars and basses too. A classical guitar has tie-on strings and no bridge pins, so you won't need a pin puller, and many classicals have no truss rod. Basses usually need a larger truss rod wrench and heavier string cutters, since bass strings are thick enough to damage small cutters.

Quick checklist

- Check your finish and fretboard type (Chapter 1) before you buy anything.
- Get at least two clean, soft cloths for the guitar only.
- Buy a cleaner that suits your finish, and a gloss polish only if your finish is gloss.
- Add fretboard oil only if your board is unfinished.
- Get a winder, cutter and, for acoustics, a proper pin puller.
- Put a digital hygrometer and a humidifier in the kit if you own an acoustic.
- Add measuring tools when you're ready to check your own setup.

Chapter 3: Everyday Care and Storage

Most guitar damage doesn't happen in one big moment. It builds up a little at a time: sweat left on the strings, a guitar left on a stand by a window, a strap that slowly eats into the finish. The good news is that the fix is just as small. A few habits before and after you play, and a smart choice about where the guitar lives, will do more for it than any polish you can buy.

This chapter covers those habits. We'll talk about your hands, wiping down after you play, stands, hangers and cases, where to keep your guitar at home, sunlight and heat, kids and pets, and playing outdoors. Cleaning the finish in depth is in Chapter 4, and humidity gets its own chapter (Chapter 7), but the daily stuff starts here.

Start with clean hands

Your hands are the dirtiest thing that touches your guitar. Skin oil, sweat, lotion and whatever you had for lunch all end up on the strings, the fretboard and the back of the neck. Skin oil is one of the main sources of grime on any guitar, so wash your hands before you play.

It sounds almost too simple, but it works. Clean, dry hands mean slower string corrosion, a cleaner fretboard and less buildup on the finish. If you play right after working in the garage or the kitchen, take one minute at the sink first.

> **Tip:** Skip the hand lotion right before you play. It goes straight onto the strings and fretboard, and it leaves a film that collects dust.

You might ask, "My hands sweat no matter what. Am I killing my strings?" It's simple: some people just have more acidic sweat, and their strings go dull faster. You can't change your skin, but you can wipe down more often, clean your strings after every session, and look at coated strings (Chapter 9).

Wipe it down every time

If you only do one thing from this chapter, do this. After every session, take a soft, dry cloth and wipe the body and the strings down before you put the guitar away. It takes a couple of minutes.

Here's the routine I'd follow:

1. Wipe each string, top and bottom. Pinch the cloth around the string and slide it from the bridge up the neck. This pulls off the sweat and oil before they start corroding the metal.
2. Wipe the fretboard edge and the back of the neck, where your hand has been sliding.
3. Wipe the body where your forearm rests and anywhere you see fingerprints.
4. Wipe the hardware: bridge, saddles, tuners and pickup covers on an electric.
5. Put the guitar back in its case or on its hanger, and put the cloth in the case pocket so it's there next time.

A string cleaner, like the ones in Chapter 2, makes the string wipe even better. Clean the strings before and after you play, and you take off the oil, sweat and acid your fingers leave behind.

Caution: Use a dry cloth for the daily wipe-down. Don't spray cleaner on the guitar every day. Save cleaners and polishes for the deeper cleaning in Chapter 4, and when you do use them, spray the cloth, not the guitar.

Stands, hangers and cases

Where your guitar sits between sessions matters a lot. Each option has pros and cons.

Cases

A hardshell case is the safest place for a guitar that isn't being played, and the major guitar makers all say the same. A case protects against bumps, falls, dust, sunlight and quick changes in temperature and humidity. A closed case also acts as its own small climate, so a humidifier inside it works faster and holds steadier than one trying to control a whole room.

A gig bag is lighter and easier to carry, and it protects against scratches and light bumps. It doesn't do much against hard knocks, and gig bags are porous, so moisture escapes more easily than it does from a hardshell case.

The case should support the neck and body evenly, and nothing should be wedged under the headstock. If your capo, tuner or string packs ride in the case, keep them in the accessory pocket, not loose where they can rattle around against the finish.

One more case issue is worth knowing: old wooden cases can pull moisture out of the guitar, so humidify the case as well as the guitar if you're using an older one.

Tip: Close the case lid while you're playing, so the humidified air inside doesn't escape while the guitar is out.

Stands

A floor stand is handy. A guitar you can see and grab is a guitar you'll play more. But stands come with two risks.

First, guitars on stands get knocked over, often while you're cleaning around them. That's the main argument for keeping the guitar in its case when you're not playing. If you do use a stand or a wall bracket, pick one with a neck support. And never lean a guitar against a couch, an amp or a wall. It will slide, and it will land on the headstock.

Second, some stand materials can damage a finish. The rubber on many stands reacts with nitrocellulose lacquer (nitro), anywhere from mild discoloration to the finish being eaten away, and Gibson says that damage isn't covered by its warranty. Cover the rubber parts of a stand with a soft cotton cloth, such as a polishing cloth, and use a stand only for short-term holding, like at a gig.

Wall hangers

A wall hanger keeps the guitar off the floor and away from feet, pets and vacuum cleaners. It also has the same material risk as a stand: the rubber or foam on the hanger arms touches the headstock or neck. And a wall hanger puts the guitar out in the room air, where humidity swings more than it does inside a closed case. A

hanger can work with a humidifier that hangs from the strings, but you'll need to refill it more often, and a room hygrometer may not tell you what's really going on inside the guitar.

Where you hang it matters too. Don't hang a guitar on an exterior wall in winter. Pick an interior wall, where the temperature stays steadier.

Rubber, vinyl, foam and nitro

This deserves its own section, because it surprises a lot of players. If your guitar has a nitro finish (see Chapter 1), certain rubbers, vinyls and foams can soften it, stain it or stick to it.

Soft vinyl contains chemicals called plasticizers that keep it pliable. Those chemicals can leach out, or even evaporate and settle on a nearby surface, and nitro is very sensitive to them. Vinyl gig bags, vinyl straps, stands and hangers have all taken finishes off guitars, and a rubber capo pad can leave dark spots. The damage shows up as soft, sticky blisters, finish that peels away with the vinyl, or case lining fibers stuck in a softened spot. Catalyzed finishes, like those on most Taylors and most imported steel-strings, are largely immune.

Straps matter here too. Vinyl and synthetic leather straps can damage a finish, so take the strap off after you play and store it separately. And keep the guitar off vinyl sofas and chairs.

Caution: If your guitar is nitro, or you're not sure, don't let it rest on bare rubber, vinyl or foam for long. Drape a soft cotton cloth over stand and hanger contact points, take a vinyl strap off before you put the guitar away, and keep it off vinyl furniture.

Here's a quick way to think about where your guitar should sit:

Option	Good for	Watch out for
Hardshell case	Long-term storage, travel, dry climates	Old wooden cases can dry the guitar; humidify the case too
Gig bag	Short trips, light protection	Less protection from impact and humidity; vinyl bags and nitro
Floor stand	Short-term, during practice or a gig	Knocks and falls; rubber on nitro
Wall hanger	Keeping the guitar off the floor	Rubber or foam on nitro; room humidity swings; exterior walls

Where to keep your guitar at home

Even inside a case, a guitar feels the room it's in. Pick the spot with care.

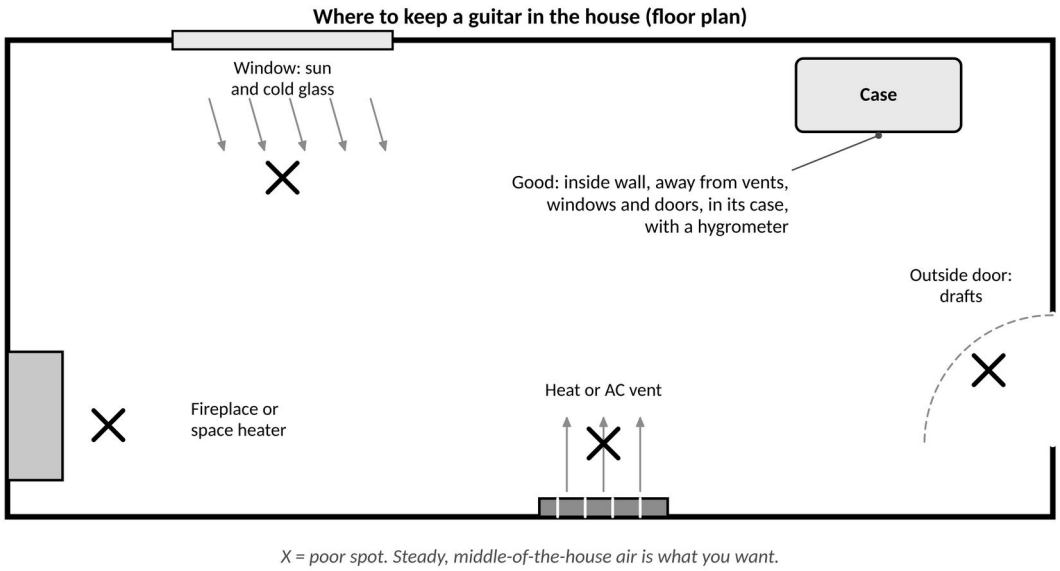


Figure 3-1. Keep the guitar away from windows, outside doors, vents and heaters.

Keep it away from heating and air conditioning vents, fireplaces, space heaters and radiators. Sunny spots, outside walls and vents all cause fast temperature swings that can crack a finish, or worse, and direct sun is its own problem.

Pick an inside room and an inside wall if you can. Basements tend to run damp, and attics and upstairs rooms tend to run dry. A closet on an inside wall, a bedroom or a music room usually works well, as long as you check the humidity there.

Put a hygrometer where the guitar actually lives. Measure the conditions where the guitar is stored, not the weather outside. A reading from the thermostat in the hallway doesn't tell you much about the closet in the back bedroom.

What humidity and temperature should I aim for?

Relative humidity (RH) is how much moisture the air holds compared with the most it could hold at that temperature. The makers don't quite agree on the number (Martin and Taylor say 45-55%, MusicNomad 40-55%, and Yamaha gives 45-55% in one guide and 40-50% in another), and Chapter 7 lays them side by side. The short answer: aim for 45-50% RH at normal room temperature, and treat anything from about 40% to 55% as fine. Chapter 7 shows you how to get there and keep it there.

The Nevada angle

I live and work in the Nevada high desert, where the air is very dry most of the year, summers are hot and winters are cold. If you live somewhere like this, everything in this section counts double. A guitar that hangs on a wall all year in a dry climate will dry out, no matter how nice the room is. In dry places, the case plus a humidifier isn't optional for a solid-wood acoustic. Chapter 7 goes into the details.

Sunlight and heat

Direct sun is bad for a guitar in two ways. It fades and bleaches the finish, and it heats the guitar fast. A guitar on a stand next to a sunny window gets both problems every afternoon.

Heat is worse. Guitars are held together with glue, and many guitar glues soften when they get hot. Heat also dries out the wood, which leads to cracks. Longtime repairman Frank Ford documented a 1973 Martin D-35 cooked by heat, the kind of damage he says usually means a car parked in the hot sun: the bridge slid about 1/8 inch forward, the neck joint loosened, braces came loose, the fretboard shrank until the fret ends stuck out, and the pickguard shrank and tore. The repair came to about what the guitar was worth.

So here's my stand on it: never leave a guitar in a hot car. Not for a quick stop, not in the trunk, not "just for a few minutes." Chapter 14 covers driving with a guitar.

Cold and quick changes

Cold is a quieter problem. A nitro finish can check (develop fine hairline cracks) after sudden exposure to cold. What does the damage is the fast change from cold to warm, not the cold itself.

When you bring a guitar in from a cold car or after shipping, leave it in its closed case and let it warm up slowly. How long is a judgment call. Some advice is simply to let it warm up in the case, and some says to leave it closed for a full 24 hours. My middle ground, which Chapter 7 explains: give it at least a few hours, and the full day if it came out of real cold or heat or off a delivery truck. Don't open the case right next to a heater to speed things up.

Kids and pets

A guitar within reach gets played, and that's a good thing when the hands reaching for it are young. But a guitar on a floor stand is also right at the height of a toddler, a wagging tail or a running dog, and a fall onto the headstock is one of the most common ways a guitar gets badly hurt.

A few plain rules help:

- If small kids or big dogs share the room, keep the guitar in its case or on a wall hanger out of reach, not on a floor stand.
- Show kids how to hold a guitar by the neck and body, never by the headstock or the strings, and how to set it down flat or in its case.
- Keep cats off. A cat's claws do a number on a soft spruce or cedar top, and some will happily sleep in an open case.
- Keep drinks off the amp and away from the guitar. A spilled drink on an electric can reach the pickups and controls.
- Keep your care supplies and cleaning sprays put away where small hands can't get to them.

Playing outdoors

Playing outside is one of the best parts of owning a guitar. Campfires, porches, backyard parties and festivals are where a lot of good music happens. A little care keeps it from costing you a repair.

- Keep the guitar in the shade. Direct sun heats a guitar quickly, especially a dark finish, and heat is what loosens glue.
- Don't leave it in the sun or in a car between sets. Put it in its case in the shade.
- Keep insect repellent away from the guitar. Bug spray attacks nitro and belongs nowhere near any finish. Put it on before you pick up the guitar, wash your hands, and keep your arm off the top if you've sprayed it.

- Watch for moisture. Dew, rain and sprinklers can soak a guitar fast. Wipe it dry right away and get it into the case.
- Keep it away from the fire. Sparks and heat do the same damage as a hot car, just closer.
- Expect to retune often. Strings go out of tune as the temperature changes through the evening.

When you get home, give the guitar a good wipe-down, let it come back to room temperature in its case, and check your hygrometer. A guitar that spent a damp night outside, or a hot dry afternoon, may need a day to settle before it plays right again.

When you won't play for a while

If you're putting a guitar away for a long time, store it in its case with the humidity under control, and detune it. Loosening each string by a single turn of the tuner is enough to ease the tension on the body. Don't take all the strings off, though. The neck is built to have some tension on it, and with none at all it can start to bow backward (Chapter 14). Check on the guitar every few weeks, refill the humidifier if it needs it, and tune it back up when you're ready to play.

Long-term string tension can also make an acoustic bridge lift. If you see a gap opening at the back edge of the bridge, loosen the strings and take it to a tech before you tune back up.

Quick checklist

- Wash and dry your hands before you play.
- Wipe the strings, neck and body with a dry cloth after every session.
- Store the guitar in its case when you're not playing it, especially in dry or changing weather.
- Never lean a guitar against a wall, amp or couch.
- Keep nitro finishes off bare rubber, vinyl and foam, and take vinyl straps off after playing.
- Keep the guitar away from vents, outside walls, sunny windows and hot cars.
- Let a cold guitar warm up slowly in its closed case.
- Read Chapter 7 before the first cold, dry month of the year.
- Keep it in the shade and away from bug spray when you play outdoors.

Chapter 4: Cleaning the Body and Finish

The finish is the first thing anyone notices about your guitar, and it's also the part that takes the most abuse. Sweat, skin oil, dust, smoke, and the occasional belt buckle all work on it every time you play. Clean it the right way and it will look good for decades. Clean it the wrong way and you can haze it, scratch it, or leave residue behind that a repair tech will have to fight later.

This chapter covers how to clean and polish the body, neck, and headstock based on the kind of finish you have. It ends with a full walk-through for cleaning everything on an acoustic guitar. The fretboard and the frets get their own chapters (Chapters 5 and 6), so I'll only touch on them here.

Start by knowing your finish

Before you put anything on a guitar, you need to know what finish is on it. Chapter 1 goes deeper; here is the short version that matters for cleaning.

- Gloss nitrocellulose lacquer. Nitrocellulose (nitro for short) is an older style of lacquer that goes on thin. It's common on vintage guitars and on many Gibson, Fender reissue, and boutique instruments. It's softer than modern finishes and can react to some chemicals.
- Gloss polyurethane or polyester. The tough, modern plastic finishes on most guitars made today. Taylor, for example, says its guitars built after 1995 use a hard UV-cured polyester finish.
- Satin or matte. A low-shine finish that feels smooth but not glassy. It can be nitro or poly underneath. What matters is the dull surface, because polishing or hard rubbing makes it shiny in spots.
- Bare or oiled wood. No hard film at all. Most rosewood and ebony fretboards and bridges are like this, and some necks too.

If you can't tell what you have, check the maker's website or ask a tech. When in doubt, treat the guitar as if it has a delicate nitro finish, and you'll never use something too harsh.

You might ask, "Why does it matter? It's all just shiny paint, right?" It's simple: different finishes react differently. A cleaner that's fine on a hard polyester top can cloud soft nitro. A polish that looks great on gloss leaves a matte finish blotchy. Matching the product to the finish is most of the job.

The ground rules

These rules apply to every finish. If you only remember one section of this chapter, make it this one.

- Dust first, then clean. Dust acts like sandpaper on a finish. Wipe it off with a clean, dry cloth or soft brush before any cleaner or polish touches the guitar.
- Spray the cloth, not the guitar. Spraying the guitar sends mist onto bare wood, into the soundhole, and into pickups and controls. Mist the cloth instead.
- Use clean, soft cloths. Microfiber works well, and a soft cotton flannel or an old t-shirt will do in a pinch. A cloth with grit in it will scratch, so wash your cloths and keep them in a bag.
- Less is more. A small amount of product, worked in and buffed off, beats a puddle every time.
- Clean before you polish. Waxing over grime just seals the grime in.
- Test first if you're unsure. Try a new product where it doesn't show, like the side near the strap button or the back of the headstock.

Tip: Keep two cloths: one for cleaning and one for the final dry buff. Mixing them up just moves dirt and product around.

Cleaning a gloss finish

Gloss finishes are the easiest to clean and the easiest to make look great. Here's the basic routine for any gloss guitar, nitro or poly.

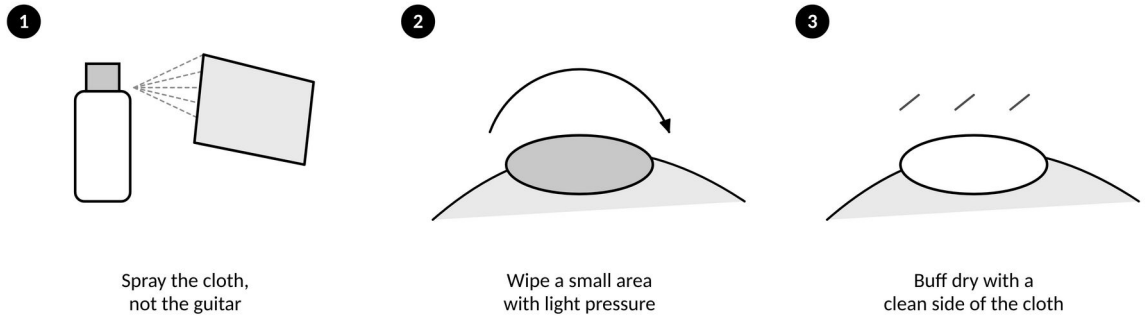


Figure 4-1. Cleaner goes on the cloth, then a light wipe, then a dry buff.

1. Lay the guitar on a padded surface with the neck supported (more on that in the acoustic section below).
2. Wipe off loose dust with a dry cloth or a soft brush. Mind the corners around the bridge, pickguard, and tuners where dust collects.
3. Mist a small amount of guitar cleaner onto your cloth.
4. Wipe one area at a time, starting with the top, then buff dry with a clean section of the cloth.
5. Do the back, the sides, the neck, and the headstock the same way.
6. Look at the guitar under a light at an angle. If you see streaks, buff them out with a dry cloth.

For the cleaner itself, use one made for musical instruments and check that it says it's safe for your finish. MusicNomad's Guitar ONE (cleaner, polish, and wax in one bottle) and Guitar Detailer (a plain cleaner) are two examples, and Taylor, Martin, Gibson, Fender, and D'Addario all make their own.

Nitro needs a lighter touch

Nitro lacquer is thin and stays a little soft over its whole life. That's part of why people love it, and part of why you have to be careful with it.

Draw a line between hard nitro and soft nitro. Hard nitro, the kind on most guitars that have been cared for, is fine with a gentle cleaner. Soft or cloudy nitro is different. You'll see it where your forearm rests or on the back of a guitar that's been played hard for years. Don't spray a cleaner over nitro that has built-up grime or softness, because the cleaner can mix with that buildup and cloud the finish. Use a polish on those spots instead, and expect it to take several passes. If color comes off on the cloth or the finish feels tacky, stop and let a tech look at it.

Two more things about nitro. Sweat is acidic and breaks a finish down over time, especially where the arm rests. And solvents and petroleum products are bad news for it, so keep the small dabs of lubricant later in this book on the metal parts only.

Older nitro guitars need one more consideration. Nitro yellows, checks (gets fine cracks), and wears with age, and many collectors value that aged look. Polishing a vintage guitar back to a new shine removes that patina and can lower its value. On a vintage nitro guitar, your goal is to remove dirt and sweat, not to make it look new.

Caution: Don't put masking tape or low-tack tape on a nitro finish unless you know it's safe on that guitar. Tape can pull up nitro and some poly finishes, especially older ones.

Poly and polyester finishes

Modern poly and polyester finishes are tough. Taylor says any guitar polish, and even a car polish, is acceptable on its post-1995 gloss finish, though it recommends its own for routine cleaning. That doesn't mean you should grab the strongest thing on the garage shelf. Car products vary, and some contain silicone or heavy abrasives. Stick with an instrument product unless the maker of your guitar says otherwise.

For a quick clean on gloss, wipe with a slightly damp cloth and follow right away with a dry one. That handles most fingerprints and smudges.

Polish and wax: when and how much

Cleaning removes dirt. Polish brings up shine and takes out very light haze. Wax leaves a thin protective layer and adds a deeper gloss. You don't need all three every time.

On a gloss finish, use a pea-sized dab of polish on a low-pile cloth, let it dry about 30 seconds until it hazes, then buff it off with a high-pile cloth. For a whole side of the guitar, that adds up to only three or four small dabs. For wax, use about a dime-sized amount in small circles, one area at a time, and keep the coats thin. Then buff to a shine.

How often? One school of thought says wax about once a month after cleaning if you play every day, with extra attention to the arm and neck areas, and about every 3 months if you play weekly. Others skip polish altogether, because polish and wax build up over time, collect in finish checks, and cause discoloration. If you do wax, pure carnauba is a good choice.

Here's my middle ground. Clean as often as the guitar needs it. Polish and wax a gloss guitar only when it looks dull after cleaning, and buff it all off. On a vintage nitro guitar, lean toward cleaning only.

Silicone: why repair techs hate it

Many furniture polishes and some guitar polishes contain silicone. It makes things shiny fast, but it leaves a residue that's very hard to remove. That residue keeps glue and new finish from sticking, and it's a main cause of "fisheyes," little craters that form when a tech tries to touch up or refinish lacquer.

You might never need finish repair. But if your guitar ever gets a ding, a crack, or a neck reset, you want the tech to be able to fix it cleanly. Use silicone-free products. Many instrument brands now say "silicone free" right on the label, MusicNomad and D'Addario among them.

Satin and matte finishes

Satin and matte finishes are easy to clean and easy to ruin. The dull look comes from a slightly rough surface that scatters light. Rub hard, polish, or wax it, and you smooth that surface out. You get shiny patches that don't match the rest of the guitar, especially on the back of the neck and wherever your arm rests. Here's how to clean satin or matte without changing the look.

1. Dust it off with a dry microfiber cloth.
2. Mist a cleaner made for satin finishes onto the cloth. MusicNomad's Guitar Detailer is one example (no wax or abrasives), and Taylor says its own guitar polish is safe on its satin finishes. A slightly damp cloth works too.
3. Wipe gently. Don't scrub.
4. Buff dry with a clean, soft cloth, again with light pressure.

Caution: Never use wax, buffing compound, or a gloss polish on a satin or matte finish. It leaves the finish shiny or blotchy, and you can't undo it easily. Use only a cleaner the maker says is safe on satin.

You might ask, "My satin neck already has shiny spots. Did I do something wrong?" Not really. Your hand polishes a satin neck just by playing it. That's normal wear. A tech can sometimes bring back the satin look, but don't try it yourself with sandpaper or steel wool on the finish unless you know exactly what you're doing.

Sweat, grime, and the arm area

The spots that get dirty fastest are the ones you touch: the top edge where your forearm rests, the back of the neck, and the back of the body if you play standing up. Focus your wipe-downs there, because that's where skin oil collects.

For built-up grime on a gloss finish, a good guitar cleaner and a little patience usually do it. Work a small area, let the cleaner sit a few seconds, then wipe. Repeat if needed. For tight spots like around the bridge or the pickup rings, a cotton swab works well.

Don't soak the guitar. A wet cloth can let moisture into seams, binding joints, or bare wood. Damp is fine. Wet is not.

Light scratches and swirl marks

Fine swirl marks on a modern gloss poly finish can often be buffed out by hand with a fine scratch remover made for guitars, such as D'Addario (Planet Waves) Restore. Skip the car "cutting" compounds; they cut fast and can go through a thin finish. Every compound removes a tiny bit of finish, so use it sparingly, only on the scratch, and never on edges, binding, satin or vintage nitro.

Deep scratches, dings that go through to the wood, and any damage on a vintage or nitro guitar are a job for a tech. Finish repair is a skill of its own. If you're not sure, leave it alone. There's no shame in that.

Preventing buckle rash

"Buckle rash" is the scratching on the back of a guitar from belt buckles, zippers, buttons, and rivets on your clothes. It's common, and it's almost always preventable.

- Turn your belt buckle to the side, or wear a belt without a big metal buckle when you play standing up. If you can't change the buckle, wear a soft shirt over it.
- Watch out for jeans rivets, jacket zippers, and big shirt buttons.
- Be careful with keys, phones, and wallet chains in front pockets.

Once buckle rash goes through the finish, it can't be polished away. A tech can sometimes touch it up. Prevention is a lot cheaper.

What not to use on a guitar finish

This is where I take a hard line. These products show up on guitars all the time, and they do real damage.

Don't use	Why
Furniture polish	Often contains silicone and wax; never belongs on a guitar
Household cleaners (glass cleaner, all-purpose sprays, pine cleaners)	Can damage the finish
Solvents (lacquer thinner, acetone, nail polish remover)	Can soften or dissolve finishes, especially nitro
Bleach	Can damage finish and wood
Abrasive cleaners, scouring pads, steel wool on the finish	Scratch the finish and strip patina
Silicone polishes	Hard to remove; cause problems with future repairs
Wax or polish on satin or matte	Leaves shiny or blotchy spots
Paper towels on gloss	Can leave fine scratches; use soft microfiber or cotton
Dish soap and water	Too much water near seams and bare wood

The back of the neck and the headstock

The back of the neck gets more hand contact than any other part of the guitar. Clean it every time you clean the body.

- Gloss neck: clean it like the body. Go light on polish, because some players find a waxed neck feels sticky.
- Satin neck: clean only, with a satin-safe cleaner or a damp cloth. No polish or wax.
- Bare or oil-finished neck: little or no hard finish, so a light wipe with a dry cloth is usually all it needs. A fretboard oil like MusicNomad's F-ONE works on an unfinished neck, but use it sparingly so the neck doesn't end up feeling oily.

The headstock collects dust around the tuners and under the string trees. Brush the corners out first, then clean the face and back like the body. On the tuners, a polish safe for chrome or nickel is fine. Gold-plated hardware needs gentler care, because guitar polish can take thin gold plating right off. Chapter 8 covers hardware in detail.

Cleaning everything on an acoustic guitar

An acoustic has more bare wood and more nooks than most electrics: a bridge, bridge pins, a saddle, a soundhole, and often a pickguard glued flat to the top.

Set up your work area

Use a big, steady table with a soft, non-slip mat. On an acoustic I'd call neck support a must: use a neck rest or a rolled-up towel. A deep acoustic body can roll over and land on the headstock in a heartbeat.

For a full clean, take the strings off. That's the best time to clean the fretboard (Chapter 5), polish the frets (Chapter 6), and get under the strings near the bridge. Chapter 10 covers restringing.

The order I'd follow

1. Dust everything. Use a soft brush or a dry cloth around the bridge, bridge pins, pickguard, tuners, and the edge of the soundhole.
2. Clean the top. Mist cleaner onto your cloth, wipe, and buff dry. Work around the bridge carefully so cleaner doesn't soak into the bare wood.
3. Watch the pickguard edges. On a flush pickguard, wipe from the pickguard out toward the top, never toward its edge. Wiping into the edge can catch it and start it lifting.
4. Clean the back and sides. Same method, with extra attention to the lower bout where your arm rests.
5. Clean the neck and headstock. Follow the neck section above for your finish type.
6. Treat the bridge. Most acoustic bridges are bare rosewood or ebony, like the fretboard, and they want conditioning right along with it. Use the same oil and the same light touch you'd use on the fretboard (Chapter 5). Wipe off all excess.
7. Clean the pins and saddle. Pull the pins only if the strings are off. Wipe them and the saddle with a cloth lightly misted with cleaner, then buff dry. Grime on pins can make them stick in the bridge.
8. Wipe around the soundhole. A dry cloth on the soundhole edge. If you have a soundhole pickup, clean it with a lightly misted cloth, never by spraying the pickup directly.
9. Polish and wax (gloss only). If the guitar is gloss and looks dull after cleaning, now is the time. Skip this step on satin.
10. Clean the hardware. Wipe the tuners. Chapter 8 covers metal polish and plating.

> **Caution:** Never spray anything into the soundhole or directly onto an undersaddle or soundhole pickup. Spray the cloth, then wipe. Liquid inside the body can stain the bare wood inside or get into the electronics.

You might ask, "Should I clean inside the body?" For most players, no. Dust in there doesn't hurt anything you'll notice, and reaching in with a rag risks snagging a brace or a pickup wire. If something rattles or you see a lot of debris, a tech can take a look.

Electric guitar notes

Electrics follow the same rules, with a few extra parts in the way.

- Wipe around pickups and controls with a misted cloth, never a spray.

- Use a soft brush or swab to get dust out from around the pickup rings, knobs, and the bridge, and don't let polish build up in those cracks or along the pickguard edges.
- Leave the pickup poles and the electronics alone with cleaners. Chapter 8 covers pickups, pots, and jacks.

Side notes for classical and bass

Classical (nylon-string) guitars often wear thin, delicate finishes, so treat one like a vintage nitro guitar: dust, gentle cleaner, and a soft cloth. If you have a handmade classical and don't know the finish, ask the maker before using any product.

Basses are just bigger guitars when it comes to the finish. Same rules, more surface.

Quick checklist

- Know whether your finish is gloss nitro, gloss poly, satin, or bare wood before you clean.
- Dust first so you don't grind grit into the finish.
- Spray the cloth, never the guitar.
- Use polish and wax on gloss only, and only a small amount.
- Never polish or wax satin or matte; clean it gently and buff with light pressure.
- Skip furniture polish, household cleaners, solvents, and silicone products.
- Move your buckle and watch your zippers when you play standing.
- On an acoustic, support the neck, wipe away from pickguard edges, and condition the bare bridge with the fretboard.

Chapter 5: Fretboard Care

Your fretboard is the one part of the guitar your fingers touch on every single note. It's also the part that collects the most grime. Sweat, skin, and dirt pack in next to the frets, and a board that started out smooth and fast starts to feel sticky and slow. That buildup happens even when a guitar just sits on a stand.

Most fretboards are bare wood with no finish on them, so they can dry out, especially in a dry climate like mine here in the Nevada high desert. A dry board looks pale and chalky, and in bad cases it shrinks or cracks. This chapter covers how to clean and condition your fretboard based on its wood, how often to do it, how much oil to use, and the long-running argument over lemon oil.

Living in Dayton, Nevada, I know how dry air pulls moisture out of an unfinished rosewood or ebony fretboard. A light coat of fretboard oil a couple of times a year, wiped off right away, keeps the wood stable.

First, is your fretboard finished or unfinished?

This is the first question, and the answer decides everything else. Chapter 1 goes deeper, but here's the quick test.

- Unfinished: You can feel the grain of the wood, and the surface looks dull or satin, not glossy. Most rosewood, ebony, and pau ferro boards are unfinished. So are unfinished maple boards and many roasted maple boards, though not all (see below).
- Finished: The board has the same smooth, glossy feel as the body, like there's a clear coat on it. Many maple boards (the classic Fender look) are finished.
- Painted or stained: Some inexpensive and older student guitars have a board that's dyed or painted black to look like ebony.

If you can't tell, check the maker's website or ask a tech. The difference matters because oil is for bare wood. On a finished board, oil just sits on top and gets sticky. It can't soak into wood that has a seal on it, and plenty of matte-looking boards have a hidden seal.

Why fretboards get dirty and dry

Rosewood, ebony, pau ferro, and similar woods are open-pore woods: the grain has tiny pores that trap dirt and skin oil. Maple is a closed-pore wood, so it doesn't trap as much, but grime still builds up along the frets.

Dryness comes from the air. When the heater runs in winter or the air conditioner runs in summer, the air gets dry, and bare wood gives up moisture. A dry board is easy to spot: pale color, a rough or chalky look, a slow feel under your fingers. If it gets worse, the board can shrink enough that the fret ends stick out past the edge (fret sprout, covered in Chapter 6), or it can crack.

You might ask, "Does oil actually put water back in the wood?" Not exactly. Oil doesn't humidify the guitar. It slows how fast the surface dries and keeps the wood from looking and feeling parched. Real moisture control comes from keeping the guitar at a steady humidity, and that's Chapter 7. Oil and humidity work together. Neither one replaces the other.

Strings on or off?

For a quick clean between string changes, leave the strings on. Slide a cloth under them and wipe between the frets. Tools like the MusicNomad Nomad Tool or a thin cloth wrapped over a guitar pick make it easier. Ernie Ball's Wonder Wipes are another option made for quick fretboard cleaning without taking strings off.

For a real clean and oiling, take the strings off. You get to the whole board, you can reach the dirt right at the frets, you keep oil off the strings, and you can use a brush or scrubbing cloth without snagging anything. That's why the best time for fretboard care is at a string change.

> **Tip:** If you take all the strings off at once, the neck relaxes a little. That's normal on most guitars. Chapter 10 and Chapter 11 cover the string change itself, including whether to remove all strings at once.

Light cleaning and conditioning (unfinished boards)

This is the routine for a board that's a little dirty or a little dry. It works on rosewood, ebony, pau ferro, and similar dark woods.

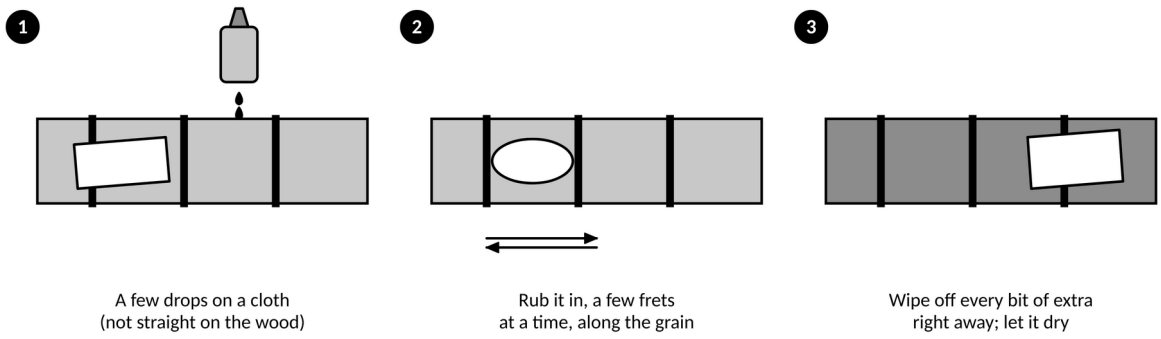


Figure 5-1. A light coat of fretboard oil: a few drops, worked in, extra wiped off.

1. Take the strings off and lay the guitar on a padded surface with the neck supported.
2. Wipe the board with a dry microfiber cloth to pick up loose dirt.
3. Put a small dab of fretboard oil in each fret space, or on your cloth.
4. Work the oil in with the cloth, getting right up against each fret.
5. Let it soak a few minutes.
6. Buff off every bit of the extra oil with a clean, dry cloth. The board should feel dry to the touch, not slick.
7. If it still looks dry and pale, do one more light coat and buff it off again.

That's it. MusicNomad's F-ONE is one example of a fretboard oil; others are D'Addario Hydrate, Fender Magic Fretboard Oil, Taylor Fretboard Conditioner, and Dr. Duck's Ax Wax. Use the one you like, and follow the label. If you have a severe nut allergy, read the label first: MusicNomad advises people with severe nut allergies not to use F-ONE, because it can't guarantee the plant that makes it is nut-free.

Deep cleaning at a string change

Sometimes the board is past a quick wipe. You see black gunk packed against the frets, or the board feels gummy. Here's how to go deeper.

1. Take the strings off and support the neck.
2. Wipe off the loose dirt with a dry cloth.
3. Put a little fretboard cleaner or oil on the worst area and let it sit a few minutes to soften the grime, up to about 10 minutes for heavy buildup.
4. Scrub with a slightly rough cloth or a soft brush. A soft toothbrush works. MusicNomad's F-ONE kit includes a two-sided cloth and a V-shaped brush made to get into the corner next to each fret.
5. For hardened gunk along the frets, use a plastic or wooden scraper. Always scrape along the length of the neck, the way the strings run, never across the grain.
6. Wipe away all the loosened dirt and leftover cleaner.
7. Finish with a very light coat of oil, as above, and buff it all off.

> **Caution:** Don't use a razor blade, knife, or screwdriver on your fretboard. A blade can gouge or scratch the wood, and those marks don't come out. A plastic scraper or an old guitar pick does the same job safely.

What about steel wool?

Makers don't agree on this one. Taylor uses and recommends very fine steel wool along bare boards and Martin mentions it as an option, while others warn that its fibers stick to pickup magnets. My rule: 0000 steel wool can be used on an acoustic with the soundhole covered, at your own discretion and with extreme care. On an electric, skip it and use a fine synthetic pad instead. Chapter 6 covers the details, since steel wool is mostly a fret-polishing tool.

Care by wood type

The basic routine above works for most dark woods. Here are the notes that differ from wood to wood.

Rosewood

Rosewood is the most common fretboard wood on both acoustics and electrics. It's open-pored, oily by nature, and fairly forgiving. Oil will darken it a bit, which most people like. Follow the standard routine.

Ebony

Ebony is very dense and very dark, with tight pores. It feels smooth and fast. It's also more likely to crack when it dries out than rosewood is, so it deserves extra attention in dry weather. Taylor, which uses ebony on most of its guitars, says to condition it whenever it looks dry, ideally at the next string change.

> **Caution:** A small crack in an ebony board, often near the end of a fret or along the edge, is a sign the guitar is too dry. Oil won't close it. Humidify the guitar (Chapter 7) and have a tech look at it before it spreads.

Pau ferro

Pau ferro (also called morado) is a common rosewood substitute, especially on Fender guitars. It's open-pored like rosewood and takes the same care. Fender's Magic Fretboard Oil is made for pau ferro along with rosewood and ebony.

Other dark woods

You'll see a lot of newer fretboard woods: walnut, granadillo, jatoba, eucalyptus, and others. Treat them like other open-pore woods. If the board is bare and dark, the standard routine applies.

Roasted maple

Roasted maple (also called baked or torrefied maple) is maple that's been heated in a low-oxygen oven to darken it and make it more stable. Fender, Charvel, and Ibanez use it, among others. Roasted maple boards come both ways: some are bare, some have a thin oil or wax finish, and some (including some Fender necks) have a gloss urethane finish like a regular maple board. Check your model's spec (Chapter 1). If it has a gloss finish, treat it like the finished maple board below. If it's bare or has only a thin oil or wax finish, clean it gently and oil it sparingly. Roasted maple doesn't have the natural oils rosewood does, and it's easy to overdo.

Unfinished maple

Raw maple boards are less common than finished ones, but you'll see them. They're light colored, so they show dirt fast. Here the product makers split. Some say their oil is fine on unfinished maple and won't change the color much. Others, D'Addario and Dunlop among them, say their conditioners and lemon oils are for dark woods only and will darken a light wood like maple.

My advice: on raw maple, use only a product whose label says it's safe for maple, use very little, and test it first on a spot under where the strings sit near the nut. If you'd rather not risk any color change, clean it with a dry or slightly damp cloth and leave it at that.

Finished maple

A finished maple board is easy, because it's really just a clear-coated surface like the body. No oil, ever, including after you polish the frets. Wipe it with a soft cloth after playing, and for a deeper clean, mist a guitar cleaner onto a cloth (not the board) and wipe between each fret. MusicNomad's Guitar Detailer is one example. A small amount of gloss polish is fine on a gloss maple board, but not on a matte one.

The dirty gray line along the edge of the frets on old maple boards is grime trapped where the finish has worn through. Gentle cleaning with a soft toothbrush helps. If the finish is flaking or worn down to the wood, use only a dry or barely damp cloth and don't scrub, since you can make it worse.

Painted or stained boards

Clean these gently with a soft, dry microfiber cloth only. It's easy to rub right through the dye or paint. No oil, no scrubbing, no scraping.

Board type	Clean with	Oil?
Rosewood	Dry cloth, fretboard cleaner or oil, soft brush for heavy grime	Yes, sparingly
Ebony	Same as rosewood	Yes, and watch closely in dry weather
Pau ferro	Same as rosewood	Yes, sparingly

Board type	Clean with	Oil?
Other dark bare woods (walnut, granadillo, etc.)	Same as rosewood	Yes, sparingly
Roasted maple	Dry cloth, gentle cleaner	Light, if bare; check with the maker
Unfinished maple	Dry or slightly damp cloth	Only a product labeled safe for maple; test first
Finished maple	Guitar cleaner on a cloth; gloss polish on gloss only	No
Painted or stained	Dry microfiber cloth only	No

How often should you oil?

Nobody agrees on an exact number. Most of the advice runs from every four months to about once a year, leaning more often if you play daily or live somewhere dry, and less often if the guitar mostly sits.

My rule is more often than most makers suggest: give a bare board a very light coat of oil at every string change, and make sure it gets one at least twice a year even if your strings stay on a long time. Because it's more often, keep every coat very light. A light coat means a few drops worked in with a cloth and the extra wiped off right away. It is not a soaking. Then let the wood tell you. If the board looks pale, rough, or chalky, it's ready. If it still looks dark and even, it can wait.

Climate matters. In a dry place, or in a dry season when the heater runs, you may need it a bit more often. Here in Dayton, Nevada, the air is dry most of the year. But more oil isn't a fix for dry air. If a board dries out fast, the guitar needs humidity control (Chapter 7) more than it needs oil.

You might ask, "Can I oil too much?" Yes. Too much oil, too often, can leave the board gummy, attract dirt, and soak into places you don't want it. Don't let oil stand and soak in, and wipe off the excess.

How much oil?

A little really does go a long way. A small dab per fret space is plenty. The goal is to feed the surface of the wood, not to soak it.

Some say coat the board and wipe off all the excess right away. Others say let it sit a few minutes first. Either way, you don't leave oil standing on the board. I'd split the difference: give it a couple of minutes, then wipe it dry.

> **Caution:** Keep oil off the finished parts of the guitar, including the binding and the body. Conditioners can damage finished surfaces. Wipe any drips off the body right away.

The lemon oil debate

Few topics start more arguments at the guitar shop. Here's what's really going on.

First, most "lemon oil" sold for guitars isn't pure oil from lemons. It's mostly mineral oil with lemon scent and color added. Dunlop's Ultimate Lemon Oil is sold as a fingerboard cleaner and conditioner, and its label says

not to use it on maple. D'Addario says lemon oil and its Hydrate conditioner are both for dark, unfinished woods only.

Second, some brands avoid it on purpose. The worry is that lemon oil can be acidic and can dry a board out faster, so you end up applying it more often, and that lemon extracts may break down the glue holding frets and binding. Fender's Magic Fretboard Oil is sold as lemon-oil free for exactly that reason.

So who's right? Here's my take. Never put pure lemon oil (the kind sold as an essential oil or cleaning product) on a guitar. A guitar product labeled "lemon oil" for fretboards, used sparingly on dark, unfinished wood, is not going to ruin your guitar. But there are good plant-oil conditioners now that sidestep the whole question, and that's what I'd reach for.

A word on boiled linseed oil

Taylor uses boiled linseed oil to condition its ebony boards and bridges and says you can use a small amount at home. It works well, but it comes with a real fire hazard.

> **Caution:** Rags soaked in boiled linseed oil can catch fire on their own as they dry. Lay used rags flat outdoors to dry, or put them in a metal can, fill it with water and close the lid tight, before you throw them out. Don't wad them up and toss them in the shop trash. If that sounds like too much hassle, use a fretboard oil made for guitars instead.

Don't forget the bridge

On most acoustics, the bridge is the same bare wood as the fretboard, and it wants conditioning right along with the board. Use the same oil, a small amount, and wipe it off well. Keep oil off the finished top around the bridge. Chapter 4 covers the rest of the acoustic cleaning routine.

What not to use on a fretboard

- Furniture polish. Never on a guitar, anywhere.
- Household cleaners and water-based or petroleum-based cleaners. They can dry unevenly or leave a sticky film.
- Alcohol on bare wood. It can dry out an unfinished board.
- Pure lemon oil or other essential oils.
- Cooking oils. They can go rancid and get sticky.
- Razor blades or metal scrapers.
- Oil of any kind on finished, painted, or stained boards.

Signs your fretboard needs more than cleaning

- Cracks in the board, especially near the fret ends or the edge.
- Fret ends that feel sharp or stick out past the edge of the board (Chapter 6).
- Frets that look like they're lifting out of the board.
- A board that dries out again within weeks of oiling (a humidity problem, Chapter 7).
- Worn finish on a maple board that's gone through to the wood in big patches.

Any of these is a good reason to visit a tech. Cracks and lifting frets get worse with time, and they're much easier to fix early.

Side notes for classical and bass

Classical guitars usually have bare rosewood or ebony boards. The same routine applies.

Bass fretboards follow the same rules as guitar boards. There's just more of them.

Quick checklist

- Figure out whether your board is finished, unfinished, or painted before you put anything on it.
- Wipe the board after playing; do the real cleaning and oiling at a string change.
- Use a small dab of oil per fret space, let it sit a few minutes, and wipe off every bit of extra.
- Give a bare board a very light coat at every string change, and at least twice a year, and let the look of the wood guide you.
- Never oil a finished maple, painted, or stained board.
- Scrape with plastic or wood along the grain, never with a razor.
- Skip pure lemon oil and household cleaners; watch for cracks and sharp fret ends.

Chapter 6: Fret Care

Frets are the metal bars across your fretboard. Every note you play presses a string against one of them. Over time they tarnish, get rough, and wear down where the strings hit. Rough frets make bends feel scratchy and slow, and worn frets can cause buzzing and notes that don't ring true.

This chapter covers what you can do yourself: keeping frets clean and polished, protecting the fretboard while you do it, and using steel wool safely if you use it at all. It also covers fret sprout (sharp fret ends from a dried-out board) and how to tell when frets are worn enough to need a tech for leveling or a refret.

A quick look at frets

A fret is a strip of metal wire. The top part you see is the crown, the rounded surface the string touches. Under it is the tang, a thin barbed strip pressed into a slot in the fretboard that holds the fret in place.

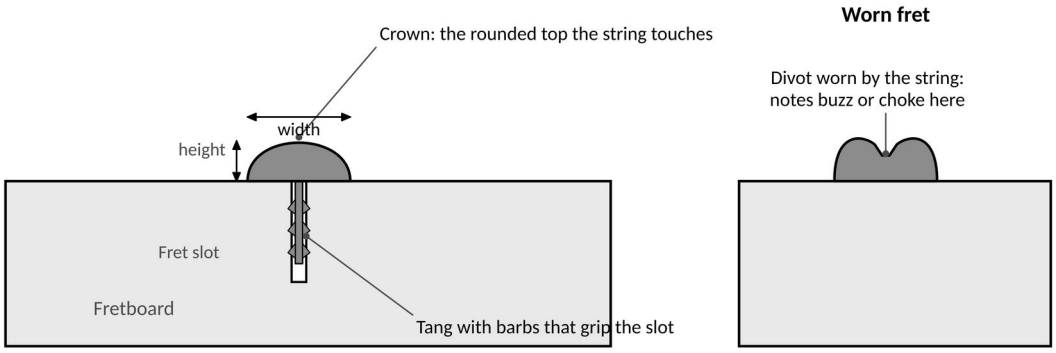


Figure 6-1. A fret in cross section, and what a worn fret looks like.

Most frets are nickel silver, a soft alloy that's easy to work and polish. Some guitars have stainless steel frets, which are much harder. Stainless wears slowly and stays shiny longer; nickel silver tarnishes and wears faster, so it needs more care.

You might ask, "Why does it matter what my frets are made of?" It's simple: harder frets need less polishing and wear out more slowly. If you don't know which you have, check your guitar's spec sheet. Most guitars, and nearly all older ones, have nickel silver.

Why polish frets?

Skin oil, sweat, and air slowly tarnish the frets. That dull, dark film is oxidation. You'll feel it before you see it: bends start to feel gritty, and slides don't glide the way they used to.

Clean, smooth frets make bending and vibrato easier and can help strings last longer. They look better too, and if you're cleaning the fretboard anyway, it's the perfect time.

How often?

Check your frets at every string change. That's the easy habit to build, and it's when polishing them is simplest.

Polishing doesn't have to happen every time, though. Look and feel. If the frets are bright and smooth, skip it. If they're dull or rough on bends, polish them. Players who play hard may need a touch-up every few months. Don't sand heavily every time, since that removes fret material and shortens fret life.

Wiping the strings and the frets after you play slows tarnish down a lot. Chapter 3 covers the everyday wipe-down.

Protect the fretboard first

Fret polish and abrasives are fine on metal, but you don't want them on the wood. Polish can dry in the grain of a rosewood board, and abrasives can scratch a finished maple board. There are two common ways to protect it.

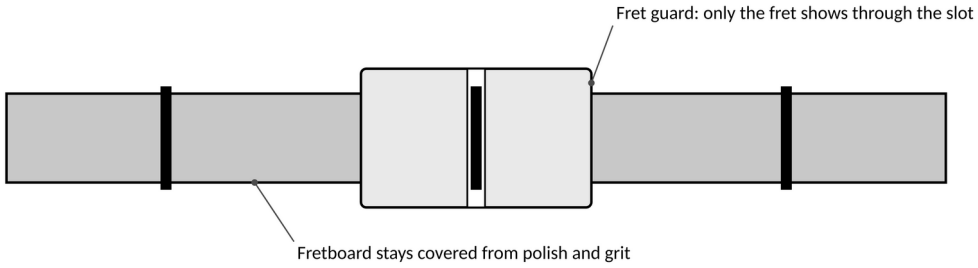


Figure 6-2. A fret guard covers the wood so only the fret is exposed.

- Fret guards: thin metal or plastic plates with a slot cut out. You slide one over a fret so only the metal shows through. MusicNomad's GRIP Guards and Fret Shield are examples, and StewMac has its own fingerboard guards.
- Low-tack tape: painter's tape on the wood on each side of the fret. De-tack it first by pressing it on your shirt a few times so it holds less.

Tape is where opinions split. Some say it can harm nitrocellulose and some polyurethane finishes. Others use low-tack tape on maple routinely, with extra care on old nitro or fresh lacquer and a metal guard on fragile vintage finishes.

My take: on a bare rosewood or ebony board, tape is fine if you de-tack it. On a finished maple board, and especially on any nitro or vintage guitar, use a fret guard instead. Guards are cheap, reusable, and remove the risk.

> **Caution:** If you use tape on a finished board, pull it off slowly, peeling back over itself at a low angle. Pulling it straight up can lift finish, especially on nitro.

Polishing frets with a polish

This is the easy method most players should start with. It removes light tarnish and leaves a shine.

1. Take the strings off and lay the guitar down with the neck supported.
2. Cover the pickups with tape or paper on an electric, or the soundhole on an acoustic.
3. Put a fret guard over the first fret, or tape the wood around it.
4. Put a small dab of fret polish on a soft cloth.
5. Rub the polish along the fret, working the top and sides of the crown. Move in the same direction as the fret, back and forth.
6. Buff the fret clean with a dry part of the cloth.
7. Move the guard to the next fret and repeat, working your way up the neck.
8. Wipe off any polish that got on the wood right away, so it doesn't dry in the grain.
9. Clean and oil the fretboard if it's bare wood (Chapter 5), then restring.

MusicNomad's FRINE is one example of a fret polish, made with very fine compounds and safe on all metal fret wire. Metal polishes and polishing cloths made for frets work too, and StewMac has its own line.

Polishing frets with abrasives

For frets that are badly tarnished or have fine scratches, polish alone won't cut it. Step up to very fine abrasives. The idea is simple: start a little coarser if the frets are rough, then move through finer and finer grits until they shine. Some common choices:

- Fret erasers: rubber blocks with grit inside. StewMac sells them in seven grits from 220 to 8000, and they don't shed sharp particles the way steel wool does.
- Micro-Mesh pads and polishing papers.
- Fine synthetic pads like Scotch-Brite.

As a guide on grit: for light tarnish, start around 1000-1500. For heavy scratches, start around 600-800, then work up through 2000 and finer to a gloss.

1. Remove the strings and cover the pickups or the soundhole.
2. Protect the board with a guard or tape.
3. Rub the abrasive along the length of the fret with light pressure, following the curve of the crown. Don't press hard enough to flatten the top.
4. Wipe off the dust, move to the next finer grit, and repeat.
5. Finish with a fret polish if you want a mirror shine.
6. Vacuum or wipe away all the metal dust before removing the guards or tape.

Caution: Light pressure only. You're polishing, not reshaping. Heavy sanding with coarse grits can change a fret's height, cause buzzing, and shorten fret life. Power buffers can groove frets or burn the finish.

Steel wool: use it carefully or skip it

Steel wool is the old-school way to polish frets and clean the board in one pass. Some big names still use it. Taylor recommends 0000 (the finest grade) steel wool, rubbed along the length of its ebony boards over the frets, and Martin mentions it as an option too. It does work.

The trouble is what it leaves behind. Steel wool sheds tiny steel fibers. On an electric, those fibers are drawn right to the pickup magnets and stick there, and they can get down into the pots. Once they're on a pickup, they're a real chore to get off. On an acoustic, the risk is fibers falling into the soundhole. If your acoustic has a magnetic soundhole pickup, treat it like an electric and skip steel wool.

Here's my stand. On an electric, don't use steel wool. Use a fine synthetic pad or fret erasers instead. They do the same job without the metal dust. On an acoustic, 0000 steel wool can be used if you cover the soundhole and clean up well, but use it at your own discretion and with extreme care. It cuts faster than you expect, and it can scratch a finish or binding it touches. Here's how:

- Cover the soundhole with a cloth or paper first.
- Use only 0000 grade.
- Rub along the length of the board, not across it.
- Vacuum up all the fibers before you remove the covers.
- Use a magnet wrapped in tape to pick up any strays left on the guitar.

> **Tip:** If you already got steel wool fuzz on your pickups, a piece of tape pressed lightly on the poles will lift most of it off. Go slowly and don't let tape sit on the guitar's finish.

Fret sprout: sharp fret ends

Fret sprout is when the ends of the frets stick out past the edge of the fretboard. You feel it as sharp little points along the edge of the neck when you slide your hand up and down. In bad cases they can scratch or even cut your hand.

What causes it

Wood shrinks when it dries out. Metal doesn't. When the air gets dry, the fretboard gets a tiny bit narrower, but the frets stay the same length, so the ends poke out. It shows up most during seasonal changes: winter when the heater runs, summer when the air conditioner runs. It turns up more often on newer, lower-priced guitars.

How to spot it

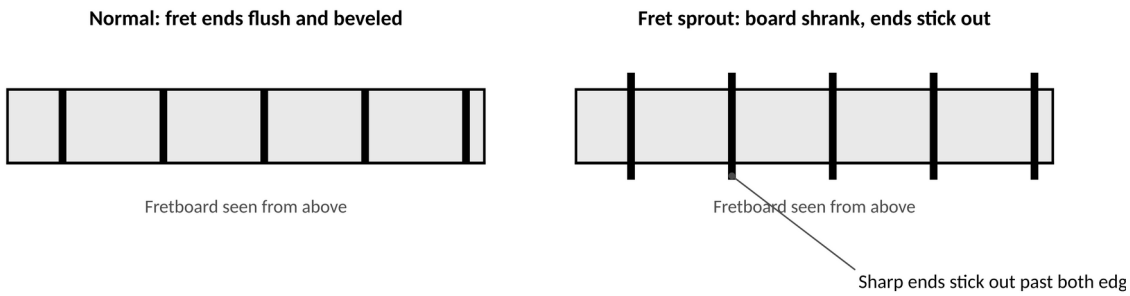


Figure 6-3. Fret sprout: the wood shrinks across the grain, the frets don't, and the ends stick out.

- Run your hand along the edge of the fretboard. Sharp or scratchy points at each fret are the classic sign.
- Look along the edge of the board. You may see the fret ends sticking out.
- Slide a wooden dowel along the edge. If it catches or skips at each fret, you have sprout.
- On a finished neck, look for a little ring of lifted or cracked finish around each fret end.
- On a bound neck (one with a plastic strip along the edge), look for small bumps or cracks in the binding at each fret.

Fix the humidity first

Before you touch a file, get the guitar back to a healthy humidity: aim for 45-50% relative humidity (RH), and anything from 40% to 55% is fine (Chapter 7). Mild sprout can shrink back on its own once the wood takes up moisture again. If the ends are still sharp after the guitar has been at a steady humidity for a while, the frets need to be filed.

Fixing fret sprout: the basics

I'll be honest with you: this is real fretwork. It's not hard to learn, but a slip with a file can scratch the finish or the side of the neck, and that damage is permanent. If you've never done it, practice on a cheap guitar first, or let a tech do it. Here's what the job looks like, so you know what you or your tech will be doing. Chapter 16 walks through the whole job with drawings, tools and the point where you should stop.

1. Bring the guitar to a steady, healthy humidity first.
2. Take off the strings or loosen them well out of the way.
3. With a fret end file held against the edge of the board, file the fret ends flush with the wood.
4. Use a beveling file to put a slight angle on the ends so they don't catch your hand.
5. Smooth and round the corners of each fret end with a fine fret end dressing file.
6. Polish out the file marks with fine abrasives.
7. Vacuum away the metal dust, clean the board, and oil it if it's bare wood.

Both MusicNomad and StewMac sell files for this job, including beveling files with handles that hold set angles.

The bevel angle is one place the tool makers don't agree. The guides range from about 23 degrees to 45 degrees, partly because they measure from different starting points, so don't chase a number. For sprout, you're only bringing the ends back flush with the bevel the factory already cut. The more you angle the bevel, the more you narrow the playing surface for the outer strings, and the easier it is for the high and low E strings to slip off the edge. Match the factory angle, or use a file with a fixed angle, which takes most of the guesswork out. Take off as little metal as you can. You can always take more off later.

> **Caution:** Don't file a bound neck yourself. Most bound necks can't be fixed at home without damaging the binding and finish. The same goes for a neck where the finish is lifting around the fret ends. Take those to a tech.

Will it come back?

It might. Sprout can return after dry seasons, especially on new guitars, and often settles down after a few seasons as the wood stabilizes. Older guitars in very dry climates still get it. The best prevention is steady humidity (Chapter 7), and keeping a bare board conditioned (Chapter 5) helps too.

Fret wear: when frets need more than polish

Every fret slowly wears where the strings press on it. On the frets you play most, usually the low ones near the nut, you'll eventually see small dents or flat spots right under the strings. These are called divots.

Signs of worn frets

- Small dents or grooves in the top of the frets under the strings, most often on the low frets.
- Flat tops on frets that should be rounded.
- Buzzing on certain notes that wasn't there before (Chapter 13 covers buzz).
- Notes that don't ring clearly, or sound a little out of tune, at a worn fret.
- Bends that catch or feel uneven.
- Frets lifting out of their slots. Shine a bright light along the board to spot a raised fret.

Uneven frets cost you sustain and clarity, throw off intonation (how well notes stay in tune as you move up the neck), and make bends harder.

Leveling and crowning

When frets are worn but still tall enough, a tech can level and crown them. Leveling means filing all the frets down to the same height so none sits higher or lower than its neighbors. Crowning means reshaping the flattened tops back into a round crown. Then they get polished. This is sometimes called a "fret dress."

Refretting

When the frets are too low to level again, they need to be replaced. That's a refret: the old frets come out and new fret wire goes in. There's no single cutoff, because fret wire starts out at different heights. One repair writer uses about .038 inch as the line for typical modern frets, but some vintage-style wire is barely that tall when it's new (*Inside the Electric Guitar* lists the common sizes). Your tech can measure what's left and tell you whether there's enough to level again. Fender lists refretting as a job for a luthier or tech, and that's the right call.

Why I'd leave this to a tech

Leveling isn't a casual job, because what you file off can't be put back. The tools can also cost more than paying a pro to do one guitar. If you have a lot of guitars and want to learn, it can be worth it. If not, it's a job for a tech. There's no shame in that. The one exception is a single high fret, which a careful owner can learn to fix; Chapter 17 shows how.

When to see a tech

- Fret sprout on a bound neck, or with finish lifting around the fret ends.
- Fret ends still sharp after the guitar has been at a steady humidity.
- Deep divots, flat-topped frets, or buzzing you can't track down.
- Any fret lifting out of its slot, or frets you can see are much lower than the ones above them.
- Any time you're not comfortable with a file near your guitar's finish.

Side notes for classical and bass

Classical guitars have the same frets and need the same care. Most have bare boards, so the polish and guard method works well.

Bass frets wear too, usually more slowly on the higher frets. Round-wound bass strings are rough on frets, so check them at each string change.

Quick checklist

- Look at and feel your frets at every string change; polish only when they're dull or rough.
- Protect the board with a fret guard; skip tape on finished maple and nitro.
- Use fret polish first; step up to fine abrasives with light pressure only if you need to.
- On an electric, skip steel wool; on an acoustic, use only 0000, cover the soundhole, and go with extreme care.
- For sharp fret ends, fix the humidity first, then file only if they stay sharp.
- Take bound necks, lifting finish, deep divots, and lifting frets to a tech.

Chapter 7: Humidity and Temperature

If I could get every guitar owner to do one thing, it would be this: learn what the air around your guitar is doing. A big share of acoustic guitar problems start with moisture. Cracked tops, sharp fret ends, bridges pulling up, action that changes from summer to winter. Almost all of it traces back to air that was too dry, too wet, or swinging between the two.

This chapter covers what humidity is and why wood cares about it, the range the guitar makers recommend, the warning signs, and the tools that keep things steady. It also covers temperature, because heat and cold cause their own trouble. None of this is hard. It boils down to measuring, then adding or removing a little moisture when the numbers tell you to.

What relative humidity means

Relative humidity (RH) is how much water vapor the air is holding compared with the most it could hold at that temperature, written as a percentage. At 50% RH, the air is holding half of what it could. Warm air can hold more water than cold air, which is why RH changes when you heat or cool a room even if no water is added or taken away.

Why does a guitar care? Wood is a bit like a sponge. It takes on moisture when the air is damp and gives it back when the air is dry, swelling and shrinking as it goes, and it moves mostly across the grain rather than along it. A guitar top is a thin, wide plate of wood glued to braces, sides and a bridge, so when it shrinks or swells it has nowhere to go. Something has to give.

Taylor gives a good example of the scale. On a spruce top about 16 inches wide, a drop to 30% RH shrinks the wood by roughly 1/8 inch, and a rise to 60% RH swells it by about 1/16 inch. That doesn't sound like much until you remember the top is only a couple of millimeters thick and glued down all the way around.

The target range, and why the numbers don't all match

You might ask, "So what number should I aim for?" Here's the honest answer: the guitar makers and the humidifier makers don't all say the same thing. Taylor and Martin both call for 45-55%. Fender's acoustic advice starts lower, at 35-50%. MusicNomad says 40-55%, and Yamaha gives 45-55% in one guide and 40-50% in another. Oasis says guitars sit stable around 40-45%, Boveda calls 40-60% safe for wood instruments, and the two-way packs themselves are set near 49%, or made to hold a case at 45-50%.

The overlap is the part that matters: nearly every one of those ranges covers 45% to 50%. So that's my safe middle ground. Aim for 45-50% RH and treat anything from about 40% to 55% as fine. Don't panic over a reading of 42% or 54%. Start paying attention when you drop under 40% or climb over 55%, and act fast if you see readings in the 20s or 30s, or above 60%.

Steadiness matters as much as the exact number. A guitar that lives at 44% all year is happier than one that bounces from 60% to 30%. The swings themselves cause many of the problems, because the neck and body keep changing size.

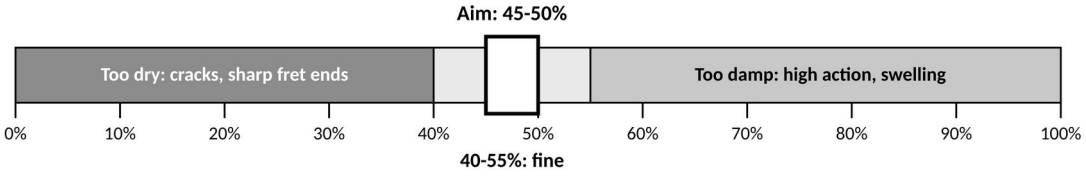


Figure 7-1. Aim for 45-50% relative humidity. Anywhere from 40% to 55% is fine.

Signs your guitar is too dry

Dry air is the more common problem in most homes, and it's the one that breaks things. You won't always see all of these, and some have other causes, but if you see two or three together, think humidity first.

- Sharp fret ends sticking out past the edge of the fretboard. This is called fret sprout: the fretboard wood shrinks, the metal frets don't, and the ends poke out and scratch your hand as you slide along the neck. Chapter 6 covers it in detail.
- Action that suddenly drops and new buzzing, often higher up the neck. Action is the height of the strings above the frets. This kind of buzz has a nickname: humidity buzz.
- A top that looks sunken between the bridge and the soundhole, or a back that looks flat when it used to have a slight curve.
- A hump in the fretboard where the neck meets the body.
- The edge of a bridge starting to lift from the top. If you can slide a piece of paper under the back edge of the bridge, stop playing it and take it to a tech.
- Cracks running along the grain of the top, back or sides.
- Fine cracks in the finish, called finish checking. These come mostly from fast temperature changes (Chapter 3), and they tend to show up in the same cold months. Nitrocellulose lacquer, a thin, older style of lacquer used on many vintage and high-end guitars (see Chapter 1), is the finish most likely to do this.

How fast can it happen? Faster than most people think. A big drop in humidity can change how a guitar plays in a matter of hours. Leave it in dry air for a few weeks and a crack becomes a real risk, and MusicNomad's humidity guide warns that at 15% RH or lower a crack can show up within a day or two. A furnace can pull a room under 20% in an hour or less in winter.

> **Caution:** A lifting bridge or a crack is a job for a repair tech. Don't try to glue a bridge down yourself, and don't put super glue in a crack. Humidify the guitar slowly and get it to a pro.

Signs your guitar is too wet

Too much moisture is less likely to crack a guitar, but it causes its own trouble.

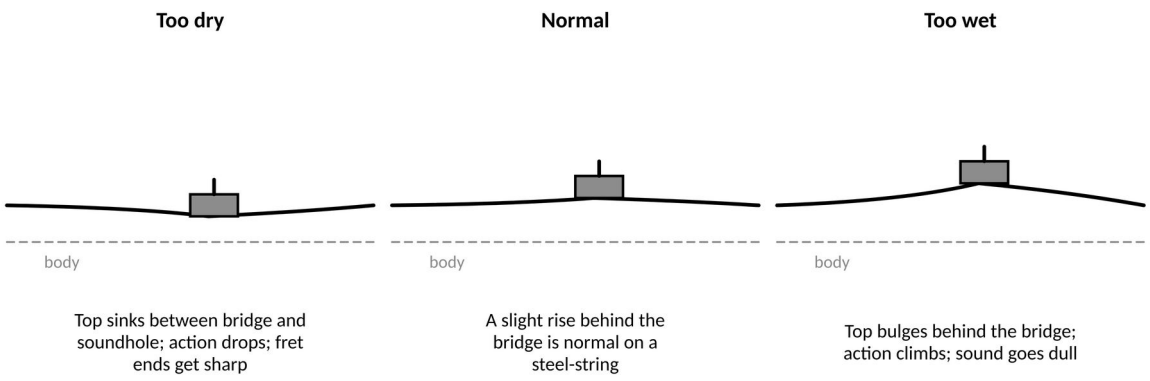


Figure 7-2. What humidity does to the top of a steel-string acoustic, seen from the side (exaggerated).

- Action that creeps up and makes the guitar harder to play.
- A dull, muddy, lifeless sound. The wood is carrying extra water weight.
- A top that bulges up behind the bridge more than usual. A small belly there is normal on a steel-string acoustic. A big one that keeps growing isn't.
- A back that dips in the middle and swells on either side near the end of the body.
- Cloudy or milky patches in a nitrocellulose finish, sometimes called blushing.
- In bad cases, glue joints soften, braces come loose, the bridge starts to lift, and mold can grow inside the body.

How long does it take? Several weeks at 80-90% RH, or several months at 60-70% RH, can over-humidify a guitar. High humidity combined with high heat is especially hard on glue joints.

> **Tip:** Don't try to fix a wet guitar by throwing on lighter strings. That's a workaround, not a fix. Get the humidity back in range and let the wood settle first.

Hygrometers: measure, don't guess

A hygrometer is a small gauge that reads humidity, and most also show temperature. If you take one thing from this chapter to the store, make it a hygrometer. Without one you're guessing, and your own comfort is a poor guide. You can feel fine in a room that's drying your guitar out.

Go digital. The old dial or needle type can stick or drift out of calibration.

Where you put it matters. A room reading doesn't tell you what's going on inside the case or inside the guitar. A room can sit at 45% while the inside of an old wooden case sits at 30%. So keep the hygrometer in the case. MusicNomad's Hone is one example, made to clip to the strings, clip at the soundhole or sit in a case. D'Addario, Oasis and Boveda sell digital hygrometers too, and so do plenty of other companies.

How often should you look? Daily during the fall and spring changeovers, when the weather swings, and every few days the rest of the year, or whenever you open the case.

> **Tip:** Hygrometers aren't all accurate out of the box. If you have two and they disagree by a lot, check them against each other in the same spot for a day. Boveda's own help pages even ask, "Have you calibrated your hygrometer?" before they tell you their product isn't working.

Humidifiers: the main types

A guitar humidifier is just a controlled way to let a little water evaporate inside the case or the guitar. There are a few styles, and each works a little differently. Whichever you pick, use the case. A guitar on a stand out in the room is exposed to whatever the room is doing, and it's much easier to control humidity in the small space of a closed case.

Soundhole humidifiers

These sit in or over the soundhole of an acoustic and release moisture right into the body, where the top, back and braces live. MusicNomad's Humitar is one example: it hangs from the strings and holds a sponge that takes up about ten times its weight in water without dripping. D'Addario makes soundhole styles too, and the Oasis OH-1 is another popular option that hangs between the strings. Fender ships its Paramount acoustics with a rubber-hose style soundhole humidifier.

One thing to watch: a soundhole humidifier does a lot for the body and very little for the neck and headstock. Taylor warns against humidifiers that seal off the soundhole unless you also put one up by the headstock, since the neck and fretboard need moisture too.

How do you know when to refill it? It depends on the product and the season. With a sponge type like the Humitar, it's simple: open it and touch the sponge. Wet, leave it. Dry, soak it again. Figure on adding water about every one to two weeks as a rough average, and check every two or three days when the weather is drying out. The Oasis models visibly shrink as the water is used up, which tells you it's time.

Case humidifiers

A case humidifier sits in the case rather than in the guitar. It humidifies the whole space, so the neck and fretboard get moisture along with the body. This is the type for electrics and for archtops or other guitars with f-holes, where there's no round soundhole to hang anything in. MusicNomad sells a case version of the Humitar that slides into a holster stuck to the case lining. Oasis makes a case model (the OH-6), and other brands make them as well.

Many people use both: one in the soundhole and one in the case near the headstock. That's a good setup for a solid-wood acoustic in a dry climate.

Caution: Keep liquid water away from the wood, because direct contact can damage an instrument. If a humidifier feels wet on the outside, it's leaking and should be replaced. Oasis warranties its humidifiers for two years and says the liner wears out eventually.

Two-way humidity packs

Two-way packs, like D'Addario Humidipak and Boveda, take a different approach. They're sealed pouches of salt and water solution that add moisture when the case is dry and absorb it when the case is damp. Nothing to refill: you put them in fabric holders in the case, close the lid and replace them when they're spent.

D'Addario's Humidipak Maintain packs hold a case at 45-50% RH, and the starter kit puts two packets in a pouch at the soundhole and one in a pouch under the headstock. There's also a Restore version for guitars that

have already dried out and an Absorb version for very humid places. Boveda's pack is set to 49% RH, and Boveda recommends two per guitar: one in a holder draped over the strings and one up near the headstock and fretboard.

How long do they last? Both makers say to replace them by three months at the latest. A pack can be spent in two months in a dry climate, so use the touch test and swap it sooner if it's hard. Boveda's touch test is handy: a pack with soft spots, or one only stiff at the corners, is still working, and one that's hard all the way through is done. Write the start date on it with a marker.

Two-way packs aren't perfect. They can be slow to respond, they can leak, and they need regular replacement. My middle ground: they're a good choice in a case that closes well and a climate that isn't extreme. In very dry places they give up their water faster, so watch your hygrometer and swap them sooner.

Room humidifiers and dehumidifiers

If you own several guitars or like to keep one out on a stand or wall hanger, a room humidifier makes sense. The idea is to keep the whole room in range. Put a hygrometer in the room, and still check inside a case now and then.

If your problem is too much moisture, work on the room, not the guitar. Don't try to dry out a single guitar in its case, because it's easy to overdo it. Run a dehumidifier in the room instead. In places that are humid year-round, silica gel or bamboo charcoal packs in the case, replaced every few months, work well, and so does a two-way pack made for absorbing moisture. Silica gel keeps absorbing without stopping, so watch the hygrometer and pull it out when the case reads about 45%. Taylor also suggests taking the guitar out and drying the empty case with a hair dryer for 10-15 minutes now and then. Never point the dryer at the guitar.

A few placement rules apply no matter what. Basements tend to run damp, and attics and upstairs rooms tend to run dry. Keep guitars away from heating and air-conditioning vents and out of direct sunlight. In winter, don't hang a guitar on an outside wall, because the cold wall can leave the back at a different temperature than the top. An inside wall is the better spot.

What water to use

Use distilled water in any humidifier you fill. Tap water leaves minerals behind that build up in sponges and gel. If a sponge gets hard and won't soak up water, warm the distilled water, let it soak and work it gently with clean hands. Don't use a kitchen sponge in a homemade rig. They drip, they grow mold, and they dry out fast.

> **Caution:** Don't over-humidify. If your hygrometer says the case is at 55% or higher, take the humidifier out until it drops back down. More water is not better.

Electric guitars need it too

You might ask, "My electric is a solid slab of wood with a thick finish. Do I really need to worry?" Less than with an acoustic, yes. But not zero. The neck and fretboard on an electric are the same kinds of wood as on an acoustic, and they shrink and swell the same way. Dry air is what gives an electric sharp fret ends and a neck that suddenly needs a truss rod tweak. A truss rod is the adjustable metal rod inside the neck that counters string pull (Chapter 12 covers it).

For an electric, a case humidifier or a pair of two-way packs is plenty. Boveda's advice is one or two packs for a solid-body electric. Keep the moisture source in its holder, off the fretboard and away from the pickups.

Laminate acoustics are tougher than solid-wood ones, but they usually still have solid wood necks and fretboards, so they get fret sprout just like everything else. Classical and nylon-string guitars are built light and are at least as touchy as steel-string acoustics, so treat them the same way. Basses follow the electric or acoustic advice depending on which kind you have.

A seasonal routine

Humidity care isn't a set-it-and-forget-it job, because the weather doesn't hold still. Here's a simple routine that works in most of the U.S.

- Fall: when the heat comes on, check your hygrometer daily for a week or two. Put humidifiers back in the cases, with fresh crystals if yours uses them.
- Winter: the danger season in most homes, because furnaces dry the air. Indoor RH can drop to 20% or lower during heating season. Check humidifiers every few days and refill them as soon as they're dry.
- Spring: as the air warms up and gets damper, watch the case readings. When the case stays at 55% or above, pull the humidifier. Wash out crystal-type units now and replace the crystals in fall, and start using the humidifier again any time the room drops under 40%.
- Summer: in humid parts of the country, you may need to dehumidify the room. Don't assume summer is safe everywhere, though. Air conditioning pulls moisture out of the air too, and it can drop RH quickly.

Expect a little seasonal change in how the guitar plays, even with good care. A guitar can feel great in summer and buzz in winter, and usually a small adjustment fixes it. If you find yourself making big truss rod changes twice a year, that's a sign the humidity is swinging too far. Chapter 12 covers checking relief and action, and Chapter 15 puts these seasonal jobs on a schedule.

Life in the high desert

I live in Dayton, Nevada, in the high desert, so this section is close to home. In a place like this, the seasonal routine above doesn't really apply. It's dry nearly all year. Summer is hot and dry, winter is cold and dry, and the furnace makes winter drier still indoors.

In desert areas, plan on humidifying year-round. Oasis makes "Plus+" versions of its humidifiers that put out more water for rooms below 25% RH, where the regular models are meant for rooms between about 25% and 40%. That tells you how far off the normal range a desert home can be.

If you live somewhere like this, here's what I'd do. Keep every solid-wood guitar in its case when you're not playing it. Use a case humidifier and a soundhole humidifier on acoustics, or a two-way pack setup if you're willing to swap packs more often. Put a digital hygrometer in the case and actually look at it. Consider a room humidifier where your guitars live. And don't leave a guitar hanging on the wall all winter just because it looks nice there.

If a guitar has already dried out, bring it back slowly and check it daily, because you can overshoot. Taylor describes one dried-out guitar taking on about 25 grams of water over four days. The body usually recovers better than the neck, and the frets may still need dressing afterward. One more thing worth knowing: bringing a cracked guitar back to normal humidity slowly often helps the crack close up and makes the repair easier. It doesn't fix the crack, though. Get it to a tech.

Temperature and temperature shock

Humidity gets most of the attention, but temperature matters too. The makers' comfortable room ranges run from the mid-60s to the high 70s °F (about 19-26°C): Yamaha says 66-77°F, Martin 72-77°F and MusicNomad 70-78°F. The simple version: if you're comfortable in the room, the temperature is probably fine for the guitar. Humidity is the one you can't feel, which is why you need the hygrometer.

Heat is a problem mostly because of glue. The heat inside a parked car can soften the glues in a guitar and let the bridge pull loose under string tension. Chapter 14 covers cars and travel in more detail. At home, keep guitars out of direct sun from a window and away from heaters, fireplaces and vents.

Cold is a different risk. The danger isn't so much the cold itself as the fast change from cold to warm. Rapid temperature changes can cause small cracks in the finish, and extreme cold can crack wood, weaken glue joints and hurt electronics.

You might ask, "I just brought my guitar in from a freezing car. Can I open the case and play?" Don't. Leave it closed and let the case and the guitar warm up together, slowly, to room temperature. Don't set it by a heater or fireplace to speed things up.

How long? Makers don't agree. Some say simply to let it reach room temperature; others give a 24-hour rule after a guitar has been shipped or has been sitting in a very hot or very cold car. My middle ground: give it at least a few hours, and if it came out of real cold or real heat, or came off a delivery truck, give it the full day. Once it's at room temperature, open it up, look it over and play it. If it seems fine at that point, it likely is.

> **Caution:** Never warm a cold guitar with a hair dryer, space heater or fireplace. Fast warming is exactly what causes finish checking and cracks.

Quick checklist

- Put a digital hygrometer inside the case, not just in the room, and check it.
- Aim for 45-50% RH; anything from about 40% to 55% is fine.
- Keep solid-wood guitars in their cases when you're not playing them.
- Humidify the neck as well as the body: case humidifier, soundhole humidifier or two-way packs.
- Use distilled water, and pull the humidifier when the case reads 55% or higher.
- Watch for sharp fret ends, low action and buzz, or a sunken top as signs of dry air.
- Let a cold or hot guitar come to room temperature in its closed case before opening it.
- In the desert, plan on humidifying all year.

Chapter 8: Hardware and Electronics

The wood gets most of the love in a guitar book, but the metal parts and the wiring are what you touch and depend on every time you play. A tuner that slips, a strap button that pulls loose, an output jack that crackles in the middle of a song: none of these are big repairs, but any one of them can ruin a gig or drop your guitar on the floor.

This chapter walks through the hardware and electronics a player can look after at home: tuners, bridges and saddles, tremolos, strap buttons and strap locks, the output jack, noisy controls, pickups, acoustic preamps and their batteries, and the plating on all that metal. At the end there's a short section on cables and pedals. I'll also tell you where to stop and hand the job to a tech.

Guitars come to my bench for a pickup swap when the real problem is a scratchy pot, a loose output jack or a cold solder joint. Players often spend money on new parts before checking the simple connections already inside. A multimeter and contact cleaner often bring the original electronics back to life.

Before you start

Most hardware work needs only a few tools: the right size screwdrivers, a set of hex keys (Allen wrenches), a soft cloth and a little light lubricant. Chapter 2 lists what goes in a kit. The most common mistake is using the wrong size screwdriver and chewing up a screw head. Take a second to find the one that fits snugly.

Unplug the guitar before you work on anything electrical. If it has an acoustic preamp, take the battery out before you open anything up. Put screws in a small dish or a magnetic tray so they don't roll under the bench, but keep magnets away from pickups. And lay the guitar on a soft work mat or towel so the hardware can't scratch the finish.

> **Tip:** Take a phone photo before you take anything apart. It costs nothing and saves a lot of head-scratching when it's time to put it back together.

Tuners

Tuners, also called tuning machines or tuning keys, are the geared pegs on the headstock that you turn to change pitch. There are two basic types. Sealed (enclosed) tuners have the gears inside a closed metal housing. Open-gear tuners, the kind you see on many vintage-style and classical guitars, have the gears out in the open.

Sealed tuners are lubricated at the factory and generally need nothing from you. Don't drill into them or try to oil them. Open-gear tuners do need a little attention. Lubricate the gears once or twice a year with a tiny amount of petroleum jelly. More is not better here. Extra grease grabs dust and can wear the gears faster. A lubricant made for the job, like MusicNomad's TUNE-IT, works too, and so does a little lip balm. Use a small dab and wipe off the extra.

There's one place on a tuner you never want lubricant: the hole in the post where the string goes through. That hole is what holds the string, and grease there can let it slip.

Most tuners also have a small screw on the end of the button. It sets how stiff the tuner feels. Check it whenever you change strings, and keep it finger-tight. Cranking it down makes the gears stiff, especially on

locking tuners. If a tuner feels loose and floppy, snug that screw a little. If it feels tight and gritty, back it off a bit.

The nut or bushing around the post where it comes through the face of the headstock can work loose over time. If a tuner wiggles in the headstock, snug that nut gently with the correct size wrench. Don't overtighten it. You can crack the finish around the bushing or crush the wood.

> **Caution:** If a tuner is bent, the gear is stripped or a post is wobbling even after you've snugged everything, replace the tuner or have a tech look at it. Replacement tuners often need the same hole spacing and screw locations, so match them carefully.

Bridges and saddles

The bridge holds the strings at the body end of the guitar. The saddle is the strip or set of pieces on the bridge that the strings rest on. Together with the nut at the other end, the saddle sets the length of the vibrating string, which is why it matters for intonation. Intonation is how well the guitar stays in tune as you play up the neck (Chapter 12 covers how to check and set it).

On an acoustic

A steel-string acoustic usually has a wooden bridge glued to the top, a bone or synthetic saddle sitting in a slot and bridge pins that hold the string ends in place. Sweat and grime build up around all of these, and that dirt can stain pins and saddles and even make them stick. Spray a gentle guitar cleaner or detailer onto a cloth, not onto the guitar, and gently scrub around the pins and saddle, then buff dry.

Bridge pins should go in with firm thumb pressure. Don't hammer them in. You can split the bridge. The same goes for the endpin at the tail of the guitar: push it in by hand with a gentle twist and never tap it in. Check it now and then to make sure it isn't working loose, since that's what your strap may be hanging on. Chapter 10 covers pins in more detail.

If your acoustic has a pickup under the saddle, be very careful when you take the saddle out. Keep cleaners and oils off the pickup element. Some systems need prep work first. On Taylor's Expression System 2, you back off the three pickup adjustment screws behind the saddle before you pull the saddle out, then turn them back in after it's reseated. Skipping that step can damage the pickup. If you don't know what pickup you have, leave the saddle in place or ask a tech.

On an electric

Electric bridges are all metal, and they come in many styles: hardtail bridges with individual saddles, Tune-o-matic bridges with a separate stopbar tailpiece, and tremolos of several kinds. The care is mostly the same. Keep them clean and dry, and give the moving parts a little lubricant.

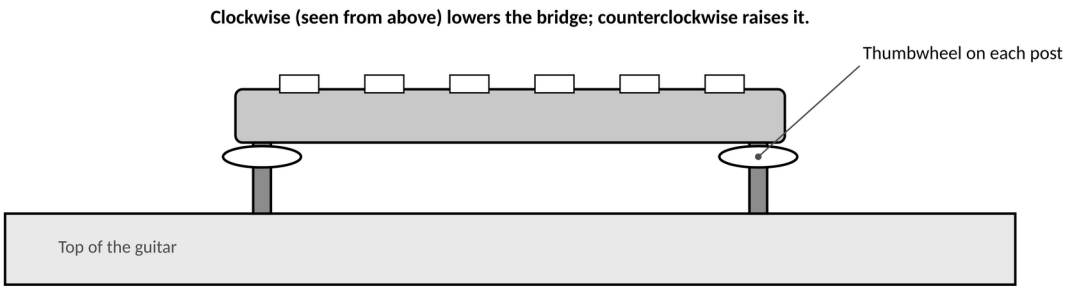


Figure 8-1. A Tune-o-matic bridge rides on two posts with thumbwheels.

Put a drop of light machine oil on each saddle contact point at every string change. It cuts down on moisture buildup, friction and string breakage. A product like MusicNomad's TUNE-IT does the same job at the saddle, the nut and string trees. Either way, use a small amount and wipe off what doesn't go where it's needed.

On a Tune-o-matic, the bridge sits on two posts with thumbwheels that set its height. If you take all the strings off at once, the bridge can fall off the posts and the stopbar can drop. That's not a disaster, but take a phone photo first so you know which way the bridge faces, and set it back in the same spot. Chapter 11 has the details on restringing these.

Caution: If saddle screws or bridge posts on an electric have rusted, soaking the parts overnight in a mix of naphtha and light oil can free them up. Naphtha is highly flammable and its fumes are harmful. Take the parts off the guitar first, work outdoors or with strong airflow away from any flame or pilot light, wear gloves, and use a closed metal or glass container. If a part is that far gone, a replacement is often the better fix.

Tremolos

A tremolo, sometimes called a whammy bar or vibrato, is a bridge that pivots so you can bend the pitch of all the strings at once. It's balanced between string tension on top and springs underneath in a cavity on the back of the body. When the two forces match, the bridge sits where it should and returns to pitch.

The Stratocaster-style tremolo is the most common one, and it comes in two kinds. The vintage-style bridge pivots on six screws across the front edge. Back all six screws out a little. Set the two outside screws so they just touch the bridge plate, and leave the four middle screws slightly higher so the bridge rocks only on the outside two. The two-point style used on many later Fenders pivots on just two larger screws. Fender's spec for a floating bridge is about 1/8 inch (3.2 mm) of gap between the back of the bridge and the body. You set that by turning the two screws on the spring claw in the back cavity, which changes spring tension.

Some players like the bridge flat on the body so it only bends down. That's called decking it. Match spring tension to string tension first, then add a little more. Don't overtighten the springs, though, because too much spring tension makes the tremolo arm stiff and hard to push.

For smoother action, put a little lip balm or petroleum jelly where the bridge pivots, and keep it off the finish. Do the same at the string trees on the headstock, where the strings rub every time the bar moves. If the guitar

goes out of tune after using the bar and you hear a "ping" as it settles, a sticky nut slot or string tree is the usual cause. A small amount of lubricant at the nut slots often fixes it.

Locking tremolos like the Floyd Rose take more setup knowledge and their own tools. Chapter 11 covers the basics of restringing them, and Chapter 12 covers the setup order. If your tremolo needs a full rebalance and you're not sure where to start, a tech can do it quickly.

Caution: Never pull the springs off a tremolo with the strings still at pitch. The bridge will snap forward hard enough to damage the finish or your fingers. Slack the strings first.

Strap buttons and strap locks

Strap buttons are the little knobs your strap hangs on. They're held in with a single wood screw, and that screw can loosen over time from the weight of the guitar swinging around. Check them every time you change strings. Give each button a wiggle. If it moves, snug the screw with a screwdriver that fits, firmly but without cranking.

What if the screw just spins and won't tighten? That means the hole is stripped. This is a common repair, but it's a repair: the hole needs to be filled and re-drilled so the screw has fresh wood to bite into. If you're handy, it's a simple job. If you're not, it's a cheap fix for a tech. Don't just stuff something in the hole and hope, because a guitar that falls off its strap is a much bigger repair.

Strap locks hold the strap to the guitar so it can't slip off the button. There are a few systems. Some replace the strap button with a special button and add a locking piece to the strap, like Schaller-style locks or Dunlop Straploks. Fender makes its own locks too. Others are simple rubber washers that fit over a regular button. My advice is to pick one lock system and use it on all your guitars and straps so you can swap straps between them, which makes sense if you play more than one guitar on a gig.

Acoustic guitars are trickier at the tail end, because the endpin is often also the output jack for the pickup. You can't just screw on a new button. One option is an adapter that threads onto the jack and carries a lock button. MusicNomad's Acousti-Lok is one example; it comes in versions for different jack threads. The other option is to drill a new hole for a button.

Caution: Don't drill a strap button hole in an acoustic yourself unless you know exactly where the internal block is. The screw has to go into the solid tail block inside the body, and drilling anywhere else would be a disaster. Have a tech do it.

The output jack

The output jack is where you plug in your cable. It's the part of an electric guitar that gets yanked, stepped on and worn the most. Two problems are common: the jack gets loose and turns when you plug in, or it gets dirty and crackles.

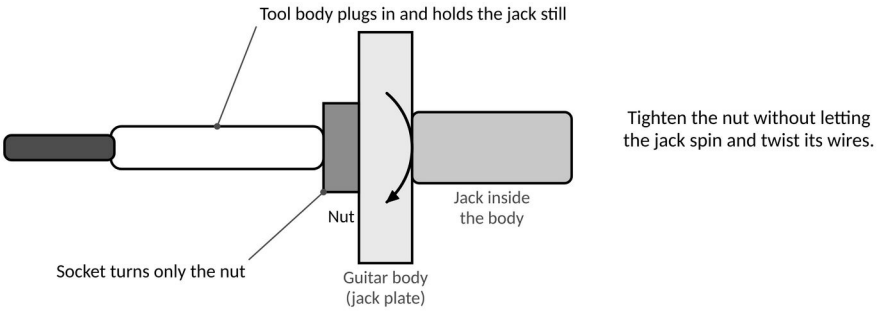


Figure 8-2. A jack tightening tool holds the jack still while you turn the nut.

A loose jack is normal over time, and it happens even more on basses because of the low-end vibration. Tighten it before it gets bad. If the nut comes all the way off, the jack can drop into the body, and then you're fishing for it. Here's the catch: if you just grab the nut with pliers or a wrench, the whole jack often turns inside the guitar and twists the wires, which can break a solder joint.

The fix is a small, inexpensive jack tightening tool. It has a part that plugs into the jack to hold it still and a socket that turns the nut around it. If you don't have one, you can sometimes reach inside through the control cavity or jack plate and hold the jack body while you snug the nut from outside. Either way, the goal is to tighten the nut without spinning the jack.

If the jack crackles when you wiggle the cable, it may just be dirty. Clean it with contact cleaner (more on that below). If that doesn't fix it, the springy contact inside may have lost its grip on the plug or a wire may be loose. Those are easy repairs for anyone who can solder, and quick ones for a tech. Chapter 19 shows how to replace a jack, pot or switch.

Scratchy pots and switches

A pot, short for potentiometer, is the part behind each volume and tone knob. Inside, a small metal wiper slides along a track. Over time, dirt and oxidation build up on that track and you hear scratching or crackling when you turn the knob, or the sound cuts in and out. Switches, like the pickup selector, have contacts that get dirty the same way.

Before you reach for anything, try the free fix: turn the knob or work the switch back and forth a bunch of times. Sometimes that's enough to wipe the contacts clean.

If it isn't, use a contact cleaner made for electronics. DeoxIT is the best-known brand; CRC, Max Professional and Permatex make them too. MusicNomad's JackPot is a small tube of DeoxIT-based cleaner that comes with a brush. Put the cleaner where the contacts are, then work the knob or switch back and forth to spread it.

> **Caution:** Many contact cleaner sprays are flammable. Check the label, use them in a room with fresh air, and let them dry completely before you plug in or pick up a soldering iron.

Makers don't agree on how to apply it. Some say spray it straight into the pot or switch. Others say one or two drops on a brush is enough, and warn that aerosol sprays can soak the inside of a guitar and hurt the finish or other parts. My middle ground: use as little as you can. If you use a spray, use the thin straw, aim right at the

opening in the pot or switch, give it a quick shot and cover the area around it with a paper towel. If you can reach the part with a dropper or brush, that's even better.

Most of the time you'll need to get at the back of the pot. On a Strat-style guitar that usually means taking off the pickguard. On a Les Paul-style guitar, you open the control cavity cover on the back. Look for the small opening on the side of the pot housing. That's where the cleaner goes.

Caution: Don't use water, WD-40 or any oil or household spray on guitar electronics. Use a cleaner made for electrical contacts, and don't breathe the spray.

If cleaning doesn't fix it, the pot or switch may be worn out. That's the only time you need to replace one. Swapping a pot means soldering. If you've never soldered, this is a good job to hand off.

Pickups

Pickups are the magnetic sensors under the strings that turn string vibration into an electrical signal. They don't need much from you. Dust around them with a soft brush or a dry cloth. If you use a cleaner on the guitar, spray it on the cloth rather than the guitar, which keeps it out of the pickups. The same goes for acoustic soundhole pickups: a light mist on the cloth, then wipe carefully.

Keep steel wool far away from pickups. The tiny steel fibers stick to the magnets and are a pain to get off. Chapter 6 explains this in the fret polishing section. Pickup height is a setup job, so I've put it in Chapter 12.

If a pickup goes dead or starts cutting out, the problem is usually a loose wire, a dirty switch or the jack rather than the pickup itself. Clean the switch and jack first. If that doesn't do it, take it to a tech.

Acoustic preamps and batteries

Many acoustic-electric guitars have a preamp, a small circuit that boosts and shapes the pickup's signal before it goes to the amp. Most run on a battery, usually a 9-volt, sometimes AA or coin cells. Where the battery lives depends on the guitar. Some have a clip-in holder near the endpin, some a door on the side, some a holder you reach through the soundhole. A soundhole-mounted battery may need changing when you restring.

Here's the thing many people miss: with most of these systems, plugging in the cable turns the preamp on, and unplugging it is how you save the battery. So don't leave a cable plugged in when you're done playing. Taylor's number for a fresh battery in its Expression System 2 is about 30 to 40 hours of plugged-in use.

How do you know the battery is getting low? On Taylor's system, the sound starts to get distorted. Other systems have a low-battery light. Don't wait for it to die on stage. Change it on a schedule if you gig.

Write the install date on the battery with a marker. Batteries left unused for a long time can leak, so if you're putting a guitar away for a while, take the battery out. A leaking battery can damage the holder and the circuit board.

If the guitar suddenly makes no sound, work through it in order. First make sure the amp or PA is on and not muted and the cable is fully seated. Try a different guitar or cable to rule them out. Then check the battery: is it dead or in backwards? Some systems have a small switch inside the soundhole that can be bumped halfway, which kills the output, so check that too. If none of that works, call the maker or take it to a tech.

Caution: Don't try to repair or rewire an acoustic preamp or pickup yourself. Martin says pickup installation on its guitars should be done by an authorized service center, and its warranty doesn't cover damage from installation. Changing batteries is fine; leave the rest to a pro.

Chrome, nickel and gold: caring for plated parts

Most guitar hardware is plated, meaning a thin layer of chrome, nickel or gold covers a base metal underneath. Each one acts a little differently.

Chrome is hard and bright, with a slightly blue shine. It holds up well. Nickel is softer and warmer looking, a little yellowish, and it dulls and tarnishes over time. Some players like that aged look; some don't. Gold looks great when new, but the plating is often very thin and wears through where your hand rests.

For chrome, nickel and stainless parts, a guitar polish such as MusicNomad's Guitar Polish is safe: a small dab on a low-pile cloth to take off the grime, then a soft cloth to buff off what's left. StewMac's Miracle Polishing Cloth is another product made for chrome and nickel hardware. Wipe sweat off your bridge and tuners after you play. Sweat is salty and acidic, and it's what eats through plating and starts rust.

Gold needs a light touch. The plating can be so thin you can polish right through it if you're aggressive. Often the best care is just a gentle wipe with a clean cloth and no polish at all. If your gold hardware has already worn through to the base metal in spots, polishing won't bring it back. Replacement is the only real fix.

Caution: Don't use household metal polish, abrasive pads or steel wool on plated guitar hardware. They can strip the plating. Badly rusted parts call for rust removers, wire brushes and overnight soaks, but that work is better done with the part off the guitar, and many times a new part is the smarter choice.

Cables and pedals, briefly

Your cable and pedals aren't part of the guitar, but they cause many of the crackles and dropouts people blame on the guitar. A quick look at them saves a lot of troubleshooting.

For cables, keep it simple. Pull the cable out by the plug, not the cord. Don't step on it, kink it or wrap it tight around your elbow. Coil it in loose loops. If a cable crackles when you wiggle it near the plug, try another one. If the noise goes away, the problem was the cable. A drop of contact cleaner on the plug can help a dirty one, but a cable with a broken wire inside needs repair or replacement.

Pedal basics are easy to handle at home. Unplug all cables and the power supply, and take the battery out before you clean anything. Wipe the outside with a lightly sprayed cloth, going easy on the printed graphics, which can rub off. Use plastic or nylon tools if you have them, since metal tools scratch pedal cases easily. If you take knobs off, loosen any set screws first and pull them straight up. For a stuck knob, loop a shoelace under it and pull up on both ends instead of prying with a screwdriver.

Treat scratchy pedal knobs, jacks and toggle switches the same way as on the guitar: a drop or two of contact cleaner on a brush, worked into the jack or into the opening on the pot, then turn or flip it back and forth. Skip big bottles that can flood the inside of a pedal, and keep water and WD-40 away. Give your pedals a check before a show or a tour and whenever you add one to your board.

Tip: Many "my guitar is crackling" problems turn out to be a dirty patch cable or pedal jack. Before you open up the guitar, plug straight into the amp with a known good cable and see if the noise is still there.

Quick checklist

- At each string change, wiggle the tuners, strap buttons and output jack, and snug anything loose.
- Keep tuner button screws finger-tight; lightly lubricate open-gear tuners once or twice a year.
- Put a drop of light lubricant on electric saddles, string trees and tremolo pivots, and wipe off the extra.
- Tighten a loose jack without letting the jack turn inside the guitar.
- For scratchy pots or switches, work them first, then use a small amount of contact cleaner.
- Unplug the cable from an acoustic-electric when you're done to save the battery, and pull the battery for storage.
- Wipe sweat off plated hardware after playing, and go easy on gold.
- Rule out the cable and pedals before blaming the guitar.

Chapter 9: Choosing and Caring for Strings

Strings are the cheapest part of your guitar and the part you'll replace most often. They're also the part that does the most work. Every note you play starts as a string vibrating over a nut and a saddle, so when your strings are tired, the whole guitar sounds tired. A great guitar with dead strings sounds worse than a modest guitar with fresh ones.

This chapter covers what strings are made of, what the gauge numbers mean, how changing gauge affects your setup, how to tell when a set is done, and how to clean your strings so they last longer. Chapters 10 and 11 walk you through the actual string change on acoustic and electric guitars.

How a string is built

Before we talk about materials, it helps to know what you're looking at. A steel guitar string has a steel core wire. The thin treble strings (the high E and B, plus the G on most electric sets; acoustic sets usually have a wound G) are just that core wire by itself. We call those plain strings. The thicker strings have a second wire wrapped tightly around the core. Those are wound strings.

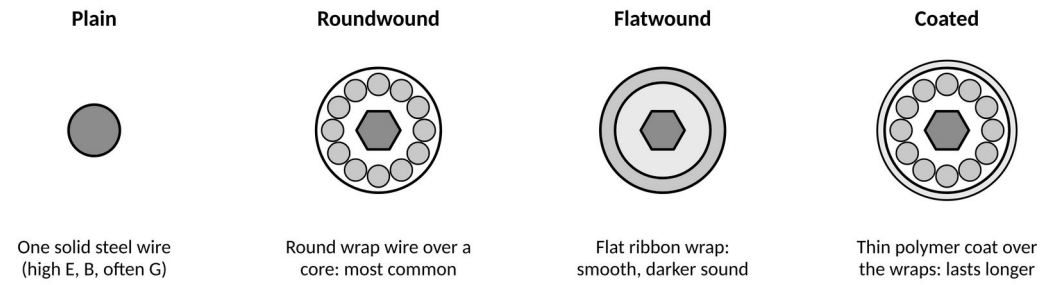


Figure 9-1. String construction, seen end-on.

At the bridge end, most steel strings have a small brass ring called a ball end. The ball end anchors the string at the bridge, under a bridge pin on an acoustic or in a tailpiece or tremolo block on an electric. Classical nylon strings usually have no ball end and are tied on instead (Chapter 10 covers that).

Here's why this matters for care. The wrap wire on a wound string leaves tiny grooves between each turn. Dirt, dead skin and sweat pack into those grooves. That's the main reason wound strings go dull first, and it's why cleaning helps so much.

String materials

The material of the wrap wire has the biggest effect on tone and on how long the string resists corrosion. Steel-string acoustics and electrics use different materials for a good reason: electric pickups are magnets, and they need a string that reacts to a magnetic field. Bronze doesn't do that well, so bronze acoustic strings sound weak and quiet through electric pickups.

Acoustic (steel-string) materials

80/20 bronze is roughly 80% copper and 20% zinc, which technically makes it a brass, though everyone calls it bronze. It's bright and crisp and projects well out of the box. Phosphor bronze adds a small amount of phosphorus to a copper-tin bronze, which improves corrosion resistance and lifespan, and it sounds warm and balanced. In plain words: 80/20 starts out sparkly and tends to lose that sparkle sooner, while phosphor bronze is a little warmer and usually holds up longer.

There are other choices too. Martin makes Monel strings (a nickel and copper alloy) and D'Addario makes nickel bronze. Ernie Ball offers aluminum bronze, pitched for more clarity and better corrosion resistance. Silk and steel strings put a layer of silk or nylon under the wrap. They have lower tension, a softer feel and a mellow sound, which makes them a good fit for beginners and folk players.

Electric materials

Nickel-plated steel is the standard electric string, a balanced all-round choice. Pure nickel wrap sounds warmer and rounder, the vintage sound of the 1950s. Stainless steel is bright, has a lot of attack and lasts a long time, but it feels a bit rougher under your fingers and is harder on frets. There are also cobalt and specialty alloys aimed at higher output.

Roundwound, flatwound and half-round

Most strings are roundwound, meaning the wrap wire is round and you can feel the ridges. Flatwound strings use a flat ribbon of wrap wire, so the surface is smooth and the tone is warm and mellow. D'Addario's Chromes are one example. Flatwounds trap less grime, so they last longer, and they're popular for jazz. Half-rounds (sometimes called ground wound) are roundwound strings ground partly flat, a middle ground between the two.

Coated strings

Coated strings have a very thin polymer layer over the string, or over the wrap wire, that keeps sweat and dirt out of the windings. Elixir, D'Addario (XS and XT), Ernie Ball (Everlast) and Martin all make them. The payoff is a longer tone life. The trade-off is a slightly different feel and, with some coatings, a slightly softer top end. Not every coated string sounds the same, though. Elixir alone ranges from bright (NANOWEB) to warm and played-in (POLYWEB).

You might ask, "Are coated strings worth the extra cost?" It boils down to how fast you kill strings. If your strings go dull in a couple of weeks because you sweat a lot or have acidic skin, coated strings will probably save you money and hassle. If you change strings often anyway, or you love that first-day brightness, uncoated may suit you fine.

Nylon strings

Classical and flamenco guitars use nylon strings. The trebles are nylon or a similar synthetic (some makers use carbon-type materials), and the basses are metal wire wound over a soft multi-filament core. Nylon strings are sold by tension (normal, hard and so on) instead of by gauge numbers. Never put steel strings on a guitar built for nylon. The extra tension can pull the bridge off or damage the neck.

String type	Common use	Sound and feel
80/20 bronze	Acoustic	Bright, crisp, strong projection

String type	Common use	Sound and feel
Phosphor bronze	Acoustic	Warmer and balanced, better corrosion resistance
Silk and steel	Acoustic	Low tension, soft feel, mellow
Nickel-plated steel	Electric	Balanced, the all-round standard
Pure nickel	Electric	Warm, round, vintage
Stainless steel	Electric	Bright, lots of attack, durable
Flatwound	Electric, jazz, bass	Smooth surface, warm and mellow
Coated (any alloy)	Acoustic or electric	Longer tone life, slicker feel
Nylon	Classical	Soft, warm, low tension

Gauges and what they mean

Gauge is the thickness of the string, measured in thousandths of an inch. A ".010" high E is ten thousandths of an inch thick. String sets are usually named by the thinnest and thickest strings, so a "10-46" set has a .010 high E and a .046 low E. Brands also give sets names like Light or Super Light, but those names don't mean the same numbers at every company. Always read the numbers on the pack.

Set name	Typical gauges	Where you see it
Electric Super Light	.009-.042	Easy bending, many electrics
Electric Regular Light	.010-.046	The most common electric set
Acoustic Extra Light	.010-.047	Easy playing, small bodies, 12-strings
Acoustic Custom Light	.011-.052	Easier than Light, still full sounding
Acoustic Light	.012-.053 or .012-.054	The most popular acoustic set
Acoustic Medium	.013-.056	Many dreadnoughts and jumbos from the factory

Notice the two numbers for an acoustic Light set. One brand's Light is .012-.053 and another's is .012-.054. That's a normal brand difference, not a mistake.

Light versus heavy

Heavier strings carry more tension at the same pitch. They drive the top harder for more volume and a fuller sound, and they hold up better, but they're harder on your fingers. Lighter strings are easier to fret and bend and put less pull on the neck and top, but they sound a little thinner and can break more easily. If you're a newer player, I'd start on the lighter side.

What came on your guitar is a good starting point. Martin, for example, ships most dreadnoughts and jumbos with medium strings and most smaller models with lights. If you don't know what's on your guitar, check the maker's spec, keep the front of the pack from your last set, or measure with calipers.

Tip: Keep the front of the string pack in your case pocket. Next time you buy strings, you'll know exactly what you had.

What changing gauge does to your setup

Here's where people get surprised. You put on a heavier set because you want more volume, and suddenly the guitar plays differently. Why? More string tension pulls harder on the neck, which can add relief (a slight forward bow in the neck) and raise the action (the height of the strings above the frets). Lighter strings do the opposite and can cause buzzing. Different gauges also change intonation, which is how well the guitar plays in tune as you move up the neck.

One step up or down usually needs only minor adjustment, but a big jump, especially to heavier strings, may need a truss rod adjustment and a full setup. Factory setup numbers assume the stock strings. Martin's advice for its guitars is stronger: if you're moving more than one gauge step, have the first change done by a pro so the setup and intonation come out right. On a floating tremolo, a gauge change also upsets the balance between the strings and the springs (Chapter 11 covers that). A much heavier low string may also not fit its nut slot, which is a job for a tech.

> **Caution:** Don't put heavier strings on an older or fragile acoustic without asking a tech. Stay with lighter gauges on older acoustics, and go back to a lighter set if the top starts rising behind the bridge. That bulge is a warning sign, not a feature.

My advice: change gauge one step at a time, then check relief, action and intonation using Chapter 12. If something feels off and you're not comfortable adjusting it, take it to a tech. There's no shame in that.

When to change strings

You'll hear all kinds of rules for this, and the makers don't agree. Advice runs from every few weeks to about every three months (or about 100 hours of playing). One common guide says weekly for an electric played every day, up to three months with light play, and one to two months for an acoustic played daily. Another says about every one to two months, sooner if the tone changes or you see rust or pitting.

Here's what I'd do: forget the calendar and judge by look, feel and sound. Strings that ring clearly, stay in tune and look clean still have life in them, no matter how old they are. If you play regularly, check your strings about once a month, and replace them whenever you see the signs below. If you only play now and then, don't assume they're fine because they're barely used. Strings rust from humidity and moisture even when nobody plays them.

Signs your strings are done

- The tone is dull and flat, with less sustain, and cleaning doesn't bring it back.
- The guitar won't stay in tune, or notes sound out of tune up the neck even when the open strings are right.
- You can see dark tarnish, rust or discoloration, especially on the wound strings.
- The strings feel rough, gritty or sticky, or you can feel flat spots or dents where they press on the frets.
- A string broke. Its neighbors are probably close behind.

Always replace the whole set. One new string next to five old ones sounds brighter than the rest and throws off the balance of your chords. The exception is when a string breaks in the middle of a gig or practice. Replace the one string to keep going, then change the set when you can.

If strings break often, and always in the same spot, the strings may not be the problem. Sharp break angles, rough spots at the saddle or nut and poor winding technique are common causes. A burr on a saddle or a sharp nut slot will keep eating strings until it's fixed. Chapter 8 covers saddles and Chapter 12 covers the nut.

Cleaning strings to make them last

Strings go dead because of what your hands leave on them. Skin oils, sweat and acid start corrosion, and dirt and dead skin build up between the windings. That gunk keeps the string from vibrating freely, so you lose brightness and sustain, and bends start to feel uneven. Humidity speeds this up, especially on the bronze and copper wrap of acoustic strings.

Washing your hands before you play helps, but it won't stop the buildup on its own. The habit that pays off is wiping your strings when you're done.

Everyday wipe-down

1. When you finish playing, take a clean, dry microfiber cloth and pinch it around each string.
2. Slide the cloth along the full length of the string, from the bridge up to the nut, a few times.
3. Work the cloth under the strings too, since the underside is where your fingertips leave the most sweat.
4. Wipe the fretboard edges and the back of the neck while you're at it.

That's it. It takes under a minute, it gets rid of the moisture that causes rust, and it does more for string life than any product.

Deep cleaning

Every so often, or when you notice the strings getting dull, give them a deeper cleaning. MusicNomad's String Fuel is one example of a string cleaner. It comes with a built-in applicator and leaves a light lubricant behind. Other brands make similar products, such as D'Addario's XLR8 and Dunlop's Ultraglide 65. MusicNomad also makes The Nomad Tool, a thin, flexible tool with a microfiber pad that slides under the strings to clean the bottom side.

1. Lay a cloth over the body behind the bridge and over the pickups to catch drips.
2. Wipe each string first with a dry cloth to lift loose dirt.
3. Apply the cleaner the way its label says. With an applicator style cleaner, run it along the top of the strings a few times.
4. Clean the underside with a tool that fits under the strings, or by pinching a cloth around each string.
5. For wound strings, use a bit more pressure and scrub along the length of the windings, since that's where grime hides.
6. Wipe off any extra cleaner with a clean, dry cloth. Don't leave a wet film on the strings or fretboard.

Caution: Keep string cleaner off the finish and out of open pickups when you can. Read the product's label for what it's safe on, and test on a small spot first if you're unsure.

Coated, flatwound and nylon strings

Here's a spot where the makers don't agree. Some say to clean coated and tapewound strings the same way as regular strings, just with lighter pressure so you don't wear the coating. Elixir says to wipe its strings with a dry cloth after playing and does not recommend cleaners or lubricants on them. If your coated strings are Elixirs, follow Elixir's advice and use a dry cloth. For other brands, check the maker's page. A dry wipe is safe on everything.

Nylon strings are softer than steel. Use the same steps with less pressure. Be gentle on the wound bass strings, since their wrap can loosen or fray.

What about new strings?

Even brand new strings can blacken your fingers. They pick up grime after they leave the factory, so give a new set a quick wipe right after you install it.

Boiling old strings

You may hear that you can boil old strings to bring them back. Boiling does remove some dirt and oil, but it can't fix dents from the frets or tired metal, so any improvement is short-lived. I'd skip it. Your time is worth more than a set of strings.

Buying and storing spare strings

Always keep a spare set in your case, especially before shows, since worn strings are more likely to break. A spare high E and B are smart too, since the thin plain strings break most often.

Leave spare sets sealed in their packaging until you need them. Many makers seal their strings in bags designed to slow corrosion. D'Addario, for example, packs its strings in a VCI bag (VCI = vapor corrosion inhibitor, a material that gives off a vapor to keep metal from rusting). Once you open the pack, use the strings. Don't open a set to look and then toss it back in the case pocket for six months.

Store spares where you'd store the guitar: away from heat, damp and direct sun. A garage, a hot car or a damp basement are bad places for strings, just like they're bad places for guitars (see Chapter 7). In a very dry climate rust is less of a worry, but strings still go dull from your hands. In a humid climate, sealed storage matters even more.

When you take old strings off, coil them up and wrap the ends so nobody gets poked. D'Addario runs a string recycling program, and some local recyclers take string metal. Check what's available near you.

A word on 12-strings, basses and classical guitars

A 12-string guitar uses octave pairs, so its sets are lighter overall. Martin ships most 12-strings with extra light sets. Bass strings last much longer than guitar strings, and a common bass medium set is .045-.105. Classical guitars take nylon sets sold by tension. Stick with the tension the maker recommends unless a tech says otherwise.

Quick checklist

- Read the gauge numbers on the pack, not just the name, and keep the pack front for next time.
- Change gauge one step at a time and recheck relief, action and intonation afterward.

- Replace the full set when tone stays dull after cleaning, tuning won't hold, or you see rust or flat spots.
- Wipe your strings with a dry microfiber cloth every time you finish playing.
- Deep clean uncoated strings now and then, and follow the maker's advice for coated strings.
- Keep a sealed spare set in your case, plus an extra high E and B.
- If strings keep breaking in the same spot, have the saddle and nut checked.

Chapter 10: Restringing an Acoustic Guitar

If you only learn one maintenance job from this book, make it this one. Changing strings is the job you'll do most often, and doing it right makes a bigger difference than most people think. A clean string change gives you a guitar that stays in tune, sounds the way it should and doesn't rattle or buzz from a sloppy wrap at the headstock.

This chapter walks you through a steel-string acoustic with bridge pins from start to finish. Then it covers pinless bridges, 12-strings and a short section on tying on nylon strings for a classical guitar. Take your time the first few times. It gets quick with practice.

What you'll need

- A fresh set of strings in the gauge you want (Chapter 9 helps you pick).
- A string winder. MusicNomad's GRIP Winder is one example, and D'Addario, Dunlop and others make good ones too.
- Flush-cut string cutters. Plain wire clippers will do, but bulky ones can scratch the finish and don't cut close to the post. MusicNomad's GRIP Cutter is one example; D'Addario's Pro-Winder has a cutter built in.
- A bridge pin puller. MusicNomad's GRIP Puller is a rubber-lined, metal-free example. Most string winders also have a small pin-pulling notch.
- A clip-on or pedal tuner.
- A soft, clean microfiber cloth, and a towel or work mat.
- Something to support the neck, such as a neck rest or a rolled-up towel.
- Optional: nut slot lubricant, fretboard cleaner and conditioner, fret polish, safety glasses.

There are also all-in-one tools, like MusicNomad's GRIP ONE, that combine a winder, cutter and pin puller. See Chapter 2 for more on tools.

> **Tip:** Wear safety glasses. Once you've had a string end whip past your eye, you'll understand why.

Set up your work area

Find a sturdy table with good light. Lay down a towel or a work mat so the back of the guitar doesn't get scratched, and put a neck rest or rolled towel under the neck so the headstock is supported. The guitar should sit flat and steady with the top facing up. You'll be pushing on the pins and pulling on strings, so you don't want it rocking around.

One at a time, or all off?

This is one of the oldest arguments in the guitar world, and the makers don't agree. Some take all six strings off together and use the time to clean the fretboard. Others say restring one at a time to avoid big swings in neck tension.

Here's my take. On a normal flat-top acoustic with a glued-on bridge, taking all the strings off for a few minutes won't hurt a healthy guitar. The neck relaxes a little, and it comes back once the new strings are up to pitch. So take them all off when it's time to clean the fretboard and polish the frets, which is the best chance

you'll get. For a quick change between cleanings, one at a time is fine and a bit easier, since it keeps the tension steady and the other strings show you where each new one goes.

> **Caution:** Archtop guitars and some mandolin-style instruments have a bridge that is held in place only by string pressure. If you take all the strings off, the bridge moves and your intonation is gone. Change those one at a time. If you must remove them all, mark the bridge position first with a pencil line on a slip of paper laid against the bridge feet.

Know your headstock

Most acoustics have three tuners on each side of the headstock, called a 3+3 layout. The tuner post is the metal shaft the string wraps around. Each string should wind so that it leaves the post on the side facing the center of the headstock. That gives the string a straight path to its slot in the nut (the slotted piece at the top of the fretboard) without rubbing against the post or a neighboring string.

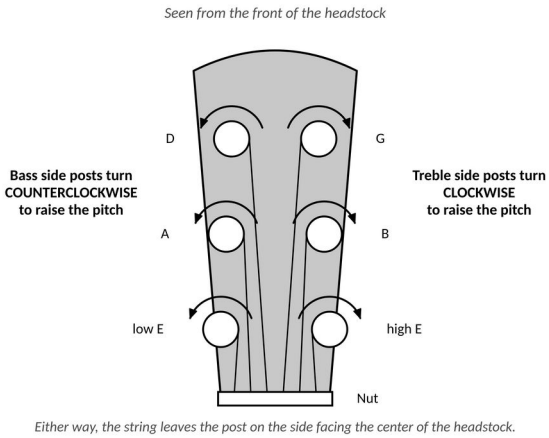


Figure 10-1. On a three-a-side headstock, the bass-side posts turn counterclockwise and the treble-side posts turn clockwise to raise the pitch.

You might ask, "Which way do I turn the tuner?" It's simple. Turning the post so the string wraps toward the center of the headstock raises the pitch. Looking at the face of the headstock, that means the bass-side posts (low E, A, D) turn counterclockwise, and the treble-side posts (G, B, high E) turn clockwise. If you're not sure, pluck the string while you turn. If the pitch goes down, you're going the wrong way.

Removing the old strings

1. Turn each tuner to loosen its string until the string is slack and flopping loose. A winder makes this fast.
2. Once a string is fully slack, cut it. You can cut each string at both ends, near the tuner and near the bridge, which makes removal faster and gives you more control, or cut once at the 12th fret. Either way works. Just never cut a string while it's still up to pitch. A string cut at full tension can snap back and injure you or mark the guitar.
3. Unwind the short piece left on each tuner post and pull it out of the hole. Watch the sharp ends.
4. Pull the bridge pins (see the next section). Keep them in order on the towel, low E to high E, so each one goes back in the same hole.

5. Lift each old string's ball end out of its bridge hole. If one drops inside the guitar, tip the guitar gently so it rolls out of the soundhole.
6. Coil the old strings, wrap the ends and set them aside for recycling.

Pulling bridge pins safely

A bridge pin is the small peg that holds the string's ball end in the bridge. It's a press fit, so it can be snug. This is where people do damage.

1. Slide the pin puller under the head of the pin until it's fully seated against the pin.
2. Lift straight up. Don't pry against the bridge, since the bridge wood is softer than you think and dents easily.
3. If the pin won't come, push the slack string about half an inch down into the hole to unhook the ball end from the pin, then rock the pin gently while you lift.
4. As a last resort, reach through the soundhole and press up on the end of the pin from below with a coin or your fingertip while you lift from above.

Caution: Don't use pliers on bridge pins. They crush plastic pins, scar bone and wood pins, and slip right onto the bridge. Some instructions, including Taylor's, use wire cutters with the saddle as a lever. I'd rather you use a real pin puller or push the pin up from inside. It takes two seconds and nothing gets marked.

While the strings are off

This is your chance to clean the parts you can't reach with strings on. You don't have to do all of it every time, but a string change is the natural time to:

- Wipe down and condition the fretboard (Chapter 5). Cover the soundhole with a towel first so dust and oil stay out.
- Polish the frets (Chapter 6).
- Wipe the top and the bridge, and dust under where the strings were (Chapter 4).
- Check that the tuners turn smoothly and that the nuts on the tuner bushings are snug, not cranked (Chapter 8). Loose tuner bushings are common.
- Check that the saddle (the strip of bone or plastic on the bridge the strings rest on) is seated and not cracked.
- Look at the bridge edge for any gap or lifting from the top. If you see one, stop and see a tech before putting tension back on.

Installing the new strings at the bridge

Start with the low E and work toward the high E, thickest to thinnest.

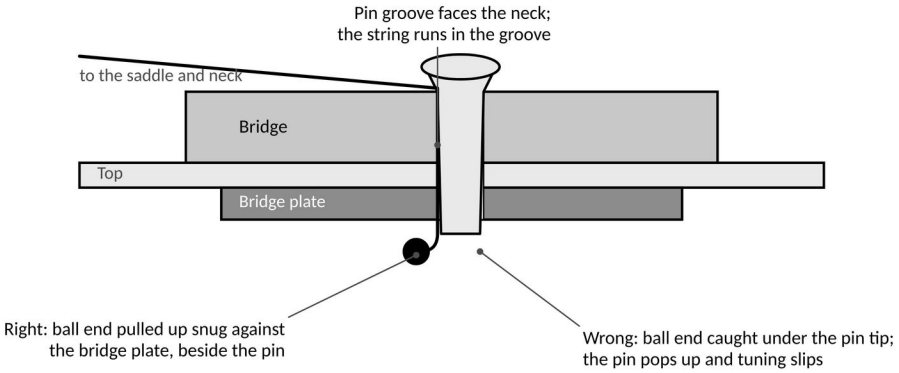


Figure 10-2. The ball end has to sit up against the bridge plate beside the pin, not under the pin tip.

1. Check the ball end color or the label so you have the right string. Many brands color-code the ball ends.
2. Put a slight bend in the string about half an inch above the ball end, so it curves a little. The bend helps the ball end slide over and catch under the bridge plate (a thin hardwood plate glued under the top that the ball ends press against).
3. Drop the ball end into its bridge hole.
4. Push the bridge pin in after it, with the groove in the pin facing the neck. The string sits in that groove.
5. Hold the pin down lightly with one finger and pull up on the string with your other hand until you feel the ball end catch. It will stop with a small click or a firm feel.
6. Give the string a gentle tug to make sure it's locked, then press the pin down snug with your thumb.

The pin should be firm but doesn't need to be jammed flush. Most pins sit with a little of the head above the bridge.

> **Tip:** If a pin pops up while you're tuning, or you hear a sharp clack, the ball end is probably resting on the tip of the pin instead of under the bridge plate. Loosen the string, push the pin down, pull up on the string to reseat the ball, and try again.

Winding the string on the tuner

This part decides whether your guitar stays in tune. The goal is a few neat wraps that stack down the post with no crossing over.

How much slack to leave

You need enough string to make a few wraps, but not so much that the post turns into a spool. Here are two good ways to measure it.

- The tuner length method: Pull the string tight past its post. For the low E, A and D, cut it about one tuner's distance past its post (the low E gets trimmed at the A string's post). For the G, B and high E, leave about one and a half tuner lengths. Thin strings need more wraps, so they get more slack.

- The palm method: Feed the string through the post hole, then lift the string up off the fretboard at the 12th fret by about the height of your hand held flat and upright. That lifted amount is the slack you'll wind on.

Winding steps

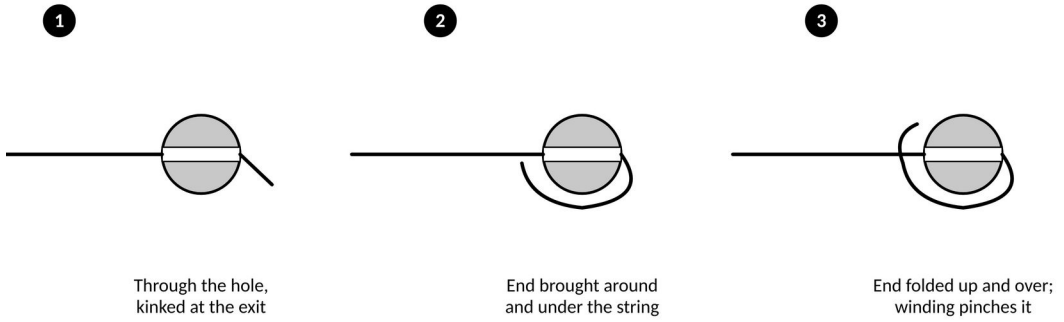


Figure 10-3. A locking wrap for slick plain strings, seen from above the post.

1. Turn the tuner so the hole points along the string's path, toward the nut.
2. Feed the end of the string through the hole, from the center of the headstock outward. If you've pre-cut it, leave about 1/8 inch poking out the far side.
3. Pull the string to set your slack, then put a sharp bend in it right where it comes out of the post. This kink keeps it from slipping as you start winding.
4. For a locking wrap (very helpful on the slick plain strings, the B and high E, and the G if your set has a plain one), bring the loose end back around the post, pass it under the main string, then fold it up and over itself so the main string pinches it.
5. Hold light tension on the string with one hand, pressing it down near the soundhole or pinning it at the nut, and turn the tuner with the other hand. The winder makes this go fast.
6. Guide each wrap so it lands below the one before it. The wraps should stack down the post toward the headstock face, with no wrap crossing another. The bottom wraps should go below the edge of the post hole so the string doesn't kink and break there.
7. Stop when the string is snug, well short of pitch. Check that it sits in its own nut slot and on the saddle before you go on. You'll bring all the strings up to pitch together in the next section.

Caution: If you use a winder bit in a power drill (MusicNomad's GRIP Bit is one), keep the drill on its lowest speed and stop well short of pitch. It's easy to overshoot and snap a string.

How many wraps?

You'll see different counts for this, and that's fine. More wraps hold better but can make tuning wander a little as they settle. Too few can slip.

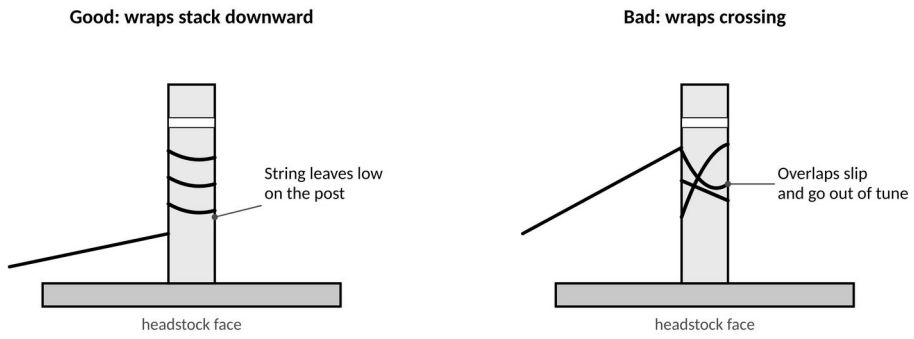


Figure 10-4. Wraps should stack neatly down the post so the string leaves near the headstock face.

Strings	Wraps I recommend
Bass side (low E, A, D)	2-3
Treble side (G, B, high E)	3-5

The plain B and high E are slick and need the extra grip. (On most acoustic sets the G is wound, so it can take the lower count.) If you use a locking wrap on the plain strings, you can stay at the lower end.

Bringing it up to pitch

Once all six strings are on and snug:

1. Make sure each string sits in its correct nut slot and saddle position.
2. Tune each string up close to pitch, starting with the low E. Bring each one up gradually and touch up the others as you go, so the neck takes the load evenly.
3. Tune all six to pitch with your tuner (standard tuning, low to high: E, A, D, G, B, E).

Stretching the new strings

New strings stretch, and the wraps settle around the post and ball end. If you skip this step, the guitar will keep going flat for the next day or two.

1. With the strings at pitch, hook a finger under one string around the middle of the neck.
2. Pull it gently away from the fretboard, an inch or so, and move up and down the length of the string pulling in a few spots. Don't yank.
3. Retune that string. It will have dropped flat.
4. Repeat for each string, then repeat the whole round two or three times until the strings stop going flat.

It also helps to press each string down behind the saddle, toward the bridge, to make sure the ball ends are seated. Don't pull too hard or too fast. Firm and steady is the idea. Even after stretching, expect to retune a few times over the next day. New strings can take a few hours to a day to settle.

> **Tip:** Before you cut the extra string off, give the excess at the post a firm tug. It takes out a bit more slack around the post, which means less settling later.

Trimming the ends

1. Lay a microfiber cloth over the headstock so clippings don't scratch the finish.
2. Cut each string end close to the post with flush cutters, leaving a short stub (an eighth of an inch or so is plenty).
3. Check that no sharp end sticks out where it can poke your hand or tear the lining of your case or gig bag.

Don't leave the ends coiled up on the headstock. Loose ends rattle and buzz, and they can scratch the headstock and snag the case.

Troubleshooting

- The string goes flat over and over: It needs more stretching, or a wrap is slipping. Add a locking wrap on plain strings.
- A bridge pin keeps popping up: The ball end isn't caught under the bridge plate. Reseat it as described above.
- Buzz or rattle after a string change: Check for loose string ends at the headstock, a pin not seated, or a string out of its nut slot. Chapter 13 covers buzz in depth.
- A string breaks at the post while tuning: It may have a kink at the post hole, or you went past pitch. Check you're tuning the right string; it's easy to turn the wrong tuner.
- The guitar is hard to tune: Make sure every string goes to its own tuner and doesn't cross another. Crossed, misrouted strings make a guitar a fight to tune.

Pinless bridges

Some acoustics have no bridge pins. Instead the strings feed through holes from the back of the bridge, and the ball end catches in a slot or hole behind the saddle.

1. Loosen and remove the old strings as above, pulling each one back out through the bridge.
2. Feed the new string through its hole from the back of the bridge toward the soundhole.
3. Pull it through until the ball end seats firmly in its pocket at the back of the bridge.
4. Wind and tune as you would on a pinned bridge.

Pinless bridges are faster and you can't lose a pin. Just check that each ball end is fully seated before you bring the string up to pitch.

12-string guitars

A 12-string works the same way, just with twice the strings and closer spacing. Each lower course has a thin octave string paired with the normal string, and the high strings are doubled at the same pitch. Leave more slack than on a six-string: about two tuner lengths for the bass strings and three for the treble strings. Go slowly, keep the pairs straight, and use a narrow winder that clears the close posts.

Classical (nylon string) guitars

Classical guitars have no bridge pins and usually no ball ends. The strings tie onto the bridge and wind onto rollers in a slotted headstock. Nylon stretches much more than steel, so expect to retune a lot for a few days.

Tying at the bridge

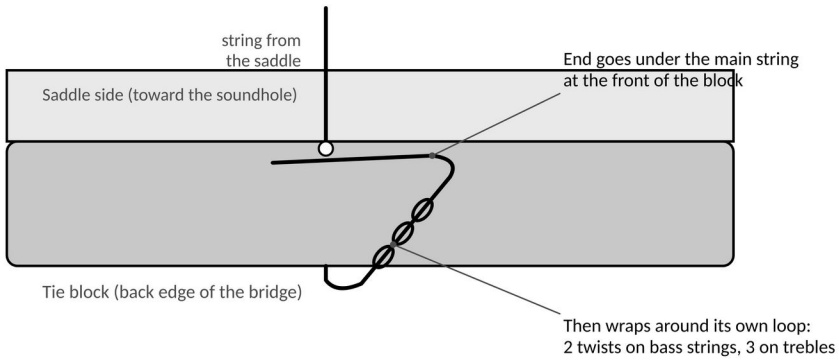


Figure 10-5. A classical tie seen from above the bridge.

1. Put a sticky note or a piece of card on the top behind the bridge so the string end can't scratch it.
2. Push the string through its bridge hole from the soundhole side, leaving about three inches sticking out the back.
3. Bring that end back over the top of the bridge and pass it under the main string, toward the treble side.
4. Tuck the end under the loop you just made so it twists around itself. Twist bass strings twice and treble strings three times, since the slick trebles slip more easily.
5. Pull the main string toward the headstock to tighten the knot. The end should lie flat along the back edge of the bridge, with the last loop down below the back corner.
6. Leave the tail short enough to tuck under the next string you install, which helps hold it in place.

Winding on the rollers

1. Pass the string through the hole in the roller so it points back toward the body.
2. Bring the end up and over the roller, then loop it under the main string to make a simple lock.
3. Wind so the string wraps toward the outside of the roller, over the tail, keeping the coils neat and not touching the sides of the slot.
4. Tune up to pitch. Keep it to about 4-6 wraps on the roller.
5. Stretch each string gently along its length, retune, and repeat two or three times. Then trim the ends.

Caution: Never put steel strings on a classical guitar. It isn't built for that much tension, and you can pull the bridge off or damage the neck.

After the change

Play for a few minutes, then retune. Listen for buzz and look down the neck. If the guitar plays differently than before, especially after a gauge change, go through the checks in Chapter 12. If you went up more than one gauge, Martin suggests having a pro handle that first change, and that's good advice for any guitar.

Quick checklist

- Loosen strings fully before cutting, and wear safety glasses.
- Pull pins straight up with a proper puller, never pliers, and keep them in order.
- Clean the fretboard and frets when the strings are all off.
- Bend the ball end slightly, seat it under the bridge plate, and press the pin snug with its groove facing the neck.
- Wind toward the center of the headstock with neat, downward wraps and no crossovers.
- Stretch each string two or three rounds and retune.
- Trim the ends close to the post with a cloth over the headstock.

Chapter 11: Restringing an Electric Guitar

Electric guitars come with more kinds of bridges than acoustics do, and that's what makes restringing them look complicated. It isn't. The headstock end works almost the same on every electric. What changes is how the string anchors at the body, and whether the bridge floats on springs.

This chapter starts with the parts every electric string change shares. Then it walks through each common bridge type: string-through hardtails, wraparounds, Tune-o-matic bridges with a stopbar, Strat-style tremolos, Bigsby vibratos and Floyd Rose double-locking systems. Find your bridge, follow those steps, and come back to the shared steps for winding, stretching and trimming.

I do not play guitar, but I have worked on guitars for more than 20 years. On the bench, I can tell when a guitar was restrung with sloppy wraps and no stretch. Two extra minutes to wind cleanly and stretch each string keeps a guitar in tune.

What you'll need

- A fresh set of strings (see Chapter 9 for gauges and materials).
- A string winder that fits the closely spaced posts on an electric headstock. MusicNomad's GRIP Winder is one example; D'Addario and Dunlop make others.
- Flush-cut string cutters, such as MusicNomad's GRIP Cutter or D'Addario's Pro-Winder.
- A tuner.
- A microfiber cloth to protect the finish, plus a towel or work mat and a neck rest.
- A phone camera, if you have a Tune-o-matic bridge, to photograph the bridge before you start.
- Hex keys (Allen wrenches) for a Floyd Rose. Most use 3 mm for the string clamps.
- Optional: nut and saddle lubricant, a small socket or multi-tool for tuner nuts and the output jack (MusicNomad's Octopus is one example), safety glasses.

> **Tip:** Wear eye protection when you change strings. A cut string end is a small, sharp spring. Treat it that way.

One at a time, or all off?

On electrics, your bridge decides this for you more than your preference does.

Bridge type	Change one at a time?	Why
String-through or top-load hardtail	Your choice	Bridge is fixed; nothing moves
Wraparound bridge	Your choice	Fixed, though the tailpiece can shift slightly on its studs
Tune-o-matic with stopbar	Three at a time is safest	Bridge and tailpiece are held on only by string pressure
Strat-style tremolo (vintage or two-point)	Yes, unless cleaning	Bridge tilts when tension changes
Bigsby vibrato	Yes	Easier to hook strings; keeps the bridge in place
Floyd Rose or other double-locking	Yes	Bridge angle changes a lot when strings come off

Change the strings on a floating bridge one at a time unless you're deep-cleaning the fretboard and frets. Pulling all the strings changes the tremolo's angle so much that it's hard to get back in tune. If you do take them all off for cleaning, support the bridge first (each section below shows how).

Removing the old strings

1. Turn each tuner to slacken its string until it's completely loose. Never cut a string at pitch. It can snap back and injure you or mark the finish.
2. Lay a cloth over the body between the bridge and the pickups. Ball ends and string tips scratch finishes, and they love to fall on the top.
3. Cut the loose string. You can cut near both the tuner and the bridge, at the 12th fret, or just above the pickups. Any of these works.
4. Unwind the piece at the tuner and pull it out of the post.
5. Pull the bridge end out the way it went in (each bridge type below describes this).
6. Coil and wrap the old strings and set them aside for recycling.

While the strings are off

If you've taken all the strings off, this is the best chance to clean the fretboard and polish the frets (Chapters 5 and 6). Cover the pickups if you're using fret polish near them (Chapter 6 explains why). It's also a good time to:

- Snug the nuts on the tuner bushings and the screws on the string trees, snug and no more. Loose tuner bushings are very common.
- Snug the output jack nut while you hold the jack still (Chapter 8 shows how). If the jack turns with the nut, stop, because a spinning jack twists and breaks the wires.
- Wipe down the bridge, saddles and pickup tops (Chapter 8).
- Put a tiny amount of lubricant in the nut slots and on the saddles where the strings touch. A light machine oil at the saddle contact point and a little lip balm on the string trees both work. MusicNomad's TUNE-IT is one example of a purpose-made lubricant; Big Bends Nut Sauce is another.

Anchoring the string at the bridge

String-through-body and top-load hardtails

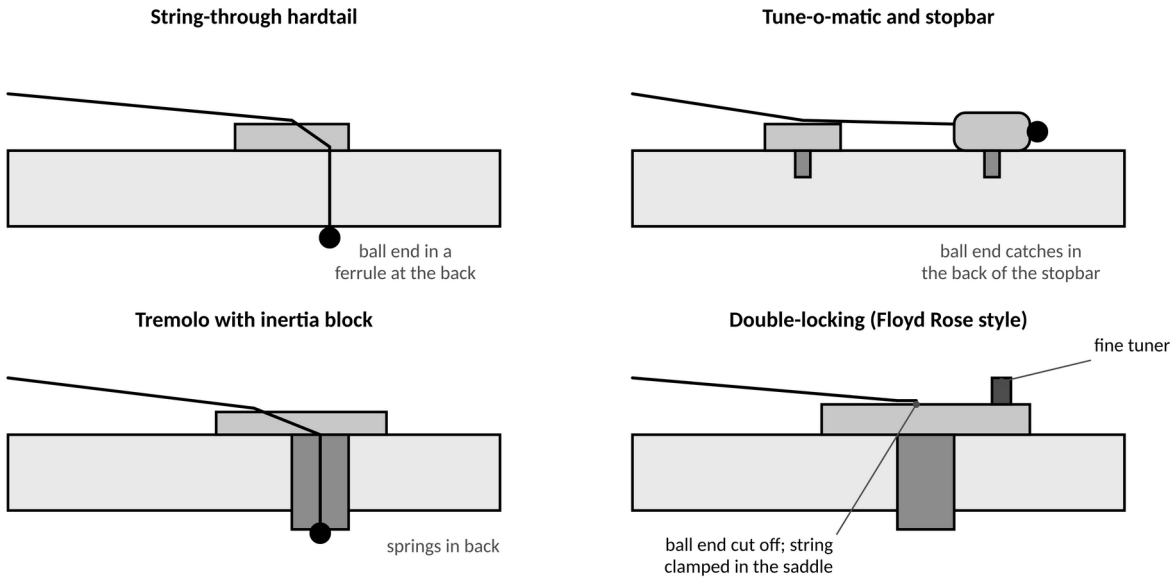


Figure 11-1. Four common electric bridges and where the ball end goes.

A hardtail is a fixed bridge with no tremolo. On a Telecaster and many other guitars, the strings pass through holes in the body from the back. Small metal cups called ferrules line those holes. Other hardtails are top-loaded, with the string feeding through holes in the back edge of the bridge plate.

1. Find the correct hole for the string. The low E is closest to your chin when you're playing.
2. Feed the string in from the back of the body (or from the back of the bridge on a top-load bridge) and pull it through until the ball end seats snugly in its ferrule or hole.
3. Lay the string over its saddle and make sure it sits centered in the saddle groove. A string sitting off-center can cause action and intonation problems.
4. Run it up to the headstock and wind it (see "Winding at the headstock").

Tip: On a string-through body, flip the guitar on a towel and look at the ferrules. If a ball end isn't fully seated, the string will keep going flat as it settles.

Wraparound bridges

A wraparound is a one-piece bridge and tailpiece, common on Les Paul Juniors and similar guitars. Feed the string through the bridge from the pickup side, then wrap it back over the top toward the nut. The ball end stops against the front of the bridge.

Tune-o-matic bridge with stopbar tailpiece

This is the classic Gibson setup: an adjustable bridge (the Tune-o-matic) with a separate tailpiece behind it (the stopbar). Here's the catch. Neither part is screwed down tight. They sit on posts and studs and stay put

because the strings press on them. Take all the strings off and the bridge can lift right off the guitar, saddles and all.

Change three strings at a time so the other three hold the bridge and tailpiece down. If you do take them all off, take a photo first, and if you use tape, put it only on the metal parts, never on the finish, and take it off as soon as the strings are back on. On a nitro guitar, skip tape altogether.

1. Keep a cloth on the top behind the stopbar. The ball end swings around as you thread it and will scratch the finish.
2. Feed the new string into the back of the stopbar (from the strap-button end of the guitar) and pull it through toward the neck until the ball end seats in the tailpiece.
3. Run the string over its saddle on the bridge and up to the headstock.
4. Check that the string sits in its saddle notch and that the saddle didn't flip or fall out.

Some players prefer to "top wrap" the stopbar: they feed the string in from the pickup side and wrap it back over the top, which gives a slinkier feel. It's a personal choice. If you try it, check intonation afterward.

Caution: If the bridge does come off, note which way it faces before you put it back. The saddle adjustment screws normally face a particular direction, and swapping it changes your intonation. If you're not sure, take a photo before you start.

Strat-style tremolo (vintage six-screw and two-point)

A Strat-style tremolo (also called a synchronized tremolo or vibrato) is a bridge that pivots on screws at the front edge, with springs in a back cavity pulling against the strings. The vintage version pivots on six screws; the two-point version pivots on two posts. On either kind, the strings anchor in a steel block under the bridge, and you load them through holes in the back of the guitar under the plastic cover plate.

Here's why one at a time matters. The bridge balances string tension against spring tension. Remove all the strings and the springs win, tipping the bridge back. Put new strings on and the balance has to settle again before tuning holds.

1. If your bridge floats (the back edge sits up off the body), slip a folded cloth or a pad of sticky notes under the back edge of the bridge plate so it stays at its normal angle while you work. On a floating bridge you can also wedge a small block of wood between the tremolo block and the cavity wall on the neck side, so the springs can't pull it forward.
2. Loosen and remove one string. Push it out from the back, through the block.
3. Feed the new string in through its hole in the back of the body, through the block, and out the top of the bridge.
4. Pull it through until the ball end seats in the block. A gentle tug from the front confirms it.
5. Lay the string in its saddle groove, take it to the headstock and wind it.
6. Bring it near pitch, then move to the next string.
7. When all six are on, remove the support and tune. Then retune again. Each string you tighten pulls the bridge forward a hair and flattens the others, so go around the strings several times until they all hold.

If the bridge doesn't come back to where it was, the spring tension and string tension don't match anymore (common after a gauge change). Fender's spec for a floating bridge is about a 1/8 inch gap at the back edge of the bridge, and the claw screws in the back cavity set that. For a bridge that rests flat on the body, Fender adds about half a turn to each claw screw past the point where it sits flush, so it stays down during bends. Chapter 8 covers tremolo adjustment.

Bigsby vibrato

A Bigsby has a roller bar with small pins on it, and the string's ball end hooks over one of those pins. It's fiddly the first time, mainly because the ball end loves to pop off before you have tension on the string.

1. Change one string at a time. A bit of foam or a cloth under the front of the Bigsby protects the top.
2. Put a slight curve in the string near the ball end so it wants to wrap around the roller bar.
3. Hook the ball end over its pin on the roller bar.
4. Wrap the string around the bar toward the neck. If your Bigsby has a tension bar (a second, smaller bar in front of the roller), pass the string under it.
5. Then run the string over the bridge and up to the headstock.
6. Hold light pressure on the string near the roller bar with one hand while you take up slack at the tuner, so the ball end stays hooked.

> **Tip:** Some players use a small foam wedge or folded paper between the string and the roller bar to keep the ball end from slipping until the string is snug.

Floyd Rose and other double-locking tremolos

A double-locking tremolo clamps each string at both ends: at the bridge saddle with a small screw and block, and at a locking nut near the headstock. That's why it stays in tune through big dive-bombs. It's also why a string change takes longer. Floyd Rose, Ibanez, Schaller and others differ in the details, so follow the maker's instructions for your exact system. Here's the general process.

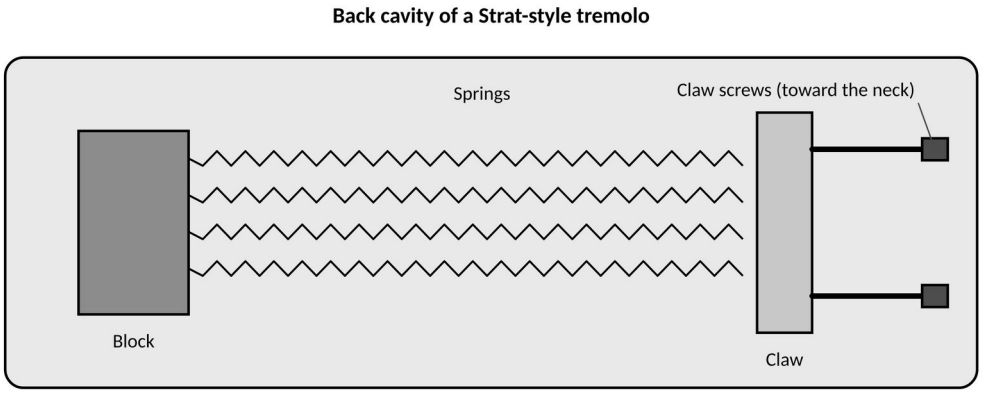


Figure 11-2. The springs in the back cavity balance the pull of the strings.

1. Change one string at a time. If you must take them all off, wedge a cloth under the tremolo to hold its angle.
2. Loosen the locking nut clamp over that string with the correct hex key (often 3 mm).
3. Slacken the string at the tuner and remove it from the post.
4. Loosen the string clamp screw on that string's saddle and pull out the old string end.
5. Cut the ball end off the new string with wire cutters.
6. Insert the cut end into the saddle, between the saddle and its clamp block, and tighten the clamp screw firmly before you tune.
7. Run the string over the saddle, under the open nut clamp, and wind it onto the tuner.
8. Repeat for each string.

Caution: Use a hex key that fits the clamp screws snugly and is fully seated before you turn it. A worn or wrong-size key strips these small screws fast, and a stripped saddle screw is a part replacement.

Then tune it. A floating Floyd takes patience, because every string you tighten pulls the bridge forward and flattens the others. Here's the method:

1. Leave the three nut clamps loose and set all the fine tuners on the bridge to the middle of their travel.
2. Tune each string to pitch, starting with the low E.
3. Check the low E again. If it has gone flat, tune the low E through B slightly sharp and the high E to pitch. If it has gone sharp, tune the first five slightly flat. Repeat until all six land at pitch.
4. Check that the bridge sits parallel to the body. If the back edge rises above parallel, tighten both spring claw screws in the back cavity a little. If it sinks toward the body, loosen them. Turn both the same amount, then repeat step 3. This is common after a gauge change.
5. When everything is at pitch and the bridge is level, tighten the nut clamps. Retune only with the fine tuners from here.

Clamping the nut usually pulls the strings a little sharp. That's normal; the fine tuners take care of it. If you run out of fine tuner range, loosen the nut clamps and start the tuning again.

Winding at the headstock

Know your tuners

Most electrics have one of three tuner types.

- Through-hole posts: the string passes through a hole across the top of the post. This is the most common type.
- Vintage slotted posts: the post has a slot and a hole down its center, as on early Fender guitars. The string goes down into the center hole and out the slot.
- Locking tuners: a thumb wheel or knob under the headstock clamps the string inside the post, so you need almost no wraps.

On a six-in-line headstock like a Strat or Tele, every post turns the same way to tighten: counterclockwise when you look at the face of the headstock, so the string leaves the post on the side toward the center of the

headstock. On a 3+3 headstock, wind so the string comes off the inside of the post, toward the center of the headstock. Either way, if you pluck while turning and the pitch drops, reverse direction.

Through-hole posts

1. Turn the post so the hole lines up with the string's path.
2. Pull the string taut through the hole, then pull back some slack for your wraps. One easy measure is to lift the string about the height of your upright palm at the 12th fret. Another is to cut the string about 2.5 to 3 inches beyond the post first and thread it, leaving about 1/16 to 1/8 inch poking through.
3. Kink the string sharply where it exits the post.
4. Lock it if you like: after the string passes through the hole, bring the loose end around the post, under the main string, and back over itself.
5. Keep tension on the string and wind, guiding each wrap down the post below the last. No crossovers. Overlapping wraps make tuning unstable.
6. Stop short of pitch, seat the string in its nut slot and saddle, then go to the next string.

For wraps, leave enough slack on the high E for at least two or three wraps and use fewer on each thicker string. You'll see counts from about two wraps plus a bit more on every string to about two on wound strings and three to four on plain strings. On electrics, I'd go with two to three wraps on the wound strings and three or so on the plain strings. Chapter 10 has more on wrap counts.

Vintage slotted posts

Slotted tuners hold the string by bending it down into the center hole, so you cut the string to length before you install it. Fender gives a cut length for each string on its vintage-style tuners, measured with the string pulled taut along the headstock.

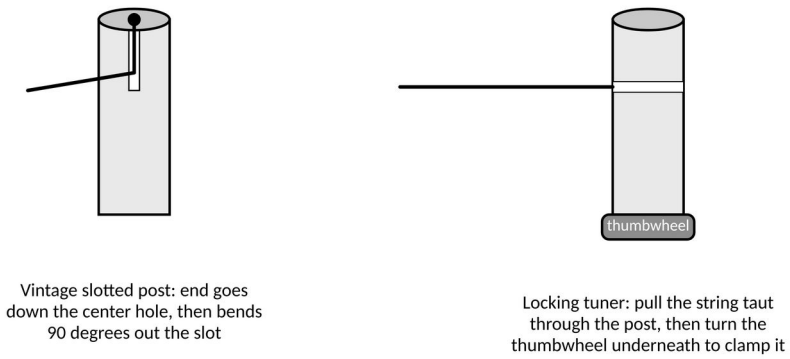


Figure 11-3. Slotted vintage posts and locking tuners hold the string differently.

String	Where Fender cuts it (pulled taut)
Low E (6th)	At the D post
A (5th)	At the G post
D (4th)	Between the B and high E posts
G (3rd)	Nearly at the top end of the headstock
B (2nd)	About 1/2 inch past the end of the headstock

String	Where Fender cuts it (pulled taut)
High E (1st)	About 1 1/2 inches past the end of the headstock

1. Thread the string through the bridge and pull it taut along the headstock.
2. Cut it at the point shown in the table.
3. Push the cut end down into the center hole of the post.
4. Bend the string sharply to 90 degrees into the slot, and crimp it so it holds.
5. Wind neatly downward, keeping the wraps from overlapping.

The nice part about slotted posts is that there's no sharp string end sticking out to poke you. If you don't have the table handy, cutting about two posts past the one you're installing gets you close.

Locking tuners

1. Turn the post so the hole lines up with the string path. Fender gives clock positions for its locking tuners: about 1:00 for the high E, 2:00 for the B, 3:00 for the G and D, 4:00 for the A, and 5:00 for the low E.
2. Pull the string through the post until it's taut, with no slack.
3. Tighten the thumb wheel or knob to clamp the string.
4. Tune up. The string will wrap only a partial turn to a single turn around the post. Use as little string around the post as possible on locking tuners. That's the whole point.

Fender adds that with its locking tuners you can tune slightly past the note and then come back down to pitch.

String trees

Many Fender-style headstocks have one or two string trees (small clips that hold the thin strings down). Make sure the right strings go under them. If a string catches on a tree while you tune, you'll hear a ping and the tuning will jump. A little lubricant there helps (see "While the strings are off").

Tuning and stretching

1. With all the strings on and seated in their slots, tune each one close to pitch, starting with the low E. Then touch up the others. Bring the strings up gradually and evenly so the neck doesn't take a sudden load.
2. Tune all six to pitch.
3. Stretch the strings. Hook your fingers under each string near the first fret, or at the 12th fret, and tug lightly. Or hold the string loosely between thumb and finger, lift and slide along its length.
4. Retune. The strings will have gone flat.
5. Repeat the stretch and retune several times until they hold.
6. Play for a few minutes, then retune again. Strings settle as they warm up.

> **Tip:** Before you trim, give each string's excess a short tug at the post. It takes up slack around the post and reduces stretching later.

On a tremolo guitar, give the arm a few gentle dips after stretching and retune. That helps everything settle against the pivots and the nut.

Trimming

1. Cover the headstock with a microfiber cloth to catch the clippings.
2. Cut each string end close to the post with flush cutters.
3. Feel for any sharp tips and trim them flat.

Long string ends left on the headstock rattle, scratch the finish and tear the lining of your case or gig bag. Locking and slotted tuners leave very little to trim.

When you need a setup check

If you put on the same brand and gauge you had before, the guitar should play the same once the strings settle. If you changed gauges, expect some changes. Factory setup numbers assume the stock strings. Heavier strings pull more on the neck and can raise the action and change relief; lighter strings can cause buzz. One gauge step usually needs only small adjustments, while a big jump may need a truss rod adjustment and a full setup.

Electric guitars add a few more things to check after a gauge change:

- Tremolo balance: a floating bridge will sit at a different angle and need its spring claw adjusted (it's right there in the Floyd tuning steps above).
- Intonation: check each string at the 12th fret. If the fretted note is sharp, the saddle moves back; if flat, it moves forward.
- Nut slots: a much heavier string can bind or sit too high in its slot. That's a job for a tech.
- Pickup height: heavier strings can change the balance between strings slightly.

Chapter 12 walks you through relief, action, intonation and pickup height in order. If you're not comfortable turning a truss rod or setting up a floating tremolo, take it to a tech. There's no shame in that.

A side note on bass

Bass strings change the same basic way, with two differences. Some basses load the strings into the back of the bridge (top-load) and some pass them through the body. And bass strings have a thin, tapered section near the end, often wrapped in colored silk. Only that tapered part should wind around the post. Trying to wind the full-thickness part around a small post can break the string. Cut the string a few inches past its post with that in mind. Before you cut, bend the string sharply at the cut point and cut just past the bend, so the outer winding can't loosen. Then push each string into its saddle and nut slot with your thumb to help it settle.

Quick checklist

- Know your bridge type before you start, and change floating bridges one string at a time.
- On a Tune-o-matic and stopbar, change three strings at a time.
- Loosen fully before cutting, and keep a cloth over the finish near the bridge.
- Seat every ball end fully, and center each string in its saddle groove.
- Wind neat, downward wraps with no crossovers, or clamp locking tuners taut with almost no wraps.

- Stretch, retune and repeat until the strings hold, then trim close to the post.
- After a gauge change, check tremolo balance, intonation and the rest of Chapter 12.

Chapter 12: Basic Setup Checks

A "setup" is the set of small adjustments that decide how a guitar feels and plays: how far the neck bows, how high the strings sit, how the nut is cut, whether notes play in tune up the neck, and how close the pickups are to the strings. When those things are right, the guitar is easy to play and stays in tune. When they drift, you get buzz, sore fingers, and chords that sound a little sour even when the open strings are perfect.

This chapter walks through the checks in the order I'd do them on the bench, with starting numbers from the guitar makers. Some of these adjustments are easy and safe to do at home. A few should go to a tech. I'll tell you which is which.

Why setups drift

You might ask, "My guitar played great when I bought it. Why would it change?" It's simple: a guitar is wood under tension. The strings pull on the neck all day long, and the wood swells and shrinks as the humidity and temperature change. Seasonal changes often mean seasonal adjustments. Changing string gauge or material changes the pull on the neck enough to need a neck adjustment. New guitars also go through a settling-in period.

Plan on a setup check twice a year, around September and March. Chapter 7 covers humidity itself; this chapter is about what to do once the air has done its work.

> **Tip:** Do your setup checks with the strings you actually plan to use. If you are changing gauge, change strings first (Chapter 11 for electrics, Chapter 10 for acoustics), tune up, and let them stretch in before you measure anything.

Before you start

Every check in this chapter needs the guitar tuned to pitch and held in playing position. Gravity changes the readings if the guitar lies flat on its back, and the neck behaves differently with no string tension on it. So tune up, sit the way you play, and measure.

You'll need a tuner, a capo, feeler gauges, a string action gauge or a 6" steel rule, the right truss rod wrench, and the screwdrivers or Allen keys that fit your hardware. Chapter 2 covers each one.

> **Tip:** Write down every measurement before you change anything. If an adjustment goes sideways, your notes are how you get back to where you started.

The order matters

Each adjustment affects the ones after it. If you set the string height first and then adjust the neck, you've just changed the string height again. That's why every setup sequence worth following starts with the neck. String height comes before nut height, so the first fret is a fixed point to measure the nut from.

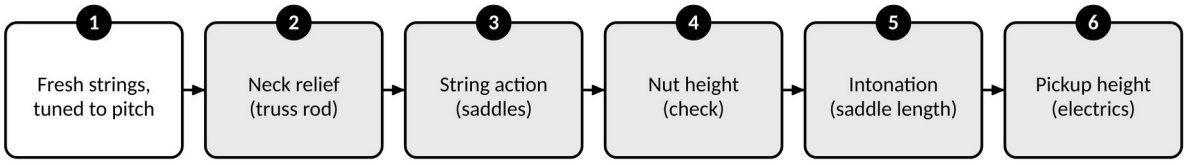


Figure 12-1. The setup order this book uses.

Here's the order this book uses:

1. Neck relief (the truss rod)
2. String action (height at the bridge or saddle)
3. Nut height (a check only, for most readers)
4. Intonation (whether fretted notes play in tune)
5. Pickup height (electrics only)

Step 1: Neck relief

What it is

Relief is the slight forward bow in the neck under string tension. A neck with a little relief is a hair concave, like a very shallow valley between the first fret and the body, and that dip gives the strings room to swing without hitting the frets.

Too much relief makes the strings sit high in the middle of the neck and makes the guitar feel stiff. Too little relief lets the strings slap the frets and buzz, mostly on the open strings and the lower frets. A flat neck, or one that bows backward (called back bow), does the same, and a badly back-bowed neck buzzes up into the middle of the neck too.

What a truss rod does

A truss rod is a steel rod buried inside the neck, with an adjusting nut at one end. Tightening the nut pushes back against the strings and straightens the neck (less relief). Loosening it lets the strings pull a little more bow in (more relief). On most electrics the nut is at the headstock under a small cover. On many acoustics it's inside the soundhole at the base of the neck. On some vintage-style Fenders it's at the heel, and you may have to loosen or remove the neck to reach it.

Not every truss rod works both ways. A standard rod can only straighten a neck with too much forward bow. It can't push a back-bowed neck the other way. A dual-action rod (Fender calls its rod Bi-Flex, PRS uses a double-acting rod) can correct in either direction.

How to measure it

There are two common methods, and they give slightly different readings, so use the same method every time and compare to numbers taken the same way.

The first method:

1. Tune to pitch and put a capo (or pick capo) at the first fret.
2. Hold the low E string down at the 12th fret.
3. Pick the feeler gauge that matches your target relief from the table below, and slide it onto the 6th fret, under the low E.
4. If the gauge slides through without touching the string, there's too much relief. If it lifts the string or jams, there's too little (or back bow). If it just kisses the string, you're there.

The second method:

1. Tune to pitch and put a capo at the first fret.
2. Hold the low E string down at the last fret.
3. Measure the gap between the bottom of the string and the top of the 8th fret with feeler gauges, starting with the one that matches your target in the table below.

On an acoustic, the second method is the same except you hold the string at the fret where the neck joins the body instead of the last fret.

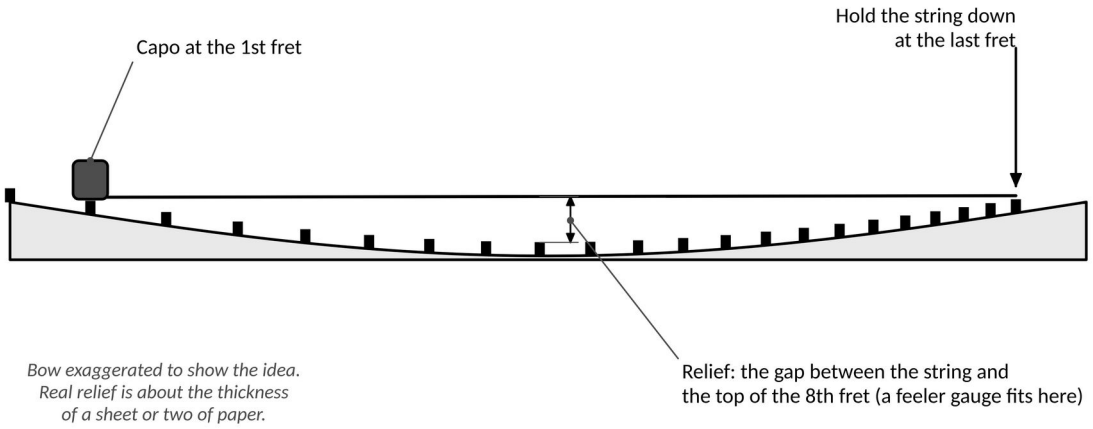


Figure 12-2. Checking relief: capo at the first fret, string held down at the far end, gap measured near the middle.

Starting numbers for relief

These are starting points, not laws. Fender calls its own numbers minimums meant as guidance. The last row is blank on purpose: write in your own guitar's maker number if you have one, or the number you settle on. Notice where each one is measured: the fret matters as much as the number.

Whose number	Guitar	Relief	Where it's measured
MusicNomad	Electric	.006" (0.15 mm)	6th fret, capo at 1, fretted at 12
MusicNomad	Acoustic	.008" (0.20 mm)	6th fret, capo at 1, fretted at 12
MusicNomad	Bass (4, 5, 6 string)	.008" (0.20 mm)	6th fret, capo at 1, fretted at 12
MusicNomad	Classical	.010" (0.25 mm)	6th fret, capo at 1, fretted at 12
Fender	Electric, 7.25" radius	.012" (0.3 mm)	8th fret, capo at 1, fretted at last fret

Whose number	Guitar	Relief	Where it's measured
Fender	Electric, 9.5" to 12" radius	.010" (0.25 mm)	8th fret, capo at 1, fretted at last fret
Fender	Electric, 15" to 17" radius	.008" (0.2 mm)	8th fret, capo at 1, fretted at last fret
Fender	Acoustic, 9.5" to 12" radius	.010"	8th fret, capo at 1, fretted at body joint
Fender	Acoustic, 15" to 17" radius	.008"	8th fret, capo at 1, fretted at body joint
PRS	All PRS guitars	.005" to .010"	8th fret, capo at 1, fretted at last fret
MusicNomad	Taylor acoustics (their kit for Taylor)	.008"	6th fret, capo at 1, fretted at 12
Your guitar			

Radius is the curve across the face of the fretboard. A 7.25" radius is a tight vintage curve; a 16" radius is much flatter and can usually run with less relief.

You can also start from a nearly straight neck and add relief if you dig in hard. All of these numbers are small, and the right one depends on how you play.

Truss rod safety rules

This is the step that makes people nervous, and for good reason. A truss rod is easy to adjust and expensive to break. Follow these rules and you'll be fine.

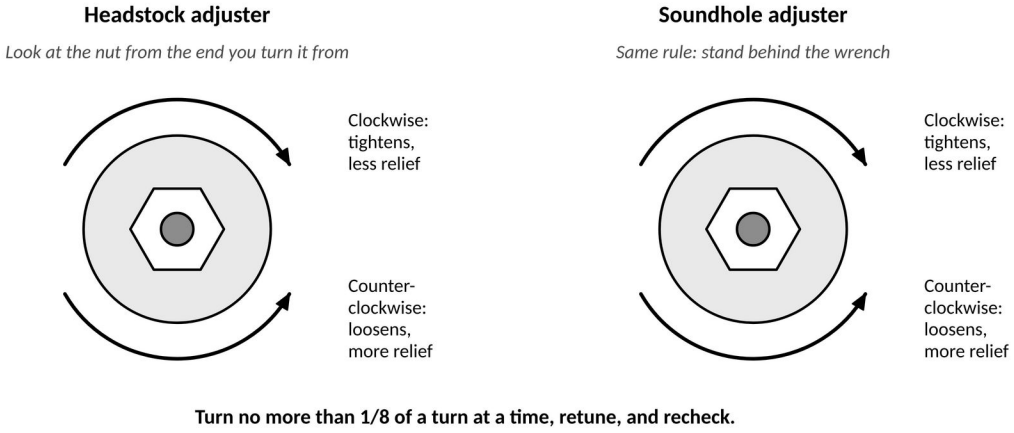


Figure 12-3. Truss rod direction, seen from the end you turn it from.

- Small turns only. No more than an eighth of a turn at a time.
- Know your direction. Look at the nut from the end you're turning it from (stand behind the wrench). Clockwise tightens the rod and reduces relief. Counterclockwise loosens it and adds relief. That holds whether the nut is at the headstock, the heel, or inside the soundhole.
- Use the right wrench and seat it all the way. A loose-fitting wrench rounds the nut, and then you have a real problem.
- Mark where you started. A dab of pencil or a small piece of tape on the nut lets you count your turns and go back.
- Tune up after every turn. The strings go out of tune as the neck moves. Retune, then remeasure.

- Give it time. Let the guitar settle for a few hours after an adjustment, then check again. Necks don't always move right away.
- Strings on and tuned. Measure with the strings on and at pitch. To make a turn on a stiff rod, it's fine to slack the strings a little first, then tune back up and measure again. On vintage-style Fenders with the adjuster at the heel, reaching it means slacking the strings and loosening or removing the neck. If you've never done that, have a tech make the adjustment.
- Stop if it binds. If the nut is stiff, creaks, or takes real force, stop. Don't crank on it.

> **Caution:** Never force a truss rod. If the nut won't turn with light, steady pressure, or you've gone more than a full turn with no change in the neck, stop and take it to a tech. Forcing a stuck nut can shear it off, and a broken rod can mean a major repair.

See a tech when the rod meets heavy resistance, needs constant adjustment, or has no effect. And if you're just not comfortable turning a truss rod, take it to a tech. There's no shame in that.

Step 2: String action

What it is

Action is the height of the strings above the frets. Low action is easier to press down and faster to play, but it leaves the strings less room to vibrate, so it buzzes sooner. High action is harder on the hands, can pull notes sharp as you press down, and adds strain to your hand, wrist and arm. Factory action is often set on the high side to avoid buzz in the store, so many new guitars benefit from being lowered a bit.

How to measure it

1. With the relief set and the guitar tuned, put the capo at the first fret.
2. Hold the string action gauge or ruler on top of the fret at the measuring point.
3. Read the gap from the top of the fret to the bottom of the low E string.
4. Do the same on the high E string. Write both down.

The catch is that the measuring point isn't the same everywhere. Most specs use the 12th fret; Fender measures electrics at the 17th fret and acoustics at the 14th. A 17th-fret number will be a little higher than a 12th-fret number on the same guitar, so compare like with like.

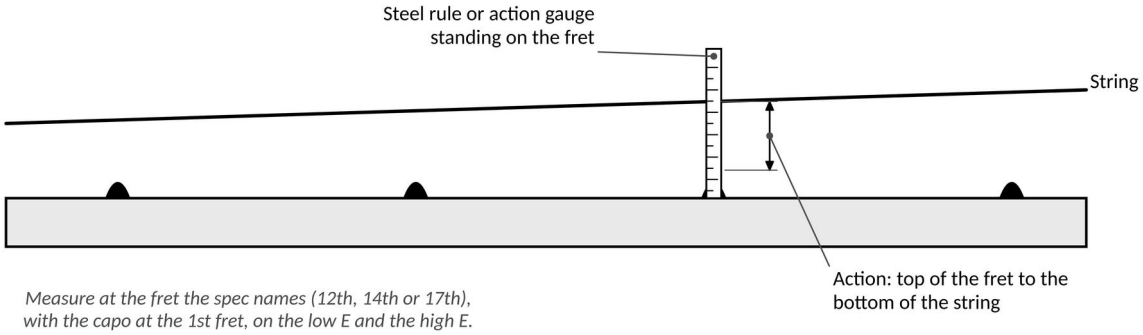


Figure 12-4. Action is the gap from the top of the fret to the bottom of the string.

Starting numbers for action

Whose number	Guitar	Bass side (low E)	Treble side (high E)	Measured at
MusicNomad	Electric 6-string	.060" (1.5 mm)	.050" (1.25 mm)	12th fret, capo at 1
MusicNomad	Acoustic	.090" (2.3 mm)	.075" (1.9 mm)	12th fret, capo at 1
MusicNomad	Classical	.120" (3.0 mm)	.100" (2.5 mm)	12th fret, capo at 1
MusicNomad	Bass 4-string	.085" (2.15 mm)	.075" (1.9 mm)	12th fret, capo at 1
Fender	Electric, 7.25" radius	5/64" (about 2.0 mm)	4/64" (about 1.6 mm)	17th fret
Fender	Electric, 9.5" to 12" radius	4/64" (about 1.6 mm)	4/64" (about 1.6 mm)	17th fret
Fender	Electric, 15" to 17" radius	4/64" (about 1.6 mm)	3/64" (about 1.2 mm)	17th fret
Fender	Acoustic	6/64" (about 2.4 mm)	5/64" (about 2.0 mm)	14th fret
PRS	U.S. electric (most bridges)	1.5-1.9 mm	1.4-1.8 mm	12th fret
PRS	SE acoustic	2.1-2.6 mm	1.6-2.0 mm	12th fret
StewMac (acoustic how-to)	Acoustic	.090"	.070"	12th fret
Your guitar				

Adjust to taste. These numbers get you in the neighborhood; your hands and your pick attack decide the exact address. On an electric, I start the low E at .060" (1.5 mm) at the 12th fret. Use the blank row for your own guitar.

How to adjust it on an electric

Most electrics have saddles you can raise and lower with a small screwdriver or Allen key. On Strat and Tele style bridges, each saddle usually has two height screws. Set the two outside strings first, then set the inner four to follow the curve of the fretboard. Keep both screws on a saddle at about the same height so the saddle sits level and doesn't rock.

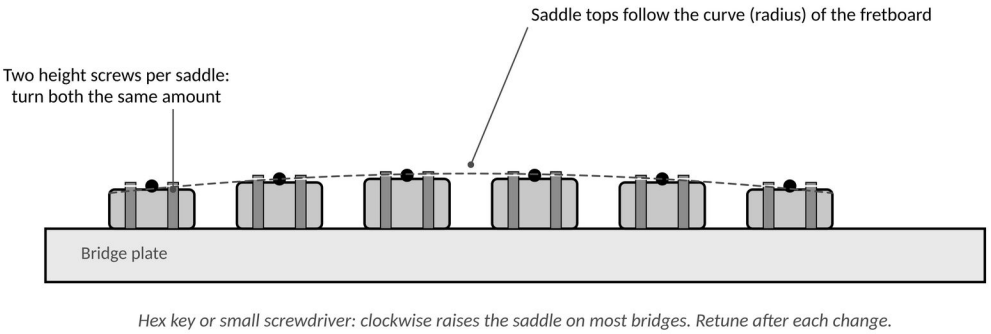


Figure 12-5. Each Strat-style saddle has two height screws; keep them even.

On a Gibson-style Tune-o-matic bridge, the whole bridge goes up and down on two posts with thumbwheels. Turning the thumbwheels clockwise lowers the bridge; counterclockwise raises it. If the wheels won't turn under string tension, slack the strings a little first rather than forcing them.

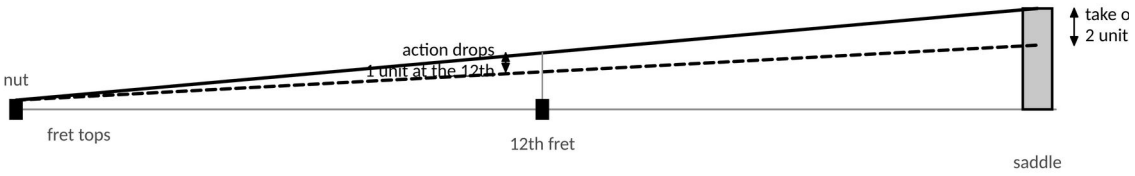
After any height change, retune, remeasure, and play every string up the neck. If it buzzes, raise it a touch (Chapter 13 covers buzz).

> **Tip:** Raise or lower in small steps and play between each one. It's much easier to find "just low enough" coming down slowly than to overshoot and climb back up.

Acoustic and classical action

On most acoustics and classicals, the saddle is a strip of bone or synthetic material sitting in a slot in the bridge. It has no adjustment screws. To lower the action, someone has to take material off the bottom of the saddle. To raise it, you need a shim under the saddle or a new, taller saddle.

Here's why that's trickier than it looks: the change at the 12th fret is only about half the change at the saddle. To drop the 12th-fret action by a small amount, you take roughly twice that amount off the saddle. Take off too much and the only fix is a new saddle.



The 12th fret sits halfway between nut and saddle, so it moves half as much. Take off a little, then check.

Figure 12-6. Taking material off the bottom of an acoustic saddle lowers the 12th-fret action by about half as much.

Sanding a saddle is a learnable job, but it's unforgiving. If you've never done it, buy a spare saddle first, or let a repair shop handle it.

> **Caution:** Don't try to lower acoustic action by cranking the truss rod flat. The rod sets relief, not overall height. Flattening the neck to fix high action at the saddle just trades one problem for buzz on the open strings and low frets.

If an acoustic's action is very high and the saddle is already low in its slot, the guitar may need a neck reset or other structural work. That's a job for a tech, not a home project. Don't attempt a neck reset yourself.

Step 3: Nut height check

What it is

The nut is the slotted strip at the headstock end of the fingerboard that holds the strings and sets their height over the first fret. Slots cut too deep let open strings buzz. Slots left too shallow make the strings hard to press down near the nut, and notes on the first few frets go sharp.

How to check it

With the guitar tuned and in playing position, slide a feeler gauge between the top of the first fret and the bottom of each string. Start with MusicNomad's number for that string. StewMac's Fender-style numbers run lower on the plain strings, so treat the table as a range, not one exact number. The right gauge fits snug against both. If it slides through loose, the slot is high. If you can't get it in and the open string buzzes, the slot is too low.

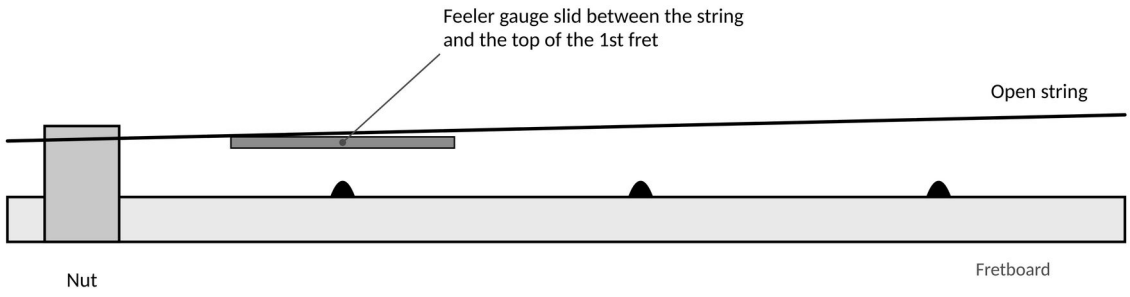


Figure 12-7. Checking nut height with a feeler gauge over the first fret.

Whose number	Strings	Gap over 1st fret
MusicNomad	Electric and acoustic, low E and A	.020" (0.50 mm)
MusicNomad	Electric and acoustic, D and G	.018" (0.45 mm)
MusicNomad	Electric and acoustic, B and high E	.016" (0.40 mm)
StewMac (Fender-style assembly guide)	Wound strings (low E, A, D)	.013" to .020"
StewMac (Fender-style assembly guide)	Plain strings (G, B, high E)	.007" to .012"

Leave the filing to a tech

I call this step a check and not an adjustment on purpose. Nut slots are filed with special gauged files, and the margin between perfect and too low is a few thousandths of an inch. Go one stroke too far and the fix is shimming the nut, filling the slot, or a new nut. A slip with the file can also cut into the fingerboard. Raising a nut or filling a slot belongs to a luthier. If you want to learn to lower a slot that's too high, Chapter 18 shows how, but most owners are better off letting a tech do it.

If your nut check shows a problem, note it, and bring it to your tech along with the other numbers you wrote down.

Step 4: Intonation

What it is

Intonation is whether the notes you fret play in tune with the open string. A guitar can be in tune open and still sound off on a chord at the 7th fret, because pressing a string down stretches it a tiny bit, and thicker strings need a slightly longer working length than thinner ones. Movable saddles let you adjust each string's

length a hair at a time, which is why the saddles on an electric usually end up staggered rather than in a straight line.

Check intonation after every string change, and after any change to action or relief. If the action is too high, notes higher up the neck tend to go sharp, so set the action first. Worn or uneven frets also throw intonation off, and that's fret work (Chapter 6).

How to check it

1. Put on fresh strings if yours are old. Worn strings don't intonate well.
2. Tune the open string exactly with a good tuner.
3. Play the harmonic at the 12th fret (touch the string lightly right over the fret wire and pick it). On an electric, use the middle pickup position with volume and tone all the way up.
4. Fret the same string at the 12th fret, pressing normally, and play it.
5. Compare. If the fretted note matches the harmonic (or the open string), that string is set.

Comparing the fretted note to the harmonic and comparing it to the open string both work. Pick one and stay with it.

Which way to move the saddle

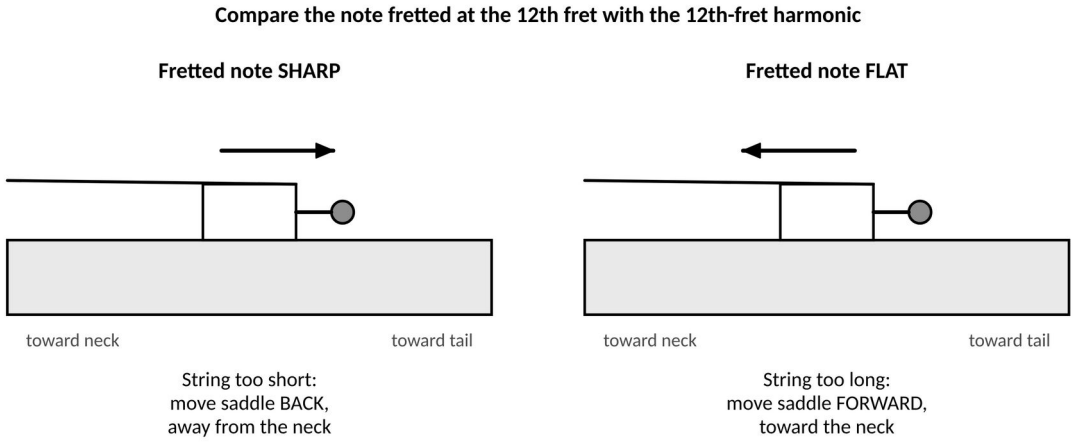


Figure 12-8. Which way to move an electric saddle for intonation.

- Fretted note sharp: the string is too short. Move the saddle back, away from the neck.
- Fretted note flat: the string is too long. Move the saddle forward, toward the neck.

On most Fender-style bridges, turning the intonation screw clockwise pulls the saddle back. Slack the string a little before you move the saddle, then retune and check again. Repeat until the fretted note and the harmonic agree. If you play high on the neck, check the 17th fret too, and split the difference if the 12th and 17th disagree.

> **Tip:** Don't chase perfection. A guitar is a tempered instrument, which means every note is a small compromise. Get it close on a good tuner and let your ears have the final say.

Acoustics are different

On most acoustics, the saddle can't be moved. If an acoustic won't intonate, the fix is filling and recutting the saddle slot or reshaping the saddle's top edge, and that's a job for a luthier. A worn nut, high action, or old strings can also make an acoustic sound off, so rule those out first.

Step 5: Pickup height

What it is

Pickups are magnets, and how close they sit to the strings changes the sound. Closer gives more output and a hotter, brighter sound, but too close and the magnets pull on the strings, which gives you a wobbly, out-of-tune sound high on the neck (sometimes called "Strat-itis") and strings slapping the pickup covers. Farther away is cleaner and softer, but too far and the guitar sounds weak.

How to measure it

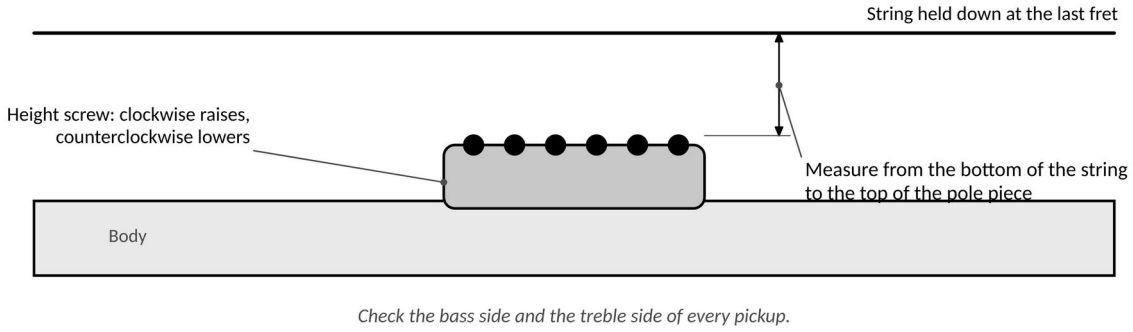


Figure 12-9. Pickup height is measured with the string held down at the last fret.

1. Hold the low E and high E down at the last fret.
2. Measure from the bottom of the string to the top of the pole piece or pickup screw with a small ruler.
3. Do the bass side and the treble side of each pickup.
4. Turn the screws clockwise to raise the pickup and counterclockwise to lower it.
5. Plug in, set volume and tone all the way up, and listen. Balance the pickups so they're about the same volume when you switch between them.

Whose number	Pickup	Bass side	Treble side
Fender	Standard single-coil	5/64" (2 mm)	4/64" (1.6 mm)
Fender	Vintage-style single-coil	6/64" (2.4 mm)	5/64" (2 mm)
Fender	Texas Special and Noiseless	8/64" (3.2 mm)	6/64" (2.4 mm)
Fender	Humbucker	4/64" (1.6 mm)	4/64" (1.6 mm)
MusicNomad	Stratocaster, all pickups	3/32" (2.4 mm)	1/16" (1.6 mm)

Heavier strings pull harder on the magnets, so they may need the pickups a little lower.

> **Caution:** On some Gibson-style pickups, the height screws can pop out of their seat if you back them out too far, and the screwdriver can skid onto the top. Go slow and keep a hand on the tool.

If notes warble up near the 12th fret after you raise a pickup, it's too close. Lower it and recheck intonation.

What to leave to a tech

Here's how I'd split the work.

Job	Do it yourself?	Why
Measuring relief, action, nut and pickups	Yes	Only takes a gauge and patience
Small truss rod turns on a nut that moves freely	Yes, carefully	Eighth turns, retune, wait, recheck
A stuck, creaking or maxed-out truss rod	No, see a tech	Forcing it can break the rod
Saddle height on an electric	Yes	Screws are made for this
Sanding an acoustic saddle	Maybe	Easy to overshoot; buy a spare or let a tech show you
Filing nut slots	Most owners: see a tech (Chapter 18 if you want to learn)	A few thousandths too deep means a new nut
Shimming or replacing a nut	No, see a tech	Needs shaping and fitting
Intonation on an electric	Yes	Small screw turns and a good tuner
Acoustic that won't intonate	No, see a tech	Slot fill or saddle work
Action still high with saddle already low	No, see a tech	May need a neck reset

Chapter 15 has a fuller list of signs that a guitar needs a pro, and what a professional setup usually includes.

Quick checklist

- Tune to pitch and measure in playing position, with the strings you plan to use.
- Work in order: relief, action, nut check, intonation, pickups.
- Write down every number before you change anything.
- Turn the truss rod an eighth of a turn at a time, retune, and give it a few hours.
- Stop and see a tech if the truss rod binds or does nothing.
- Compare your numbers only to numbers measured the same way, at the same fret.
- Leave nut filing, neck resets and acoustic slot work to a tech.

Chapter 13: Tracking Down Fret Buzz

Fret buzz is that sizzle or rattle you hear when a vibrating string slaps a fret it isn't supposed to touch. A little is normal on almost any guitar if you dig in hard enough. A lot makes notes die early, chords sound fuzzy, and an otherwise good guitar feel cheap.

The trouble is that buzz has a lot of possible causes, and the fix for one can make another worse. Lowering the action to make a guitar easier to play can cause buzz; raising it to stop buzz can make it harder to play. This chapter gives you a way to track buzz down to its real cause before you start turning screws, and it tells you which fixes are yours and which belong to a tech.

First, is it really fret buzz?

You might ask, "How do I know the buzz is coming from the frets?" Good question, because a lot of buzzes aren't. Loose hardware can make a rattle that sounds just like fret buzz. Before you blame the neck, rule out the easy stuff.

1. Play the note that buzzes, then lightly touch different parts of the guitar while it rings: the tuner buttons, the strap buttons, the truss rod cover, the pickguard, the output jack.
2. If the buzz stops when you touch something, that part is loose. Snug it up gently. Chapter 8 covers hardware.
3. Check the tuner nuts and washers on the face of the headstock. Loose tuner bushings turn up on a large share of the guitars that come into repair shops.
4. Look at the strings. Grime, a kink, or a winding coming loose can all rattle. If the strings are dull, rough or discolored, change them first (Chapter 9).
5. On an acoustic, listen inside. A loose brace or something dropped in the body (a pick, a battery, a loose wire on a pickup) can buzz. A loose brace is a tech job.

> **Tip:** Change to fresh strings of the same gauge before you do any serious buzz hunting. It removes one whole category of causes, and you'd need fresh strings to set up the guitar properly anyway.

Where buzz comes from

Once you know the sound is a string touching a fret, the causes fall into a short list.

Your playing

Technique is the cause nobody wants to hear about, but it's often the answer. Not pressing firmly enough, fretting too far behind the fret, strumming too hard, sloppy barre chords, a heavy pick attack: any of them will do it. A hard attack swings the string wide enough to hit frets a lighter touch would clear.

Here's a quick test. Play the buzzing note again, fingertip right behind the fret, normal pressure, and pick it softly. If the buzz goes away, your setup is just a little low for how you play. That's not a flaw in the guitar, it's a setup choice, and Chapter 12 shows how to raise the action a touch.

Neck relief

Relief is the slight forward bow in the neck under string tension (Chapter 12 explains it in full). Too little relief, or a neck bowed backward, puts the strings too close to the frets. You hear it mostly on the open strings and the low frets, and on a badly back-bowed neck it reaches into the middle of the neck too. A truss rod, the adjustable steel rod inside the neck, sets that relief.

String action

Action is how high the strings sit above the frets. Low action is easy to play but leaves less room for the strings to move, and it's one of the main causes of buzz. If the saddles have been lowered, or an acoustic's saddle has been sanded down, buzz is a common result.

A high or uneven fret

Sometimes one fret sits a little higher than its neighbors. It may have been seated poorly at the factory, or it may have lifted out of its slot. When one fret is higher than the rest, the string hits it when you play the fret just below it. So the problem fret is usually the next one up toward the bridge from the fret that buzzes. Chapter 17 shows how to find it with a fret rocker and how to fix one high fret.

Worn frets

Years of playing wear grooves into the frets, usually in the first five or so and under the strings you bend most. That leaves the frets uneven. Chapter 6 covers fret wear and when leveling or a refret is needed.

A worn or low nut slot

The nut is the slotted strip at the headstock end of the fingerboard. If a slot is cut too deep, or has worn down over the years, the open string sits too close to the first fret and buzzes. This mostly shows up on older guitars. Buzz at the first fret, and buzz on open strings, usually points at the nut.

Humidity

Dry air is a buzz maker. A sunken top and a back-bowed neck are both signs of a guitar that's too dry, and both buzz. When the top of an acoustic sinks, the bridge drops, the strings drop with it, and the action is suddenly too low. Dry air also shrinks the fingerboard and lets frets lift, and seasonal swelling and shrinking can loosen frets in their slots.

Here in Nevada, a guitar that played clean in August can buzz by December. Chapter 7 covers humidity: what relative humidity (RH) is, the safe range, and how to keep the guitar in it. If your buzz showed up with the change of seasons, deal with the humidity first and give the guitar a week or two to settle before you change the setup.

A change of strings or tuning

A recent change in string gauge or tuning will do it too. Lighter strings pull less on the neck, so the neck straightens, relief drops, and the strings sit lower. Tuning down does the same thing. If the buzz started right after a string change, that's your first suspect.

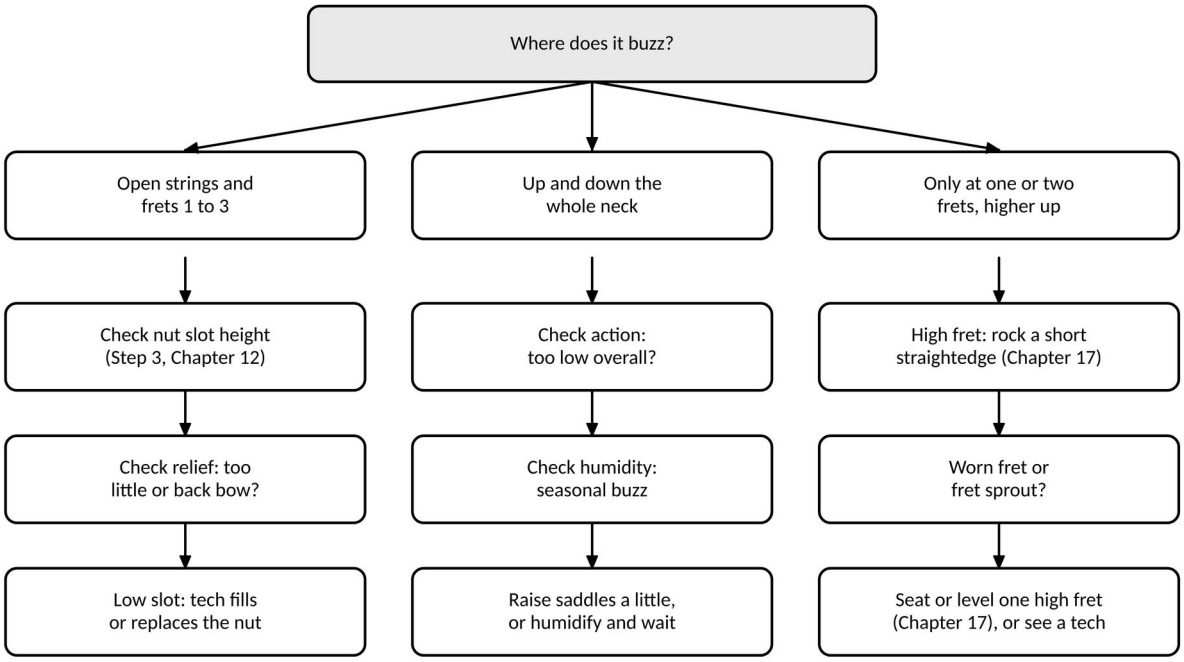
Where it buzzes tells you why

This is the heart of the chapter. Play every note on every string and write down where the buzz happens. It's tedious, but it's the fastest way to the right answer. Tune up, sit in playing position, and work up each string one fret at a time.

Where you hear the buzz	Most likely cause	What to look at
Open strings only	Nut slot too low or worn	Nut slots (tech job to fix)
First fret or two only	Nut slot too low, or too little relief	Nut, then relief
Low frets (about 1 to 5)	Too little relief or a back-bowed neck	Relief (Chapter 12)
Middle of the neck	A badly back-bowed neck	Relief, then action
Most frets, all over the neck	Action too low, or not enough relief	Action and relief
Upper frets only	High fret near the body, or a rising fingerboard on an acoustic	Fret check (Chapter 17), or a tech
One or two notes on one string	A high or loose fret, often the next one up	Fret rocker check
One note on every string	A high or lifted fret	Fret rocker check
Only when you play hard	Your attack is wider than the setup allows	Lighter touch or slightly higher action
Started with the dry season	Low humidity	Chapter 7
Started after a string change	Lighter gauge or new tuning dropped the relief	Relief and action

A simple flow to follow

Here's the way I'd work through it, from easiest to hardest. Do one step at a time, and play the guitar after each one.



Rule out your hands first: a light, clean fretting spot just behind the fret stops a lot of buzz.

Figure 13-1. A quick way to trace buzz to its cause.

1. Rule out loose hardware and old strings, as described at the start of this chapter.
2. Check your hygrometer. If the air has been dry, fix the humidity first (Chapter 7) and wait.
3. Play the buzzing note gently and with your fingertip close to the fret. If it goes away, decide whether you want to adjust your touch or raise the setup a little.
4. Map the buzz with the table above.
5. Measure the relief (Chapter 12). If it's below the starting number for your guitar, add a little relief with the truss rod, an eighth of a turn at a time.
6. Measure the action at the 12th fret. If it's low on an electric, raise the saddles a touch. On an acoustic, low action means a saddle shim or a new saddle (see below).
7. If the buzz is on open strings only, check the nut.
8. If one or two frets still buzz after the setup is right, check for a high fret.
9. If several areas still buzz with a correct setup, the frets probably need leveling. That's a tech job for most players.

Do the proper setup first. If the relief and action are right and the guitar still buzzes, the frets are the likely cause.

Fixes you can do at home

Add a little relief

If the neck is too straight, loosening the truss rod a little lets the strings pull a bit more bow into the neck. That helps most in the middle of the neck. A heavy-handed player can loosen the rod slightly for more relief, which raises the action in the middle of the neck while keeping it comfortable overall. Follow the truss rod rules in Chapter 12: small turns, the right wrench, retune after each turn, and stop if it binds.

> **Caution:** If the truss rod nut is stiff, creaks, or won't turn with light pressure, stop. Forcing it can strip or break the rod. That's a tech job.

Raise the action a touch

On an electric, raise the saddles or the bridge in small steps, play, and repeat until the buzz clears. Here's a useful test: measure at the 12th fret. My own target on an electric is .060" (1.5 mm), the same starting number as Chapter 12. MusicNomad's buzz guide goes a little higher, raising both E strings to about .070" (1.8 mm) and calling for a full setup past .075" (1.9 mm). If either E string is well under .060", raise both E strings to about .060" and play again. If the buzz goes away, bring the strings in between back to follow the fretboard curve. If you're already at .060" or a little above and it still buzzes, raising it more only makes the guitar harder to play, so look for another cause or see a luthier.

On an acoustic, raising the action means a shim under the saddle or a new, taller saddle. That's usually the point where it's worth handing the guitar to a repair shop.

Test the nut slot

Here's a simple test for a low nut slot: cut a narrow strip of ordinary printer paper and slip the end of it under the buzzing string right in the nut slot. If the open-string buzz stops, the slot is too low. The fix is a nut repair or a new nut, and that's a tech job. The test itself is free and tells you exactly what to ask for.

Find a high fret

A fret rocker is a short straightedge that spans three frets at a time. StewMac sells one, and any straightedge that covers exactly three frets does the same job. Set it on three frets under where the string runs. If it rocks back and forth, the middle fret is higher than the two on either side.

1. Loosen the strings enough to move them aside, or work between them.
2. Set the rocker on the buzzing fret and the two above it, then move it one fret at a time up the neck.
3. Check each fret across its width: bass side, middle, and treble side.
4. Mark any fret that rocks with a small piece of painter's tape.
5. Press down on a high fret with your thumb. If it moves or clicks, it may be lifted out of its slot.

You can also check whether a fret is fully seated by sliding a .004" (0.10 mm) feeler gauge under the ends. A gap means the fret has lifted.

> **Caution:** Finding a high fret is a home job. Fixing one usually isn't. Leveling, crowning, and reseating frets take special files and a steady hand. Reseating a fret is luthier work, and so is any real fret dressing.

Spot leveling one to three frets with fret files can be done, and full leveling with a long beam is the answer when four or more frets are uneven. If you're handy and have the tools, it can be learned. My advice: learn it on a cheap practice neck, not on your favorite guitar.

Adjust your touch

This one costs nothing. Fret just behind the fret wire, not in the middle of the space. Keep your thumb around the middle of the back of the neck, and strum with confidence instead of force. Try a slightly lighter pick or a softer attack and see how much of the buzz goes with it.

Buzz that only you can hear

You might ask, "My electric buzzes when I play it unplugged, but it sounds fine through the amp. Do I need to fix it?" Not always. Buzz you only hear acoustically is often fine, because the pickups don't hear contact happening away from them. If the buzz comes through the amp, it's worth fixing.

Acoustics are a different story. What you hear is what the audience hears, so buzz matters more.

Fixes for a tech

Problem	Why it's a tech job
High or loose fret	Reseating or leveling takes fret tools and practice
Several worn or uneven frets	Full fret leveling and crowning, or a refret
Low or worn nut slot	Shimming, filling, or a new nut
Acoustic action too low	Saddle shim or new saddle
Stuck or maxed-out truss rod	Forcing it can break the rod
Rising fingerboard over the body on an acoustic	Fret work and possibly more
Loose brace inside an acoustic	Needs regluing inside the body
Buzz that stays after a good setup	Frets or structure need a trained eye

When you bring a guitar in for buzz, bring your notes. Tell the tech which notes buzz, when it started, and whether you changed strings, tuning or rooms lately. That information saves time on the bench.

Quick checklist

- Rule out loose hardware and old strings before you touch the setup.
- Check humidity first if the buzz showed up with the season.
- Play every note on every string and write down where it buzzes.
- Use the location to point to the cause: open strings to the nut, low frets to relief, one fret to a high fret.
- Adjust relief and action in small steps, playing after each one.
- Find high frets with a rocker, but leave the fret work to a tech.
- Buzz you can't hear through the amp may not need fixing.

Chapter 14: Travel and Shipping

A guitar at home on a stand in a steady room has an easy life. The minute you take it out the door, that changes. Cars get hot and cold. Airplanes come with baggage handlers and crowded bins. Shipping boxes get dropped, stacked and left on loading docks. Plenty of broken headstocks and loose bridges start with a trip.

This chapter covers how to carry a guitar safely: picking a case, driving with it, flying with it, dealing with cold weather and packing one to ship. Much of it builds on Chapter 7, so if you haven't read the humidity and temperature chapter yet, start there.

Building guitars taught me that a guitar faces its hardest test when it leaves the shop. Temperature swings in transit can shift a neck or crack a finish. Support the headstock when packing, and let a cold case warm up slowly before you open it.

Cases and gig bags

The case is your guitar's first line of defense, so let's start there.

A gig bag is a soft padded bag with a zipper. It's light, easy to carry on your back and fine for walking to a lesson or a jam. It doesn't do much against a hard hit or someone setting a heavy box on top of it. Some newer gig bags have stiffer foam panels and do better, but none match a hard case.

A hardshell case is a rigid case, usually wood, plastic or composite, lined with padding shaped to the guitar. It protects against bumps and crushing, and it creates a small, steadier pocket of air around the guitar. Holding humidity steady is much easier in a closed case than in a room, and much easier in a hardshell than in a gig bag. One thing to watch: an old wooden case can pull moisture out of a guitar, so humidify the case too.

A flight case is a heavier-duty hard case built for checked baggage and road use. If you plan to fly, buy an approved flight case, and know going in that even a hard case may not fully protect a guitar from rough handling.

You might ask, "Do I really need a hard case?" For a cheap guitar going across town, a good gig bag is fine. For anything you'd hate to lose, anything going in a car trunk or truck bed with other gear and anything getting on an airplane, use a hard case. That's my stand.

Tip: Check the fit. The guitar shouldn't slide around when you close the lid and gently tip the case. If it moves, add padding in the gaps. Soft cotton, a folded towel or a clean cloth all work.

Tip: Look under the headstock. Don't let anything rest in the gap under the headstock in the case. That space is there on purpose, so don't stuff cables or a tuner in it.

In the car

Cars are where a lot of guitars get hurt, and almost always because of heat.

You might ask, "It's only going to be in the car for an hour. What's the harm?" On a hot day, quite a bit. The heat inside a parked car can soften the glues that hold a guitar together. On an acoustic, that lets the bridge start pulling up under string tension, and in extreme cases other parts come apart. Think of it the way you'd think about a dog in a hot car. If you wouldn't leave your dog there, don't leave your guitar there.

And never put it in the trunk. The temperature in a trunk can swing widely, a dark lid takes the full heat of the sun with no air moving, and you can't see or hear what's going on back there.

When you have to drive with a guitar, put it in the passenger area where it's at the same temperature you are, and run the air conditioning or heat the same as you would for yourself. If you have to stop, take the guitar in with you. If you truly can't, park in the shade, use a windshield shade and crack the windows. Treat that as a last resort, not a plan.

Caution: Don't leave a guitar in a parked car on a hot day, even in its case and even for a short stop. Heat softens glue, and a lifted bridge is a real repair.

Flying with a guitar

Flying with a guitar used to be a gamble that depended on the airline, the gate agent and your luck. In the U.S. there's now a federal rule, and it's worth knowing what it says and what it doesn't. It covers U.S. airlines. If you fly another country's airline, check that airline's own rules before you book.

The U.S. rule

The rule comes from section 403 of the FAA Modernization and Reform Act of 2012. FAA is the Federal Aviation Administration. The U.S. Department of Transportation (DOT) turned that law into a regulation, 14 CFR Part 251, which took effect March 6, 2015. CFR stands for Code of Federal Regulations. It applies to U.S. airlines on their flights, domestic and international. Here's the plain version of what it says.

Carry-on: a guitar can come in the cabin as a carry-on if it can be stowed safely in the overhead bin or another approved storage spot, and if there's room for it when you board. Airlines have to make room in their carry-on programs for instruments the size of a guitar or smaller when one fits safely in approved space.

First come, first served: the airline doesn't have to move other people's bags to make space for your guitar. But DOT's rule says that once your guitar is safely stowed, the airline can't make you take it out to make room for a bag from someone who boarded later.

It counts as a bag: the guitar counts toward your carry-on limit. If it's your carry-on, your other bag may have to be checked, with whatever fee normally applies. The airline can charge its usual carry-on fee, but it can't charge extra just because the item is an instrument.

Buying a seat: if the instrument is too big for the bin, the airline must let you bring it in the cabin in a seat you buy for it, as long as its FAA-approved baggage program allows instruments in a seat. Ask before you book. The instrument has to be in a case or covered, weigh no more than 165 pounds including the case (or the aircraft's limit) and be stowable under FAA rules. The airline can't charge more than the price of that seat.

Checked: the airline must accept an instrument as checked baggage if the case's length, width and height add up to no more than 150 inches and it weighs no more than 165 pounds, or the aircraft's own limits if lower. Normal checked-bag fees apply, including oversize and overweight charges.

Situation	What the rule says
Carry-on in the cabin	Allowed if it fits safely in approved stowage and there's room when you board
Who gets the space	First come, first served; no priority for instruments
Seat for the instrument	Must be allowed if you buy the seat and the airline's program permits seat stowage; case or cover required; 165 lb limit; can't charge more than the seat
Checked baggage	Must be accepted up to 150 total inches and 165 lb (or aircraft limits); normal bag fees

What the rule doesn't do is guarantee you a spot in the bin. If the bins are full when you get on, you may be asked to check the guitar at the gate. So check in online, board early, and consider paying for pre-boarding if the airline offers it. When you can, pick nonstop flights and less crowded times of day. Regional flights on smaller planes often have smaller bins, so check what aircraft you're on.

Before you go

Read your airline's own policy before you book, not at the gate. Search the airline's contract of carriage for the word "music." Look at their liability limits for damaged bags too. Some airlines limit or exclude coverage for instruments, so if your guitar is worth much, look into insurance that covers it while you travel.

Pack the guitar as if it will be checked, even when you plan to carry it on. If you get turned away at the gate, you want it ready for the cargo hold. Use a good hard case, fill any gaps with soft padding, mark the case fragile and put your name and phone number on a tag outside and a note inside.

TSA, the Transportation Security Administration, screens instruments in both carry-on and checked bags, and carry-on instruments get a physical inspection at the checkpoint. If your guitar needs special handling, tell the officer. Tools in your case pocket, like a truss rod wrench or string cutters, are up to the officer at the checkpoint, so pack them in your checked luggage if you can't risk losing them.

Loosen the strings or not?

Makers don't agree on this one, so I'll lay it out plainly. Martin says to loosen the strings when you fly, to take tension off the neck and body, and some airlines recommend the same for checked instruments. Taylor says the opposite: don't detune, because the cabin and the cargo hold are both pressurized, loosening the strings doesn't protect against handling damage, and a neck with no string tension can start to bow backward from the truss rod. (A truss rod is the adjustable metal rod inside the neck that pushes back against string pull; see Chapter 12.)

So what should you do? Here's my middle ground. For a carry-on, leave it at pitch or drop it a half step to a step. For a checked guitar, slack the strings a little, enough that they aren't at full tension but still sit in their slots and keep the bridge and saddle in place. Don't take them fully slack, and don't take them off. If your guitar's maker gives specific advice, follow theirs over mine.

Humidity on the trip

Airplane cabins are dry, and you may be landing somewhere very different from where you left. Take a digital hygrometer and a case humidifier along, keep the guitar at the book's target (aim for 45-50% relative humidity, or RH; anything from 40% to 55% is fine) and watch it after you arrive. Chapter 7 covers how to do that.

There's one wrinkle. Two-way packs like D'Addario's Humidipak hold about 2 ounces of liquid and don't have the volume printed on them, so security may not accept them in a carry-on. Pack them in your checked bag or buy fresh ones when you land. A sponge humidifier like MusicNomad's Humitar or an Oasis unit can be dried out before the flight and re-wet when you get there.

Cold weather

Cold is mostly a problem when the guitar warms back up too fast. Rapid temperature change can crack the finish, and extreme cold can crack wood, weaken glue and harm electronics.

The fix is patience. When you bring a cold guitar inside, leave it in its closed case and let it come up to room temperature slowly. Don't set the case by a heater or fireplace to rush it. A good rule is the 24-hour rule: leave a guitar closed in its case for a full day after it has been shipped or sat in a very cold or very hot car. Chapter 7 covers the warm-up in more detail and my middle ground on how long to wait.

A few other cold-weather habits help. Use a hard case for winter trips, since it holds temperature better than a gig bag. Don't leave the guitar in the car overnight. At a cold venue, give it time in its case in the room before you open it, and expect to retune more than once as it settles. Don't hang it on an outside wall at home in winter, as Chapter 7 explains.

Caution: If a guitar has been out in freezing temperatures, don't open the case and start playing right away. Let it warm up in the closed case first.

Shipping a guitar

Sooner or later most players ship a guitar, whether it's a sale, a repair or a move. A well-packed guitar usually arrives fine. A badly packed one is a coin toss. Here's the way most repair shops do it.

Get it ready

1. Take photos of the guitar from all sides before you pack it. If it arrives damaged, you'll need them for a claim.
2. Slack the strings a little. Reduce the tension without going fully slack. Makers disagree here too, and a few (Larrivée among them) prefer full tension, but a slight detune is the usual compromise.
3. Remove or tie down anything loose: tremolo arms, capos, picks, strap parts and anything else rattling in the case pocket. Take the battery out of an acoustic-electric.
4. Slip a strip of plain paper between the strings and the frets to protect the fretboard.
5. If the guitar has a floating bridge or a trapeze tailpiece, like many archtops, pad under and around it so it can't shift.

Caution: A floating bridge on an archtop is held in place only by string tension. If you slack the strings, mark where the bridge sits first, or pad it well so it can't move. If it shifts, the intonation will be off when it arrives.

Pack the case

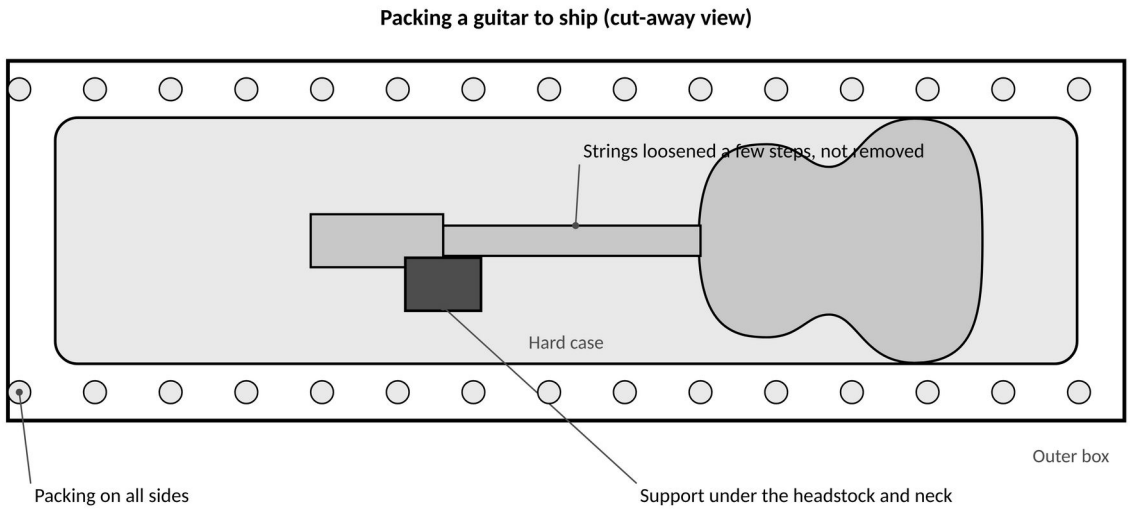


Figure 14-1. A guitar packed in its case inside a shipping box.

1. Fill the space around the headstock so it can't move. Use crumpled paper around the headstock, not piled on top of it, and not stuffed so tight it presses on anything.
2. Fill the gap under the neck heel, where the neck meets the body, so the neck can't lever up and down in transit.
3. Fill any other gaps in the case so the guitar can't shift. Then close the lid and gently tip the case. Nothing should move.

Box it

1. Use a sturdy shipping box big enough to leave several inches of space on every side of the case.
2. Put a cushioned layer in the bottom, set the case in the center and fill every gap around it.
3. Close the box and shake it. If you hear or feel anything shift, open it and add more padding until it's quiet.
4. Tape every seam well. Mark the box fragile and show which way is up.

Two more things. Don't write "guitar" on the box, since that can attract theft, and don't rely on packing peanuts or loose newspaper as your main padding. A box from a guitar shop is often the right size and shape, and many shops will give one away. There are also inflatable shipping systems that hold the case or the guitar in the middle of the box, sold by StewMac and others.

Ship it smart

Insure the guitar for what it would cost to replace. The carrier's standard coverage often isn't enough. Ship early in the week so the box isn't sitting in a hot or cold warehouse over the weekend. Ask the person on the other end to look over the box and the guitar right away and take photos if anything looks wrong.

When the guitar arrives, the person receiving it should leave it in the closed case to come to room temperature before opening it. That's the same rule as for cold weather. Then tune it up, check the neck and play it. If the neck relief or action has moved a little from the trip, Chapter 12 covers how to check and adjust them.

A note for classical and bass players

Nylon-string classical guitars take the same care on the road as steel-strings. They're often lightly built, so keep them in a hard case and watch humidity closely. Basses are longer and heavier, which makes the overhead bin a long shot on many planes. Plan on checking a bass in a flight case, and check the airline's size limits before you book.

Quick checklist

- Use a hard case for flights, shipping, and anything you'd hate to lose.
- Never leave a guitar in a hot car, and never put it in the trunk.
- Read your airline's instrument policy before you book, and board early if you want the guitar in the cabin.
- Pack the guitar as if it will be checked, even when you plan to carry it on.
- Put tools and two-way humidity packs in your checked bag.
- Detune slightly for checked flights and shipping; don't take the strings fully slack.
- Let a cold or shipped guitar warm up in its closed case before you open it.
- When shipping, photograph, pad, shake-test, insure and don't label the box as a guitar.

Chapter 15: Your Maintenance Schedule and When to See a Tech

Everything in this book works best as a habit, not a rescue. A guitar that gets wiped down after every session, restrung on time, and checked when the seasons change almost never surprises you. One that sits in a corner until something goes wrong usually needs more than a wipe and a new set of strings.

This chapter pulls the routine together into a schedule you can follow, then covers the signs that mean a guitar needs a professional, what a professional setup usually includes, and a simple log you can keep. The schedule points back to the chapters where each job is explained, so you won't find the how-to repeated here.

How to use the schedule

You might ask, "Do I really have to do all of this?" No. The schedule is a menu sorted by how often each job comes up. A player who practices an hour a day will hit the string-change row more often than someone who plays on weekends. A guitar in a humid coastal city will need less humidifier attention than one here in the Nevada high desert. Start with the "every time you play" row, because it's the cheapest care there is, and add the rest as they come due.

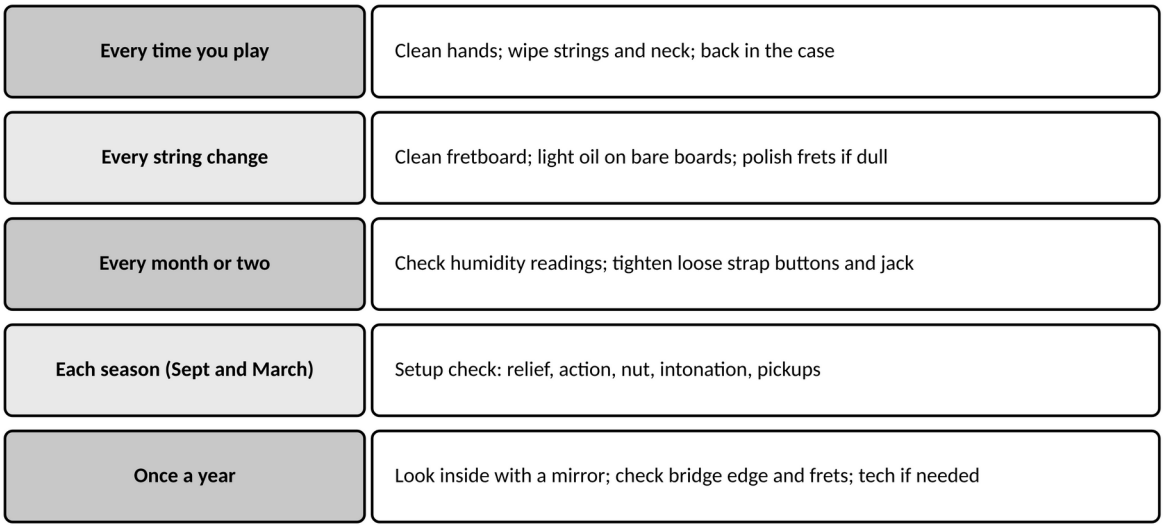


Figure 15-1. The maintenance schedule at a glance.

Where the intervals are a judgment call, I've picked a safe middle ground and said so. Your own guitar will tell you more than any table. If the strings go dead in two weeks, change them in two weeks.

Every time you play

These take a minute or two and save you hours later.

Job	Why	Chapter
Wash and dry your hands before playing	Less sweat and grime on strings and fretboard	3

Job	Why	Chapter
Wipe the strings with a dry cloth after playing	Strings last longer when cleaned before and after playing	9
Wipe the body and back of the neck	A wipe-down after every session is the cheapest habit there is	3, 4
Glance at the hygrometer when you open the case	Catches dry or damp air before it does damage	7
Put the guitar back in its case or on a safe stand	Protects from knocks, sun and dry air	3
Check tuning, and listen for new buzz or rattles	Early warning that something moved	12, 13

Cleaning strings before and after playing extends their life. MusicNomad reports that String Fuel users tell them their strings last two to three times longer than uncleaned ones. That's a customer report, not a lab test, but the habit is cheap and nobody argues against it. A plain dry microfiber cloth works, and a string cleaner like MusicNomad's String Fuel, or a similar product from another brand, goes a step further.

Every string change

A string change is the best time to do the jobs you can't do with strings in the way. Chapters 10 and 11 cover the restringing itself.

Job	Why	Chapter
Check the tuner nuts, string trees and strap buttons	Loose tuner bushings are very common	8
Clean the fretboard and give a bare board a very light coat of oil	Easiest with strings off	5
Polish the frets if they look dull	Smoother bends, cleaner feel	6
Clean the body under the strings	Grime hides under the strings near the bridge	4
Lubricate the nut and saddle slots	Helps tuning stability	8, 11
Check the output jack is snug	Hold the jack still so it doesn't twist the wires	8
Check intonation	It shifts with every new set of strings	12
Do a full setup check if you changed gauge or tuning	A different gauge changes the pull on the neck	12

> **Caution:** Don't over-tighten the output jack nut, and hold the jack still while you snug it. If the jack spins, it can twist and break the wires inside. If the jack keeps working loose or crackles, that's a tech job (or Chapter 8 if you're comfortable with a soldering iron).

How often to change strings

There's no one number, and that's honest, because it depends on how much you play, how much your hands sweat, and what kind of strings you use. Here's roughly what to expect.

Situation	How long strings may last
Electric, played daily	About a week

Situation	How long strings may last
Electric, played occasionally	Up to about three months
Acoustic, played daily	A month or two
Coated strings	Until the coating wears or the tone changes
Bass	Often much longer; change when cleaning stops helping
Any guitar	When they sound dull, won't hold tune, or look or feel grimy or rusted

It comes down to this: go by sound, feel and tuning, not the calendar. Strings that still sound clear and hold tune don't need to come off because a date passed. My middle ground is to check them about once a month if you play regularly and replace them when you see the signs, which Chapter 9 covers in more detail.

Every month or two

Job	Why	Chapter
Check the strings for dullness, rust or rough spots (about once a month)	Change them before they go dead	9
Look over the fret ends for sharpness	Sharp ends mean the wood is drying out	6, 7
Check that the hygrometer still reads sensibly	A bad hygrometer gives false comfort	7
Check the humidifier sponge or packs (every two or three days in dry weather)	Refill or replace before they're spent	7
Try the volume and tone knobs and the pickup switch	Catches scratchy controls early	8
Change the battery in an acoustic preamp if output is weak	Weak batteries distort and fade	8

In dry weather, the humidifier check moves up. Check the sponge every two to three days once room humidity starts dropping, and re-wet it when it goes from soft to firm.

Twice a year, as the seasons turn

The seasons are when most guitars change. Wood swells in damp air and shrinks in dry air, and heaters and air conditioners both pull moisture out of a room. Seasonal change usually means a seasonal adjustment to the action.

Job	When	Chapter
Do a setup check (relief, action, nut, intonation, pickups)	Fall and spring, around September and March	12
Check the hygrometer daily	During the fall and spring changeover	7
Check the hygrometer every few days	Once the weather settles	7
Start or step up humidifying	When the heat comes on in fall or winter	7
Ease off or stop humidifying	When humid weather returns	7
Clean and condition the fretboard (bare boards only)	A very light coat at every string change, and at least twice a year	5

On fretboard oil, the makers don't quite agree. Some say about every six months; Martin's advice ranges from once or twice a year to a few times a year, depending on humidity. MusicNomad's F-ONE oil guidance runs every 4-6 months for daily players and 6-9 months for once-or-twice-a-week players. My rule is a very light coat at every string change, and at least twice a year. Light means a few drops wiped in and the extra wiped off, never a soaking. Chapter 5 covers which boards need oil at all.

> **Tip:** Tie the checks to dates you already remember: Labor Day in early September and the spring clock change in March. If you live where the seasons run the other way, or your heat comes on at a different time, use the week you first turn the heat on and the week you turn it off.

Every year

Job	Why	Chapter
Check fret wear	Grooves under the strings lead to buzz and poor intonation	6
Inspect an acoustic's top, bridge and neck joint closely	Catches cracks, lifting and sinking early	7, this chapter
Tighten loose screws on hardware, gently	Strap buttons, pickguard, jack plate, tuners	8
Deep-clean the finish (polish or wax gloss only if it looks dull)	A deeper clean than the after-play wipe	4
Lubricate open-gear tuners lightly (sealed tuners need nothing)	Keeps the gears smooth	8
Check the case: latches, hinges, handle, lining	A failing case drops guitars	14

Have a tech look the guitar over, or do a full setup yourself, as needed: when something feels off and you're not comfortable fixing it yourself (Chapter 12 and this chapter).

Signs you need a pro

Some problems are yours to fix with the chapters in this book. Others aren't, and putting them off makes the repair bigger. If you see any of these, take the guitar to a qualified tech or luthier (a builder and repairer of stringed instruments).

Cracks

Any crack in the top, back or sides of an acoustic needs a pro. Crack repair can be difficult and expensive, which is a good reason to get it looked at early. Bringing the guitar back to normal humidity often helps a crack close up and makes the repair easier, but it doesn't fix it. A tech still needs to glue and cleat it.

> **Caution:** Don't glue a crack yourself, and don't keep playing a guitar with a crack that's growing. Loosen the strings a little and get it to a tech.

A lifting bridge

Look at the back edge of the bridge on an acoustic. If you can slide paper under it, or see a gap or a line of daylight, the bridge is coming loose. Slack the strings and take it in. A bridge that lets go under full tension can tear up the top.

A sinking or swelling top

A top that dips behind the bridge is a sign of dry air. A top that bellies up behind the bridge is usually too much moisture. Fixing the humidity may bring it back. If it doesn't, or the top has stayed out of shape for a long time, a tech should check it.

Loose braces or a rattle inside

Braces are the thin wooden strips glued inside an acoustic's top and back. When one comes unglued, you'll often hear a buzz or rattle that changes when you press on the top. It needs regluing from inside the body, which is shop work.

Sharp fret ends

Sharp fret ends poking out past the edge of the fretboard (called fret sprout) are a sign the fretboard has shrunk from dry air. The ends may stay sharp even after the humidity is restored. A tech can file and dress them. Chapter 6 covers when this is a home job and when it isn't.

Frets that need leveling or replacing

If the guitar still buzzes after a good setup, or the frets have deep grooves under the strings, it's time for fret leveling or a refret. Chapter 13 shows how to find the problem. The fix is usually a tech job.

A neck that won't behave

Take the guitar in if the truss rod is stuck, creaks, has no effect, or the neck keeps needing adjustment. Any of those is a reason to see a qualified tech, or an authorized service center if the guitar is still under warranty. The same goes for a neck with a twist or an S-shaped curve that the truss rod can't fix.

Action that can't come down

If an acoustic's action is too high and the saddle is already low in its slot, the neck angle may have changed. That can mean a neck reset, which is a major repair. Don't try one yourself.

Electronics problems

Crackling, cutting out, hum that wasn't there before, a dead pickup, or an acoustic preamp that won't power up with a fresh battery. Chapter 8 covers contact cleaner and the easy fixes. If those don't help, a tech with a soldering iron and a meter is the next step.

Mold, water damage or a fall

Mold inside the soundhole is shop work. Water can ruin both wood and electronics. And if a guitar has taken a hard fall, especially onto its headstock, have it checked even if it looks fine. Headstock cracks can be hard to see.

What a professional setup includes

Shops differ, so ask what yours includes before you drop the guitar off. Here's the usual split.

Usually included	Often included or offered	Usually extra
Restringing (sometimes with strings you supply)	Cleaning and conditioning the fretboard	Fret leveling and crowning
Truss rod adjustment for relief	Polishing the frets	Refretting
Action set at the bridge or saddle	Tightening tuners and hardware	Making a new nut or saddle
Nut slot check and light adjustment	Cleaning the body	Crack and bridge repairs
Intonation	Checking the electronics	Electronics repair or rewiring
Pickup height (electrics)		Neck reset

When you take a guitar in, tell the tech what you play, what strings and tuning you use, and what's bothering you. Bring your log. Bring any cables or accessories you use with the instrument too, which matters if the problem is electronic.

A simple maintenance log

A log turns guesses into facts. When a guitar starts buzzing, you can look back and see you changed to lighter strings three weeks ago, or that the room humidity dropped last month. Make a copy of this page for each guitar, or keep the same columns in a notebook.

Guitar: _____ Serial number: _____

Date	What I did	Strings (brand and gauge)	Room or case RH	Relief	Action low E / high E (12th)	Notes

Tip: Write the RH (relative humidity) reading every time you log something. Over a year it shows you exactly when your house goes dry, and that tells you when to start humidifying next fall.

Quick checklist

- Wipe the strings and the guitar after every session.
- Use string changes to clean the fretboard, polish frets and check the hardware.
- Change strings when they sound dull or won't hold tune, not just by the calendar.
- Do a setup check every fall and spring, and after any gauge change.
- Watch the hygrometer closely when the seasons turn.
- See a tech for cracks, a lifting bridge, loose braces, a stubborn neck, or frets that need leveling.
- Keep a log for each guitar and bring it to the shop.

Part 2: Bench Jobs

Illustrated steps for the repairs a careful owner can learn, and where each one should stop.

Chapter 16: Smoothing Sharp Fret Ends

Everything up to this point has been care: cleaning, strings, humidity and setup checks. This part goes one step further. These six chapters cover small repairs that a patient owner can learn with a few good tools. I've put them in the order most people need them, starting with the one that shows up every dry winter: fret ends that cut your hand.

Before you start any bench job, know this. Each of these jobs can be done well at home, and each one can also do permanent damage if you rush it. Every chapter tells you what skill it takes, what you'll need, and where to stop and hand the guitar to a tech. Read the whole chapter before you pick up a tool.

What this job is

Chapter 6 explained fret sprout: the fretboard shrinks in dry air, the metal frets don't, and the fret ends end up sticking out past the edge of the board. This chapter is the hands-on version. The goal is simple: file the fret ends back flush with the wood, put a smooth bevel on them, round off the sharp corners, and polish them so your hand slides without catching.

Skill level: careful beginner. The filing itself is easy. Keeping the file off the finish is the part that takes care.

What you'll need: A smooth-cut mill file or a fret beveling file, a fret end dressing file, low-tack painter's tape, fine abrasives (0000 steel wool or micro-mesh pads), a small vacuum or brush, a neck rest, and fretboard oil for bare boards. Eye protection.

Before you pick up a file

Fix the humidity first. Bring the guitar to a steady 45-50% relative humidity (RH) and give it a week or two (Chapter 7). Mild sprout often shrinks back on its own once the wood takes up moisture again. If the ends are still sharp after that, file them. If you file in the dead of winter at 25% RH, the board can swell back in spring and leave the fret ends short of the edge.

Look at the neck. If it has binding (a plastic or wood strip along the edge of the fretboard), or if the finish is cracked and lifting around the fret ends, stop here and see a tech. Those jobs need different tools and techniques, and a file in the wrong hands tears up binding fast.

Stop and see a tech if: the neck is bound, the finish around the fret ends is lifting, or the sprout keeps coming back season after season even with steady humidity.

Which file

StewMac, whose tools and guides many repair shops use, recommends a smooth-cut mill file for this job and warns against files with widely spaced or crosshatched teeth and against diamond-coated files. Their fixed-angle beveling file holds the file at a set angle so every fret end gets the same bevel. A fixed-angle tool takes the guesswork out, and I'd buy one if you plan to do this more than once.

What angle? Chapter 6 covered the disagreement. StewMac's beveling file is set at 35 degrees, and their fret end video says bevels typically run about 35 to 45 degrees and warns against going shallower than about 30. MusicNomad gives a smaller number measured a different way. Don't chase a number. Match the bevel the factory already cut on your guitar. For sprout, you're only bringing the ends back to where they were.

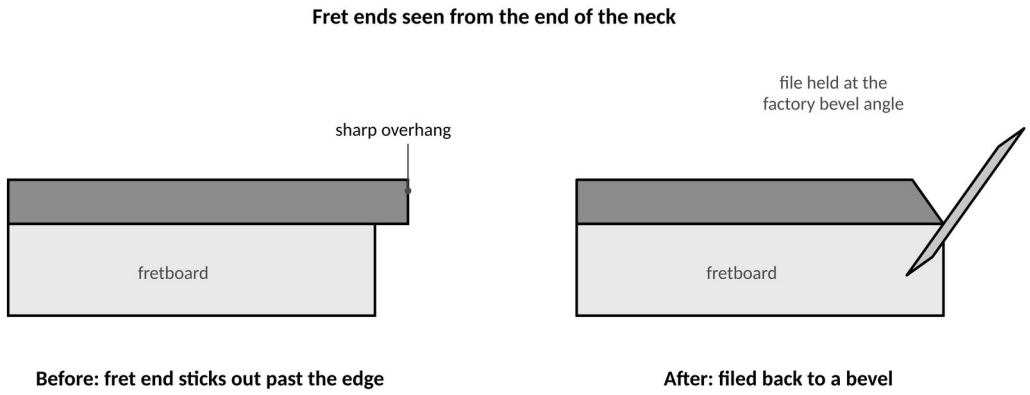


Figure 16-1. Fret ends seen from the end of the neck: filed back flush and beveled to match the factory angle.

Step by step

1. Take the strings off, or loosen them well and slide them off the edges of the board.
2. Put the guitar on a neck rest with the neck well supported.
3. Mask the danger zones. StewMac's video tapes the body where the neck meets it and the headstock area near the first fret, because that's where the file runs off the end of the board. On an electric, cover the pickups with tape so filings can't stick to the magnets. On an acoustic, plug the soundhole with a cloth.
4. Hold the file flat against the edge of the fretboard at your bevel angle, and push it along the length of the neck in long, light strokes. Let the file ride the fret ends, not the wood. Work one side, then the other.
5. Listen and feel. When the file stops cutting metal and starts touching the board or finish, the sound changes. That's your signal to stop on that side.
6. Run your hand along the edge. If any fret end still catches, give that area a few more light strokes.

Rounding the corners

Filing leaves a flat, square corner on top of each fret end. That corner is what still catches your fingers on a fast slide. A fret end dressing file has smooth, safe edges so it can round the fret end without cutting into the board. Use the flat side to ease the corner and the rounded side to roll the top of the fret end into a smooth dome. A few light strokes per fret end is plenty. Don't overdo it.

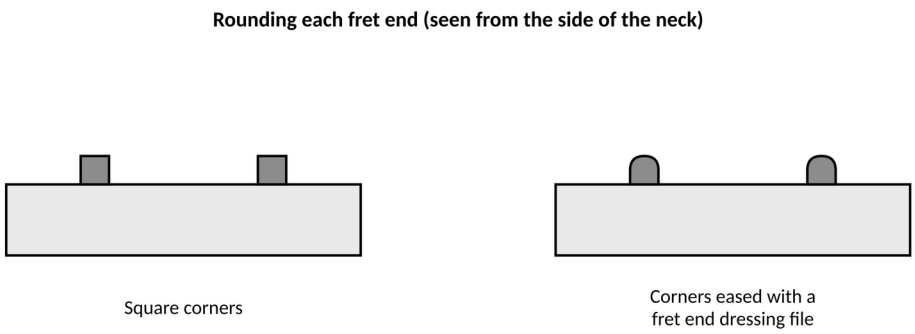


Figure 16-2. Rounding the corners of each fret end with a fret end dressing file.

Polish and clean up

StewMac's method finishes with 0000 steel wool and then micro-mesh pads, going finer through about 1,500, 3,600 and 8,000 grit. If you use steel wool, the pickups must be covered and an acoustic's soundhole plugged. The magnets grab the fibers and they're hard to get out. Micro-mesh alone works fine and is cleaner.

Vacuum or brush away every bit of metal dust. Pull the tape off slowly, peeling it back over itself at a low angle. Clean the board, and give a bare board a light coat of oil (Chapter 5). Restring and play a few slides up and down the neck.

> **Caution:** Sharp fret ends can cut you. Run your hand along the edge gently when you check your work, and keep your fingers out of the file's path.

When it comes back

Sprout can return after the next dry season, especially on a newer guitar. If you keep the humidity steady (Chapter 7), it usually settles down after a few seasons as the wood stabilizes. If it keeps coming back badly, that's a guitar living in air that's too dry. Fix the air, not the frets.

Quick checklist

- Humidify first and give the wood a week or two before you file.
- Stop and see a tech if the neck is bound or the finish is lifting at the fret ends.
- Tape the body and headstock danger zones, and cover pickups or the soundhole.
- Match the factory bevel angle; a fixed-angle beveling file makes it easy.
- Round the corners with a fret end dressing file, then polish with fine abrasives.
- Clean up every bit of metal dust before you restring.

Chapter 17: Finding and Fixing a High Fret

A single fret that sits a hair taller than its neighbors can cause buzz that no amount of truss rod or saddle adjustment will fix. The note one fret below the high one hits it and buzzes or dies. This chapter shows you how to find a high fret, how to tell whether it's one fret or a whole neck that needs work, and how to level and recrown one fret by hand.

Skill level: intermediate. You're removing metal from a fret, and you can't put it back. Go slowly.

> **What you'll need:** A fret rocker (a short straightedge, about 2 to 3 inches long, that spans three frets), a fine-tip permanent marker, a fret leveling tool or small flat diamond file (StewMac's Fret Kisser is one example), a fret crowning file, fret guards or low-tack tape, fine abrasives for polishing, a neck rest, and a good light.

First, rule out the easy causes

Before you blame a fret, go back through Chapter 13. Check relief, action and the nut slot. Make sure the guitar is at a normal humidity. A neck with too little relief or a back bow can make perfectly good frets look high. Only when the setup is right and one spot still buzzes is it time to look for a high fret.

Finding a high fret

A fret rocker is the simplest tool for this. It's short enough to sit on three frets at once. If the middle fret is taller than the two on either side, the rocker will rock on it like a seesaw.

1. Slacken the strings and move them aside, or do this at a string change with the strings off. Set the neck to roughly straight with the truss rod only if you know how (Chapter 12); otherwise just work with the neck as it is, since a rocker spans such a short distance.
2. Stand the rocker on edge across three frets, under where the low E string runs.
3. Tap each end of the rocker lightly. A solid click with no movement means the three frets are even. A rock means the middle fret is high.
4. Move up one fret and repeat, all the way up the neck.
5. Do the same under the middle strings and under the high E path. A fret can be high on one side only.
6. Mark every high fret you find with a small piece of tape on the side of the neck.

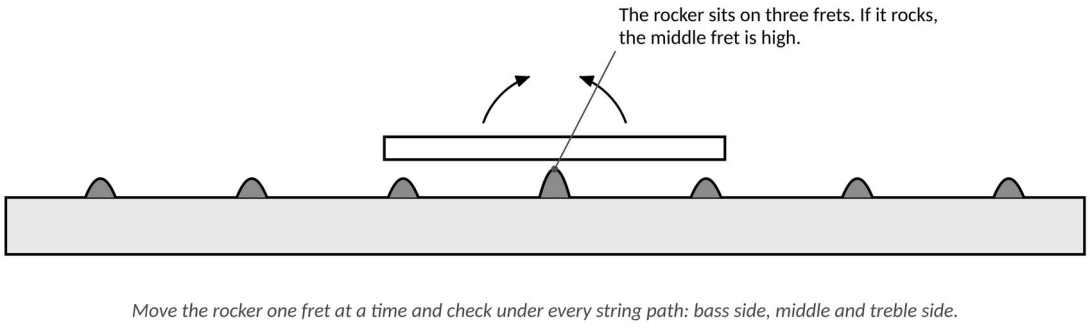


Figure 17-1. A fret rocker sits on three frets. If it rocks, the middle fret is high.

Is the fret lifted, or just tall?

Look closely at the end of the high fret where it meets the board. If you can see a dark gap under the crown, or the fret moves when you press on it, the fret has lifted out of its slot. Filing a lifted fret just removes metal from a fret that should be pressed back down. Reseating and gluing a lifted fret is a job for a tech.

Stop and see a tech if: the fret is lifted or loose, more than two or three frets rock, the high spots run across a whole area of the neck, or the frets are already low and flat on top. Those mean a full fret level or more, which belongs with a tech (Chapter 6).

Leveling one fret

1. Protect the board. Put fret guards or low-tack tape over the wood on both sides of the high fret (Chapter 6).
2. Color the top of the high fret with the marker, end to end.
3. Lay the leveling tool flat across the high fret, bridging onto the frets on each side if the tool is long enough, and stroke lightly along the length of the fret. StewMac's method uses the diamond face of the Fret Kisser this way.
4. Check often. Stop as soon as the marker is just gone from the top along the length of the fret. That means the fret now sits level with its neighbors.
5. Check again with the rocker. If it still rocks, take a few more light strokes and check again.

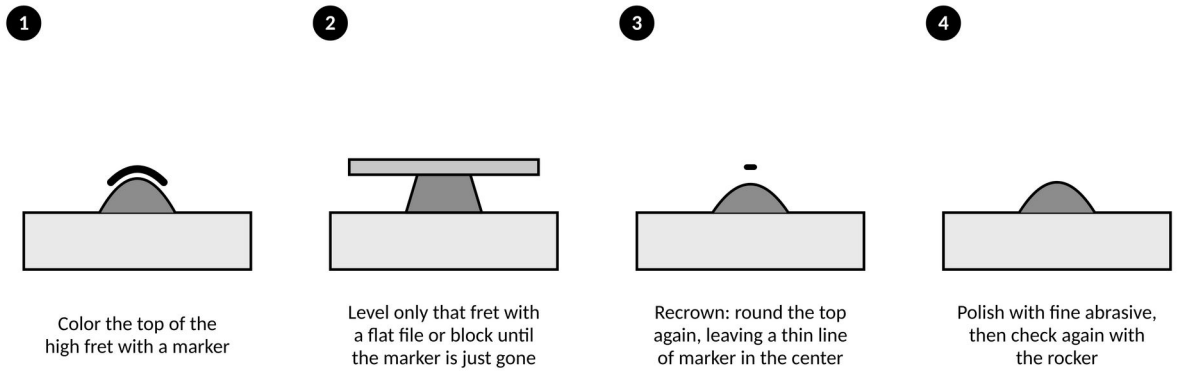


Figure 17-2. Level, recrown and polish one high fret.

Recrowning

Leveling leaves a flat spot on top of the fret. A flat top makes the note less clear and can throw intonation off a little, so the top needs to be rounded again.

1. Color the fret again with the marker.
2. Use a crowning file to round the shoulders of the fret, working from both sides toward the center. StewMac's demo uses a 300-grit diamond understring file held at about 30 degrees.
3. Stop when only a thin line of marker is left along the very top. That thin line is the high point, and it should stay right in the center of the fret.

Polish and check

Polish the fret with fine abrasives until the file marks are gone (Chapter 6). Clean off the dust, remove the tape, restring, tune and set the guitar up. Play every note around the fret you leveled. The buzz should be gone. If it isn't, go back to the rocker and Chapter 13.

> **Caution:** Take off as little metal as you can. A fret you've filed too low becomes the new problem, and the only fixes are leveling every other fret down to match or replacing that fret.

Quick checklist

- Set up the guitar first; many "high frets" are really relief or nut problems.
- Use a fret rocker across three frets, under the bass, middle and treble string paths.
- See a tech if a fret is lifted or several frets are high.
- Mark the fret, level until the marker just disappears, then recheck.
- Recrown until a thin center line of marker is left, then polish.

Chapter 18: Checking and Lowering Nut Slots

Chapter 12 showed you how to check nut height with a feeler gauge, and I told you to leave the filing to a tech. That's still my advice for most owners. But if you're careful, have the right files, and are willing to practice on a spare nut first, lowering a nut slot that's too high is a learnable job. This chapter shows you how, and how to tell when a slot is too low and needs a tech instead.

Skill level: intermediate to advanced. The margin between right and too low is a few thousandths of an inch, and a slot cut too deep can't be filed back up.

What you'll need: Gauged nut files sized for your string gauges, a set of feeler gauges, a capo, a pencil (graphite for lubricating the slots), low-tack tape, a small mirror or magnifier, a good light, and a tuner. A spare nut blank to practice on first.

Too high or too low?

Do the nut check from Chapter 12 with the guitar tuned and the strings you play.

- A slot that's too **high** makes the first few frets hard to press and pulls fretted notes sharp, mostly on the first and second frets. This is the one you can fix at home by lowering the slot a little.
- A slot that's too **low** lets the open string buzz on the first fret. You can't fix that with a file. It needs the slot filled and recut, or a new nut, and that's a tech job.

Stop and see a tech if: the open string already buzzes on the first fret, the nut is cracked or loose, or the slots are badly worn or chipped.

The targets

Use the gap over the first fret from Chapter 12. MusicNomad's numbers are a good place to start: .020" (0.50 mm) under the low E and A, .018" (0.45 mm) under the D and G, and .016" (0.40 mm) under the B and high E. StewMac's assembly guide runs lower on the plain strings (.007" to .012") and around .013" to .020" on the wound strings. Start at the higher numbers. You can always take a little more off later. You can never put it back.

How a good slot is shaped

Three things matter, and the drawing shows them.

- The slot should slope **down toward the headstock**, so the string touches the nut only at the front edge, right where it leaves the fretboard. StewMac describes filing at a gentle back angle toward the tuners. A slot that slopes the other way makes the string's true starting point move back, which can hurt intonation and cause buzz at the nut.
- The floor of the slot should be **rounded** to match the string, just a little wider than the string itself.
- The slot shouldn't **pinch** the string. A tight slot makes the string stick and then jump with a ping as you tune.

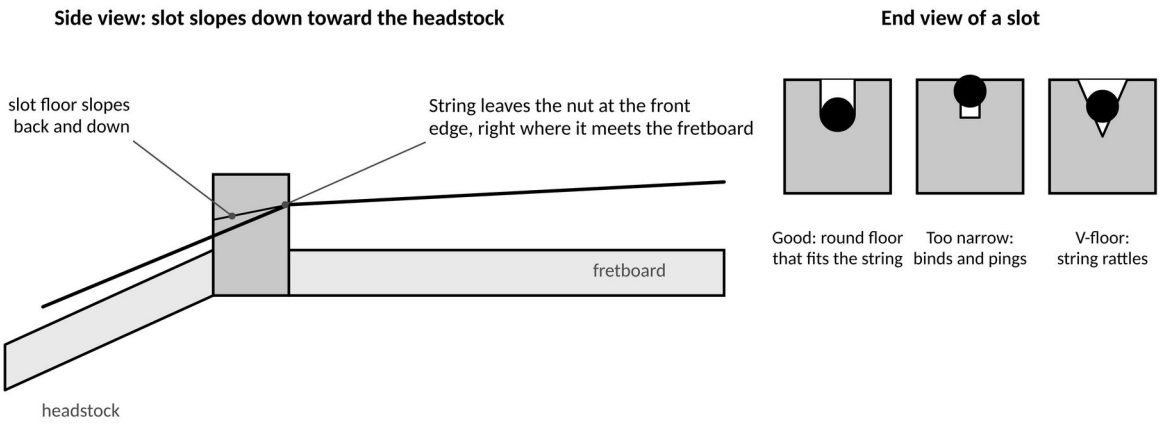


Figure 18-1. A good nut slot slopes down toward the headstock and has a rounded floor that fits the string.

Step by step

1. Write down your first-fret gap for every string before you start.
2. Tape the headstock face and the end of the fretboard right behind the nut, so a slipped file hits tape instead of finish.
3. Slacken the string you're working on and lift it out of its slot. Move it to the side, or rest it on top of the nut between slots.
4. Pick the nut file that matches the string, or one a little wider. Set it in the slot at a gentle angle, with the handle end down toward the headstock.
5. Take two or three light strokes. That's all. Pull the file back toward the headstock as you stroke so you don't chip the front edge of the nut.
6. Put the string back in the slot, tune to pitch, and measure the gap over the first fret again.
7. Repeat steps 3 to 6 until you're just above your target. Then stop.
8. Play every string open and at the first and second frets. If an open string buzzes, you've gone too far on that slot (see below).
9. Rub a soft pencil into each slot, or use a nut lubricant, so the strings slide freely when you tune.

Caution: Measure after every few strokes, with the string tuned to pitch. Nut slots go from too high to too low in a single extra stroke more often than you'd think.

If you go too deep

It happens to everyone once. A slot that's a little too low can be filled and recut, or the whole nut can be shimmed up, or a new nut can be made. Those are tech jobs. Stop filing, note which string buzzes, and take it in.

Quick checklist

- Lower a slot only when it's too high; a buzzing low slot is a tech job.
- Start from the higher target numbers and work down.
- Use a gauged nut file that fits the string, angled down toward the headstock.
- Two or three strokes, then retune and measure.
- Lubricate the slots with graphite when you're done.

Chapter 19: Replacing a Pot, Jack or Switch

Scratchy knobs and crackling jacks often clean up with contact cleaner (Chapter 8). When they don't, the part is worn out and needs replacing. Swapping a volume or tone pot, an output jack or a pickup selector switch is one of the easiest soldering jobs on a guitar, because you're replacing a part with the same part and moving wires from one to the other.

Skill level: beginner with a soldering iron. If you've never soldered, practice on scrap wire first. Soldering is a skill like any other, and an hour of practice makes a big difference.

What you'll need: A temperature-controlled soldering iron (not a soldering gun), rosin-core solder, a damp sponge or brass tip cleaner, a solder sucker or desoldering braid, small pliers, wire cutters and strippers, the right size wrench or nut driver for the pot and jack nuts, masking tape and a pen for labels, a phone camera, and a multimeter. Eye protection and a fan or fume extractor.

Soldering safety and basics

- Work in a room with good airflow, and use a fan or fume extractor to move the smoke away from your face.
- Most guitar solder contains lead. Fralin Pickups' guide says to always wash your hands after soldering with leaded solder. Don't eat or drink at the bench.
- Use a temperature-controlled iron. Fralin warns never to use a soldering gun around pickups, because it can damage the pickup magnets. A Fralin staff reply puts the usual iron setting at about 700 to 800 degrees Fahrenheit.
- Too much heat for too long melts switch housings and cooks pots. Heat the joint, flow the solder, and get out.
- Make a mechanical connection first. Fralin's tip is to bend the wire through or around the lug so it holds on its own, then solder it.
- Tin first. Melt a little solder onto the wire end and onto the lug before you join them. The joint then takes only a second.
- Keep the iron in its stand whenever it's not in your hand, and unplug it when you walk away.

Caution: A soldering iron tip is hot enough to burn skin instantly and to melt a finish or a pickguard. Lay a towel over the body around the cavity, and never reach across a hot iron.

Buy the right part

Before you order anything, take the old part out (or look at it in the cavity) and match it.

- **Pots:** read the value printed on the pot, such as 250K or 500K. The usual pairing is 250K pots with single-coil pickups and 500K pots with humbuckers, but match what came out unless you want a different sound. Match the taper too (audio or linear; the code on the pot tells you), and the shaft. A split, knurled shaft takes push-on knobs. A solid shaft takes knobs with a set screw.

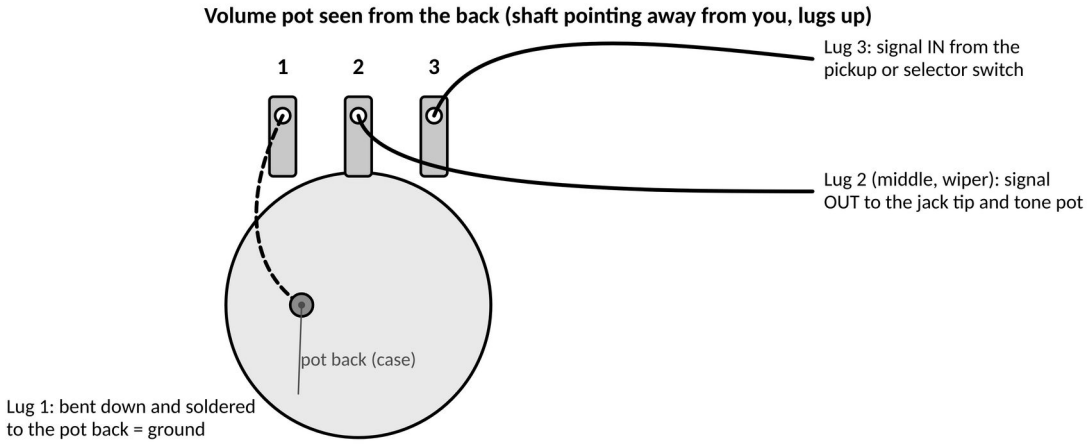
- **Bushing size matters.** U.S.-made pots, such as CTS, use a 3/8-inch threaded bushing. Many import guitars use smaller metric pots. Allparts warns that its U.S.-size pots don't fit import guitars built for metric parts. If the new pot doesn't fit the hole, don't drill it out without thinking it through.
- **Jacks:** most electric guitars use a simple mono jack with two lugs. Stereo and switching jacks have three or more lugs and are used for active electronics. Match what you have.
- **Switches:** match the type and the number of positions (for example, a 3-way toggle or a 5-way blade). Even switches that look alike can be wired differently inside, so compare the lugs.

Before you desolder anything

1. Unplug the guitar, and take the battery out if it has active electronics.
2. Take clear photos of the wiring from two or three angles.
3. Label every wire with a strip of tape and a short note: "from neck pickup," "to jack tip," "ground."
4. Loosen the strings if you need to lift the pickguard.

Replacing a volume pot

On most guitars, the volume pot has three lugs and a metal case. Seen from the back with the lugs pointing up, one outer lug takes the signal in from the pickup or selector switch, the middle lug (called the wiper) sends the signal out toward the jack, and the other outer lug is grounded, usually by bending it down and soldering it to the back of the pot case. Ground wires from the pickups and the bridge also land on the pot back.



Check your own diagram: some wiring uses the lugs differently (for example 50s-style).

Figure 19-1. The usual volume pot connections, seen from the back with the lugs up.

That layout is common, but it isn't universal. Some wiring styles move the tone capacitor or use the lugs differently. Copy what came out of your guitar, one wire at a time.

1. Desolder the wires from the old pot, one at a time, and keep each one's label on it.
2. Remove the knob and the nut on the front, and lift the old pot out.
3. Fit the new pot in the same hole and orientation, with the washer and nut. Snug the nut, but don't crank it.

4. Move each labeled wire to the same lug on the new pot.
5. Solder the ground connections to the pot back last. The case is a big piece of metal and takes more heat, so give it a moment, then let the solder flow and remove the iron.

Check your work with a meter

A multimeter takes the guessing out. Set it to resistance (ohms).

- With the knob turned all the way up, the input lug and the middle lug should read nearly zero ohms. If they don't, the input wire is on the wrong outer lug.
- The grounded lug and the pot back should read nearly zero ohms.
- From the jack tip to the jack sleeve, with the volume up, you should read roughly the resistance of the pickup (a few thousand ohms). Near zero means a short. No reading at all means an open connection.

Replacing an output jack

A mono jack has two lugs. The **tip** lug sits on the long spring arm that presses against the tip of the plug. It takes the hot signal wire from the volume pot. The **sleeve** lug is part of the frame and takes the ground wire.

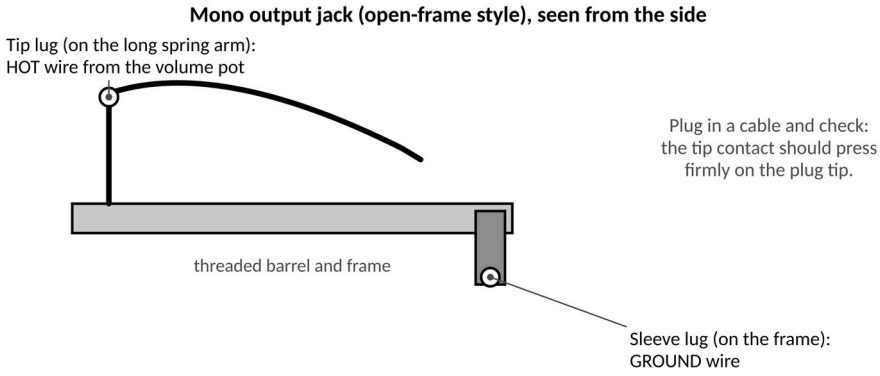


Figure 19-2. A mono output jack: hot to the tip lug, ground to the sleeve lug.

1. Note which wire goes where, and photograph it.
2. Desolder both wires and remove the old jack.
3. Solder the hot wire to the tip lug and the ground wire to the sleeve lug of the new jack.
4. Before you close it up, plug in a cable and make sure the tip contact presses firmly on the plug.
5. Mount the jack and tighten its nut while holding the jack still, so the wires don't twist (Chapter 8).

Replacing a selector switch

Switches are where the photos and labels earn their keep. A 5-way blade switch can have eight or more lugs.

1. Photograph the old switch from both sides.
2. Set the new switch beside the old one, in the same orientation.

3. Move one wire at a time from the old switch to the same lug on the new one. Don't pull them all off at once.
4. Check every pickup position through an amp at low volume before you button everything up.

Stop and see a tech if: the guitar has active electronics or a preamp you don't understand, the wiring doesn't match any diagram you can find, a pickup lead breaks off at the pickup itself, or you smell burning or see melted plastic.

Quick checklist

- Unplug, photograph and label before you desolder anything.
- Match the old part: value, taper, shaft, bushing size and lug layout.
- Use a temperature-controlled iron, good airflow, and wash your hands after leaded solder.
- Make a mechanical connection, tin both parts, and keep the heat short.
- Check with a meter before you close the cavity.

Chapter 20: Shielding a Control Cavity

Single-coil pickups and long runs of wire inside a guitar act a little like an antenna. They pick up hum and buzz from lights, dimmers, computer screens and other electrical gear. Shielding lines the control and pickup cavities with a conductive layer that's connected to ground, which helps keep that noise out. It won't cure every kind of hum (the 60-cycle hum a single coil picks up from its own magnetic field is a different problem), but it often makes a noisy guitar quieter, especially near screens and lights.

Skill level: beginner to intermediate. It's mostly careful cutting and sticking, plus one or two solder joints.

Single-coil guitars often come to my bench because the owner cannot stand the hum. Inside, the control cavity often has no continuous ground path. Lining the cavity with copper shielding tape tied to ground is one fix among several, depending on what the real problem is.

> **What you'll need:** Self-adhesive copper foil tape or conductive shielding paint, a sharp craft knife and scissors, a burnishing tool (the back of a spoon works), a soldering iron and solder, a short length of wire, a multimeter, masking tape, and photos of the wiring before you start. For paint, a small brush and naphtha on a rag for cleanup.

Before you start

Photograph and label the wiring (Chapter 19). Most of the time you'll need to lift the electronics out of the cavity, so give yourself slack in the wires or take the pots out of the pickguard or control plate. Clean the cavity of dust and loose wood chips.

Copper tape or paint?

StewMac sells both and shows both methods.

- **Copper foil tape** goes on cleanly and conducts well, and you can see that you have full coverage. It takes some patience to fit into corners. Overlap each piece onto the last. If the adhesive on your tape isn't conductive, solder across the seams so every piece is connected.
- **Conductive shielding paint** is easier in deep, odd-shaped cavities. In StewMac's Squier upgrade video, the advice is not to skimp: plan on three or four coats, and each coat takes about 12 hours to dry. Stir it well, and wipe any overspray off the finish with naphtha on a clean cloth.

Step by step

1. Lift out the electronics and set them aside on a towel.
2. Line the floor and walls of the control cavity with tape or paint, all the way up to the top edge. Do the same in the pickup cavities if you're shielding those too.
3. If the guitar has a pickguard or control plate, put shielding foil on the back of it so it covers the cavity when it's screwed down. StewMac connects the pickguard shielding to the body shielding with a wood screw and a wire.

4. Connect the shield to ground. StewMac's grounding article puts it plainly: shielding only works when it's in contact with ground. The simplest way is a short wire from the shield (soldered to the foil, or held by a solder lug screwed into the cavity wall) to the back of a pot, where the other grounds meet. Pot cases that sit against the foil also make contact.
5. Keep the shielding away from any hot connection. A pot lug, the jack tip or a switch lug that touches the foil shorts the signal to ground, and the guitar goes silent. Trim the foil back from the jack hole and any spot where lugs come close, or put a bit of electrical tape over the foil there.
6. Reinstall the electronics, checking your photos.

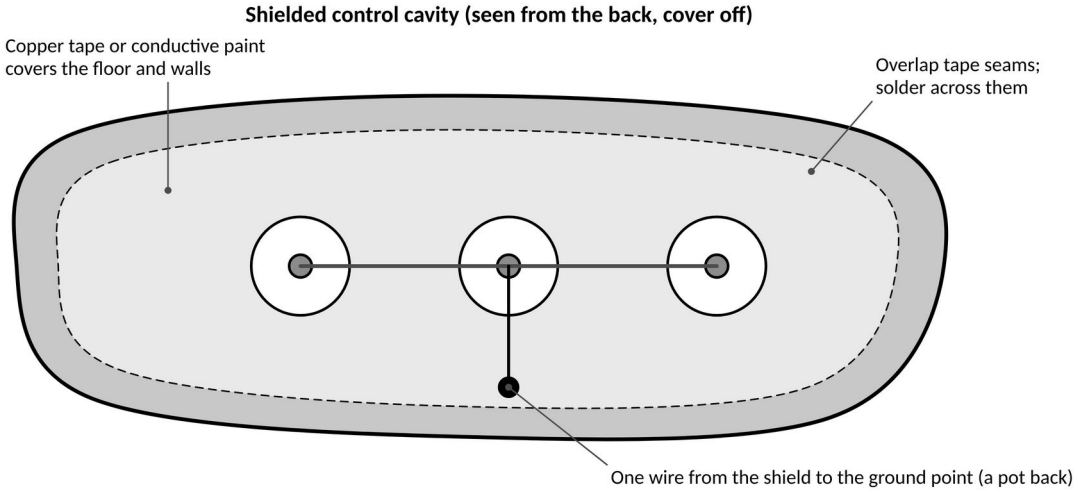


Figure 20-1. A shielded control cavity with one ground wire to the back of a pot.

Test it

Set a multimeter to continuity or the lowest ohms range. Touch one probe to the shielding and the other to the sleeve of the output jack (or the back of a pot). StewMac's video checks the cavity the same way. You want a reading near zero ohms. Check each separate piece of shielding, including the back of the pickguard and each pickup cavity.

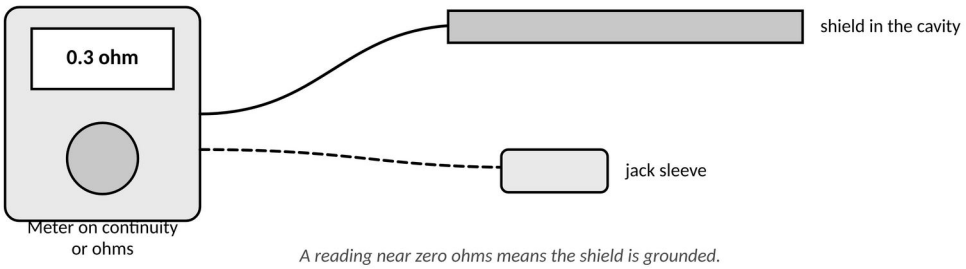


Figure 20-2. Checking that the shield is connected to ground.

Then plug in and play near your usual noise sources. It should be quieter. If it's silent, a hot lug is touching the shield. If it's louder or the hum changes oddly, a ground connection may be loose.

Caution: Shielding can change the sound of single-coil pickups a little, as StewMac's video notes. If you love the way your guitar sounds and the noise doesn't bother you, there's no need to shield it.

Stop and see a tech if: the guitar has active electronics, the cavity is shared with a battery compartment you can't work around, or the guitar goes silent and you can't find the short.

Quick checklist

- Photograph and label the wiring before you lift anything out.
- Cover the cavity floor and walls; overlap foil seams and connect every piece.
- Shield the back of the pickguard or control plate too.
- Connect the shield to ground with one wire to a pot back.
- Keep foil away from hot lugs and the jack tip.
- Check every piece with a meter for near-zero ohms to ground.

Chapter 21: Checking Neck Alignment and Scale Length

These last two checks come from my own shop procedures. Neither one needs special tools, and both answer questions people bring to the bench all the time: "Why does my high E keep slipping off the edge of the neck?" and "What scale length is my guitar, so I can buy the right neck or bridge?"

Skill level: beginner for both checks. Moving a bolt-on neck is a careful intermediate job, and resetting a glued neck is a tech job.

> **What you'll need:** A steel rule at least 18 inches long, marked in 1/64 inch or 0.5 mm; a 6-inch steel rule; a pencil and notepad; a good light. Digital calipers are handy but optional.

Part one: neck alignment

What it is

The neck should point straight down the centerline of the body so the strings run evenly over the fretboard. If the neck is turned a little to one side, one outer string sits close to the edge of the fretboard. The high E slips off when you play near the edge, or the low E runs off when you bend or pull it.

How to check it

The check that matters most is the distance from each outer E string to the edge of the fretboard.

1. Tune to pitch with the guitar in playing position.
2. At the 1st fret, measure from the low E string to the bass edge of the fretboard, and from the high E string to the treble edge. Write both down.
3. Do the same at the last fret.
4. Compare. The bass-side and treble-side gaps should match at each fret, within about 0.5 mm (0.02 inch).

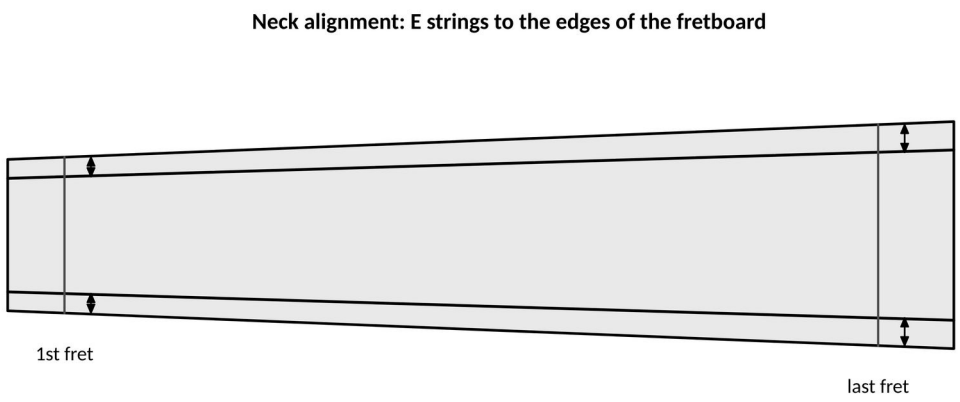


Figure 21-1. Neck alignment: measure from each outer string to the edge of the fretboard at the 1st and last frets.

A small difference at the 1st fret and a bigger one at the last fret means the neck is turned in the pocket. The same difference at both frets usually means the nut slots or the bridge saddles are off center, not the neck.

Nudging a bolt-on neck

On a bolt-on neck there's usually a little play in the neck pocket. You can use it to straighten a neck that's slightly off.

1. Slacken the strings well.
2. Back each neck screw out about a quarter turn. Don't remove them.
3. Push the neck toward the side that needs it and hold it there.
4. Snug the screws back in a crisscross pattern. Snug, not cranked; over-tightening strips the screw holes in the neck and can crack the finish around the neck plate.
5. Tune up and measure again.

This only works within the play the pocket allows. A bigger correction means shimming the walls of the pocket, and moving the bridge is the last resort. Those are bench jobs for an experienced builder or a tech.

> **Stop and see a tech if:** the guitar has a glued (set) neck or a neck-through design, the neck is far off, or the pocket is loose enough that the neck shifts on its own. A set neck that's out of line needs a neck reset, which is a major repair.

Part two: measuring scale length

What it is

Scale length is the vibrating length of an open string as the frets were laid out. In theory it runs from the nut to the saddle. In practice the saddles always sit a little farther back from the nut than the true scale length, and each one sits in a different spot. That's compensation, and it's what lets the guitar play in tune (Chapter 12). So you never measure scale length to the saddles.

The reliable method: nut to 12th fret, times two

The 12th fret sits at exactly half the scale length, and that layout is fixed in the neck. So:

1. Lay the guitar flat on a padded bench with the neck supported. You can leave the strings on and slide the rule along one string so it rests on the fret tops.
2. Line up the end of the rule (or a clean whole-inch mark if the end is worn) with the edge of the nut where the strings leave it on the fretboard side. On a guitar with a zero fret, start at the center of the zero fret instead.
3. Read the rule at the top center of the 12th fret crown. That's where the string touches when you fret it.
4. Look straight down at the mark, not at an angle. Repeat along the high E side.
5. Multiply the reading by 2. For example, 12.75 inches times 2 is 25.5 inches.

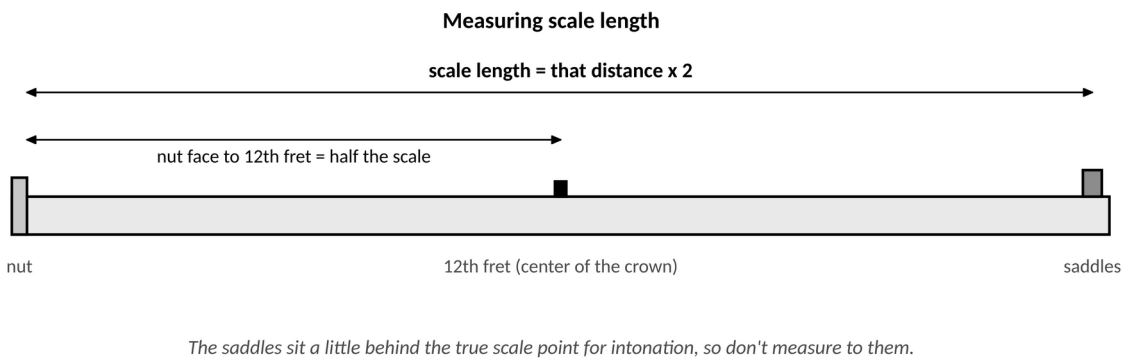


Figure 21-2. Scale length is twice the distance from the nut to the center of the 12th fret.

MusicNomad's scale ruler instructions and Sound Pure's guide use the same nut-to-12th-fret method.

A cross-check when the nut edge is hard to find

If the nut is worn, chipped or compensated (built with a shelf that moves the string's starting point), skip the nut. Measure from the center of the 1st fret crown to the center of the 12th fret crown, then divide by 0.4439. That works because on any equal-tempered fretboard the 1st fret sits about 5.61% of the scale from the nut and the 12th sits at 50%, so the distance between them is about 44.39% of the scale. For example, 11.32 inches divided by 0.4439 is 25.50 inches.

Common scale lengths

Scale length	Where you usually see it
25.5" (647.7 mm)	Fender Stratocaster and Telecaster, and many similar guitars
25" (635 mm)	PRS standard models
24.75" (628.65 mm) listed	Gibson Les Paul, SG and ES-335
24" (609.6 mm)	Fender Mustang, Jaguar, Duo-Sonic and other short-scale guitars
34" (863.6 mm)	Standard long-scale electric bass, for comparison

Some Gibson-style guitars measure a little under the listed 24.75 inches. Trust your own measurement over the spec sheet when you're buying a replacement neck or bridge. Expect to land within about 1/32 inch of a standard value. A small difference is usually reading error, not an odd scale.

Mistakes to avoid

- Measuring to the saddles.
- Starting at the back or middle of the nut instead of the fretboard-side edge.
- Reading to the edge of the 12th fret instead of the center of the crown.
- Using a tape measure with a loose hook. A steel rule is more accurate.

Quick checklist

- Check neck alignment from each outer E string to the fretboard edge at the 1st and last frets.
- Gaps should match within about 0.5 mm (0.02 inch).
- Nudge a bolt-on neck only within the pocket's play; leave set necks to a tech.
- Scale length is nut to the center of the 12th fret, times two.
- Never measure scale length to the saddles.

Glossary

14 CFR Part 251. The U.S. Department of Transportation rule that sets how U.S. airlines must handle musical instruments as carry-on and checked baggage.

80/20 bronze. An acoustic string wrap alloy of about 80% copper and 20% zinc, known for a bright tone.

Action. How high the strings sit above the frets.

Archtop. A guitar with an arched, carved or pressed top, often with a bridge held in place only by string pressure.

Back bow. A neck that curves backward, away from the strings, which usually causes buzz.

Backfile. To file a nut slot so it slopes down toward the headstock, leaving the front edge as the contact point.

Ball end. The small brass ring at the end of a steel string that anchors it at the bridge or tailpiece.

Beveling file. A file held at a fixed angle against the edge of the fretboard to cut an even bevel on every fret end.

Bigsby. A vibrato tailpiece where the strings hook over pins on a rolling bar.

Binding. A plastic or wood strip along the edge of the fretboard or body.

Boiled linseed oil. A drying oil some makers use on bare wood; its rags can catch fire on their own.

Brace. A strip of wood glued inside an acoustic guitar's top or back to strengthen it and shape its sound.

Bridge pin. A small tapered peg that holds a string's ball end in the bridge of an acoustic guitar.

Bridge pin puller. A tool that lifts bridge pins out of an acoustic bridge without prying on the wood.

Bridge plate. A hardwood plate glued under an acoustic top, beneath the bridge, that the string ball ends press against.

Buckle rash. Scratches on the back of a guitar from belt buckles, zippers, and buttons.

Coated string. A string with a thin polymer layer that keeps sweat and dirt out and makes the tone last longer.

Compensation. Setting each saddle slightly behind the true scale length so fretted notes play in tune.

Contact cleaner. A liquid or spray made for cleaning electrical contacts in pots, switches and jacks. Use as little as you can.

Continuity. An unbroken electrical path between two points, shown on a meter as a reading near zero ohms.

Crown. The rounded top of a fret that the string touches.

Detune. To loosen the strings below pitch to reduce tension on the guitar, usually for storage or travel.

Divot. A small dent worn into a fret by string pressure.

Double-locking tremolo. A tremolo, such as a Floyd Rose, that clamps each string at the bridge saddle and at a locking nut.

Feeler gauge. A thin metal blade of known thickness used to measure very small gaps.

Ferrule. A small metal cup that lines each string hole in the back of a string-through body.

Fine tuner. A small knob on a locking tremolo that makes small pitch adjustments after the nut is clamped.

Finish checking. Fine cracks in a guitar's finish, usually from fast temperature or humidity changes, most common in nitrocellulose lacquer.

Fisheye. A small crater that forms in new finish when it is sprayed over silicone residue.

Flatwound. A string wrapped with a flat ribbon of wire, giving a smooth surface and a warm, mellow tone.

Floating bridge. A tremolo bridge set so its back edge sits off the body, balanced between string and spring tension.

Fret. A metal bar set across the fretboard that the string is pressed against to make a note.

Fret buzz. The rattle or sizzle made when a vibrating string touches a fret it shouldn't.

Fret end dressing file. A small file with safe, smooth edges used to round and smooth the ends of the frets.

Fret guard. A thin shield that covers the fretboard wood so a fret can be polished without scratching or staining the board.

Fret leveling. Filing all the frets to the same height so none is higher or lower than its neighbors.

Fret rocker. A short straightedge that spans three frets and rocks when the middle one is high.

Fret sprout. Fret ends that stick out past the edge of a fretboard that has shrunk from dryness.

Fretboard (fingerboard). The strip of wood on the front of the neck that holds the frets.

Fretboard conditioner. An oil made to keep a bare fretboard from drying out.

Fretboard radius. The side-to-side curve of the fretboard surface, given as the radius of a circle (for example, 9.5 inches). Also just called radius.

Gauge. The thickness of a string, measured in thousandths of an inch (.010 = ten thousandths).

Gig bag. A soft, padded guitar bag that is light to carry but gives less protection than a hardshell case.

Ground. The common return path in a guitar's wiring, connected to the jack sleeve, pot backs, bridge and shielding.

Hardshell case. A rigid guitar case that protects against impact and slows changes in humidity and temperature.

Hardtail. A fixed electric guitar bridge with no tremolo.

High fret. A fret that sits higher than its neighbors, so the string hits it when playing the fret below.

Hygrometer. A small gauge that measures the relative humidity (moisture) in the air around a guitar.

Intonation. Whether a guitar plays in tune as you move up the neck, set by the saddle's distance from the frets.

Laminate. Wood made of thin layers glued together, which moves less with humidity than a single solid piece.

Lemon oil (guitar). A fretboard product, usually mostly mineral oil with lemon scent, sold for dark unfinished boards.

Lifted fret. A fret that has risen partly out of its slot, often leaving a visible gap under the crown at the end.

Locking tuner. A tuner that clamps the string inside the post so it needs almost no wraps.

Locking wrap. A way of winding a string so it pinches its own loose end against the post, which keeps it from slipping.

Luthier. A person who builds and repairs stringed instruments.

Micro-mesh. Cushioned abrasive pads in very fine grits, used to polish frets.

Neck heel. The part of the neck where it joins the body.

Neck pocket. The routed slot in the body that a bolt-on neck fits into.

Neck reset. A major repair that removes and refits the neck to restore the correct angle.

Nitrocellulose lacquer. A thin, classic guitar finish that dries by evaporation, ages with checking and yellowing, and can react with rubber and vinyl.

Nut. The slotted strip at the top of the fretboard that sets string spacing and height at the first fret.

Nut file. A thin, gauged file sized to cut a nut slot for a particular string width.

Nut slot. The groove in the nut that holds a string and sets its height over the first fret.

Open-gear tuner. A tuner with its gears exposed rather than sealed in a housing; it needs occasional light lubrication.

Open-pore wood. Wood like rosewood with tiny pores in the grain that trap dirt and oil.

Output jack. The socket where you plug the cable into the guitar.

Oxidation. The dull tarnish that forms on metal frets from air, sweat, and skin oil.

Patina. The yellowing, fine cracks, and wear an old finish gets with age, often valued by collectors.

Pau ferro. A dense South American wood used as a rosewood substitute for fretboards.

Phosphor bronze. Copper-tin bronze with a small amount of phosphorus added, used on acoustic strings for a warm tone and better corrosion resistance.

Pickguard. A thin plastic or wood plate that protects the top from pick scratches.

Pickup height. The distance between a pickup's pole pieces and the bottom of the strings.

Pinless bridge. An acoustic bridge where the strings feed through the back and anchor without bridge pins.

Plain string. A string that is a single solid steel wire with no wrap, usually the high E and B, plus the G on most electric sets.

Plasticizer. A chemical in soft vinyl that can leach out or evaporate and damage nitrocellulose lacquer finishes.

Polyester (UV-cured). A hard modern finish that is cured with ultraviolet light, used by Taylor and others.

Polyurethane. A hard, durable modern finish that cures into a tough coat and does not check or yellow like nitro.

Potentiometer (pot). The variable resistor behind a volume or tone knob; dirt on its internal track causes scratchy noise.

Preamp. A small circuit in an acoustic-electric guitar that boosts and shapes the pickup's signal, usually powered by a battery.

Recrown. To round the top of a fret again after it has been leveled flat.

Refret. Replacing worn frets with new fret wire.

Relative humidity (RH). How much moisture the air holds compared with the most it could hold at that temperature, given as a percentage.

Relief. The slight forward bow in a guitar neck under string tension, which gives the strings room to vibrate.

Roasted maple. Maple heated in a controlled way to darken it and make it more stable with humidity changes.

Roller. The plastic or bone cylinder in a classical guitar's slotted headstock that the string winds around.

Saddle. The part of the bridge the strings rest on, which sets string height and intonation at the body end.

Satin finish. A low-sheen, flat-looking finish that should be cleaned but not polished to a shine.

Scale length. The vibrating length of an open string as the frets were laid out, found by doubling the nut-to-12th-fret distance.

Setup. The way a guitar is adjusted to play, including string height, neck bow, nut height, intonation and pickup height.

Shielding. A conductive lining in a guitar's cavities, connected to ground, that helps keep electrical noise out of the signal.

Silicone. An ingredient in many household polishes that leaves a film and can make later finish repairs harder.

Stopbar. A separate bar-shaped tailpiece behind a Tune-o-matic bridge that anchors the string ball ends.

Straightedge. A precision-flat bar laid along the frets or fretboard to check neck bow and fret level.

String tree. A small guide on the headstock that holds certain strings down to keep enough angle over the nut.

String winder. A small crank that fits over a tuner button to wind strings on quickly.

Tang. The thin, barbed part of a fret that is pressed into a slot in the fretboard.

Taper. How a pot's resistance changes as you turn it. Audio taper changes gradually at first; linear changes evenly.

Temperature shock. Damage such as finish cracks caused by moving a guitar quickly between very different temperatures.

Tinning. Melting a thin coat of solder onto a wire or lug before joining them.

Tip and sleeve. The two contacts of a mono plug and jack. The tip carries the signal; the sleeve is ground.

Tremolo. A pivoting bridge, balanced by springs, that lets you raise or lower the pitch of all the strings with a bar.

Truss rod. A metal rod inside the neck that can be tightened or loosened to control how much the neck bows under string tension.

Tune-o-matic. An adjustable bridge with individual saddles that sits on two posts, usually paired with a stopbar tailpiece.

Tuner. A geared peg on the headstock that tightens or loosens a string to change its pitch; also called a tuning machine.

Tuner post. The metal shaft on a tuner that the string wraps around.

Two-way humidity pack. A sealed pouch that adds moisture to a dry case and absorbs moisture from a damp one to hold a set humidity level.

Unfinished fretboard. A fretboard of bare, sanded wood with no clear coat, which benefits from occasional oiling.

Wiper. The middle lug of a pot, connected to the contact that moves as the knob turns.

Wound string. A string with a second wire wrapped tightly around its core to add mass for the lower notes.

Zero fret. A fret placed right at the nut position on some guitars; the nut behind it only spaces the strings.

Sources and Further Reading

These are the pages I checked while writing this book. Web addresses change, so if one stops working, search the site for the title. They are listed by chapter.

Introduction

MusicNomad's library of care guides (index). https://musicnomadcare.com/guides/

MusicNomad: what a setup covers, including relief, action, nut height, intonation and pickup height. https://musicnomadcare.com/guides/the-complete-setup-guide-for-electric-acoustic-bass-and-classical-guitars/

Martin: truss rod, saddle and nut adjustments and all repairs belong with an Authorized Service Center. https://www.martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/dwd14d239e/pdf/2022-care-and-feeding-guide.pdf

Taylor: symptoms of a dry guitar, including sharp fret ends, action changes and cracks. https://www.taylorguitars.com/support/maintenance/symptoms-dry-guitar

StewMac: using correct-size screwdrivers to avoid stripped hardware. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-repair-tools-and-repair-techniques/do-your-own-setups-8-tools-you-need/

Chapter 1: Know Your Guitar

MusicNomad: how to tell finished, unfinished and painted fretboards, and which woods are usually unfinished. https://musicnomadcare.com/guides/fretboard-cleaning-and-care-guide/

MusicNomad: telling gloss from satin, common lacquer types, and why satin gets no polish or wax. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

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Fender: acoustic guitar parts, including the top, soundhole, rosette, bridge and heel. https://www.fender.com/articles/instruments/the-acoustic-vocabulary-you-need-to-know

Gibson: nitro is thinner than poly finishes and develops patina, checking and yellowing with age. https://www.gibson.com/blogs/gibson-gazette/video-how-to-clean-and-polish-your-guitar

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Frank Ford (FRETS.com): why nitro finishes are most at risk from vinyl, bug spray and colognes. https://mail.frets.com/FretsPages/Musician/GenMaint/Vinyl/vinyl.html

Taylor: its UV-cured polyester finish since 1995, and no wax or thick polish on satin. https://www.taylorguitars.com/support/maintenance/properly-cleaning-your-guitar

Taylor: top woods and back and side woods, and which models use solid or layered wood. https://www.taylorguitars.com/tonewoods

Martin: guitar part names, plus never polish satin and never put steel strings on a classical. https://www.martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/dwd14d239e/pdf/2022-care-and-feeding-guide.pdf

Chapter 2: Tools and Supplies

MusicNomad: tools and products for cleaning an acoustic, with tips to avoid silicone and spray the cloth. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

MusicNomad: Guitar Detailer for finished boards, F-ONE for unfinished boards, and no furniture polish. https://musicnomadcare.com/guides/fretboard-cleaning-and-care-guide/

MusicNomad: a list of setup tools and a truss rod wrench finder covering over 75 brands. https://musicnomadcare.com/guides/the-complete-setup-guide-for-electric-acoustic-bass-and-classical-guitars/

MusicNomad: the Hone hygrometer and Humitar soundhole and case humidifiers. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-humidity/

MusicNomad: string changing tools, including GRIP Winder, GRIP Cutter, GRIP Puller, GRIP Guards and the Cradle Cube. https://musicnomadcare.com/product-category/string-changing-tools/

MusicNomad: guitar setup tools, including truss rod wrenches in several sizes, gauges and screwdrivers. https://musicnomadcare.com/product-category/guitar-setup-tools/

MusicNomad: fret care tools, including Fret Shield, a straightedge, fret files and leveling tools. https://musicnomadcare.com/product-category/guitar-fret-care/

MusicNomad: its surface care line, from Guitar Detailer and Guitar ONE to JackPot, FRINE and cloths. https://musicnomadcare.com/product-category/guitar-surface-care/

MusicNomad: Guitar ONE is safe on hard nitro and poly gloss but not on matte or soft nitro. https://musicnomadcare.com/shop/guitar-surface-care/the-guitar-one-4-oz/

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Taylor: polish, fretboard oil and 0000 steel wool for cleaning gloss and satin guitars. https://www.taylorguitars.com/support/maintenance/properly-cleaning-your-guitar

Taylor: care essentials, including a microfiber cloth, clip-on tuner, string winder, hygrometer and humidifier. https://woodandsteel.taylorguitars.com/guitar-guide/the-2025-guitar-guide/5-guitar-care-essentials/

Taylor: a digital hygrometer is more reliable than an analog one. https://www.taylorguitars.com/sites/default/files/10_UsingaGuitarHumidifier.pdf

Taylor: its digital hygrometer. https://www.taylorguitars.com/taylorware/guitar-care/hygrometer

D'Addario: humidification products, including its humidity and temperature sensor. https://www.daddario.com/products/accessories/humidification/

Gibson: clip-on tuners and rubber stand parts can damage nitro finishes. https://www.gibson.com/en-GB/Support/FAQ/kvYw7pZrOo4tINxQhP3vr

Yamaha: clean strings before and after playing, and use the wrench supplied with the guitar. https://hub.yamaha.com/guitars/g-how-to/essential-guitar-maintenance/

Martin: avoid silicone, polish gloss only with a soft cloth, and leave truss rods to a service center. https://www.martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/dwd14d239e/pdf/2022-care-and-feeding-guide.pdf

Chapter 3: Everyday Care and Storage

Martin: wash hands, wipe the guitar and strings after playing, and store it in its case. https://www.martinguitar.com/blog-categories/tips-tutorials/blog-011823-guitar-care-tips.html

Martin: storage at 45-55% RH and 72-77°F, safe cases, long-term storage, and straps that damage finish. https://www.martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/dwd14d239e/pdf/2022-care-and-feeding-guide.pdf

Gibson: stand rubber can react with nitro, so cover it with cloth, and a case is safest. https://www.gibson.com/en-GB/Support/FAQ/kvYw7pZrOo4tINxQhP3vr

Frank Ford (FRETS.com): how vinyl in straps, stands and gig bags damages nitro finishes. https://mail.frets.com/FretsPages/Musician/GenMaint/Vinyl/vinyl.html

Frank Ford (FRETS.com): heat damage to a 1973 Martin D-35, likely from a hot car. https://mail.frets.com/FretsPages/Musician/GenMaint/Heat/73D35Heat/73d35heat.html

MusicNomad: storing at 40-55% RH and 70-78°F, cases versus gig bags, where to keep guitars, and the 24-hour rule. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-humidity/

MusicNomad: wipe down after playing, and spray the cloth, not the guitar. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

Taylor: store a guitar in its case at 45-55% RH. https://www.taylorguitars.com/support/maintenance/symptoms-dry-guitar

Taylor: fall care tips, including storing in the case and measuring humidity where the guitar is kept. https://blog.taylorguitars.com/6-guitar-care-tips-for-fall

Taylor: never leave a guitar in a hot car, and park in the shade if there is no choice. https://blog.taylorguitars.com/5-tips-for-traveling-with-your-taylor

Yamaha: storing at 45-55% RH, away from sun and air conditioning, and loosening strings for long storage. https://www.yamaha.com/en/musical_instrument_guide/acoustic_guitar/maintenance/maintenance002.html

Yamaha: 40-50% RH and 66-77°F, how sun and heat harm a guitar, and safe use of stands. https://hub.yamaha.com/guitars/g-how-to/essential-guitar-maintenance/

Fender: nitro finishes check after sudden exposure to cold. https://www.fender.com/articles/behind-the-scenes/the-science-and-style-of-finishes

Chapter 4: Cleaning the Body and Finish

MusicNomad: cleaning an acoustic, including cleaning order, how much polish and wax to use, and how often. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

MusicNomad: Guitar Detailer is a cleaner with no polish or wax, safe on gloss, satin and matte. https://www.musicnomadcare.com/FAQS/Guitar-Detailer-FAQs/

Taylor: cleaning its gloss and satin finishes, with no wax or thick polish on satin or raw wood. https://www.taylorguitars.com/support/maintenance/properly-cleaning-your-guitar

Premier Guitar (LeVan): safe ways to clean nitro and modern finishes, and products to avoid. https://www.premierguitar.com/pro-advice/guitar-shop-101-safe-ways-to-clean-your-guitars-finish

MusicNomad: Guitar ONE on nitro, how much polish to apply, and using F-ONE sparingly on bare necks. https://www.musicnomadcare.com/FAQS/MN108-FAQs/

Martin: wipe with a dry cloth first, polish sparingly, and don't over-rub satin. https://www.martinguitar.com/blog-032322-guitar-care-tips.html

Martin: wipe after playing with a soft flannel cloth, and avoid harsh polishes. https://www.martinguitar.com/blog-categories/tips-tutorials/blog-011823-guitar-care-tips.html

Taylor: damp then dry cloth for light cleaning, no polish on non-gloss, and never furniture polish. https://blog.taylorguitars.com/faq-how-should-i-clean-or-polish-my-guitar

Gibson (Jim DeCola): dust before polishing, and handle gloss, satin and nitro patina differently. https://gazette.gibson.com/?p=2374

MusicNomad: never use furniture polish on a guitar. https://musicnomadcare.com/guides/fretboard-cleaning-and-care-guide/

Chapter 5: Fretboard Care

MusicNomad: cleaning and conditioning fretboards, signs of a dry board, and why to avoid lemon oil and furniture polish. https://musicnomadcare.com/guides/fretboard-cleaning-and-care-guide/

MusicNomad: letting oil soak to loosen grime, scraping along the string path, and conditioning a bare bridge. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

MusicNomad: how often to use F-ONE, how little you need, and which boards it is not for. https://www.musicnomadcare.com/FAQS/MN144-FAQs

MusicNomad: F-ONE won't penetrate sealed wood, and matte finishes often have a hidden seal. https://www.musicnomadcare.com/FAQS/MN108-FAQs/

Taylor: conditioning ebony boards and bridges with boiled linseed oil, and using 0000 steel wool. https://www.taylorguitars.com/support/maintenance/properly-cleaning-your-guitar

Taylor: its fretboard conditioner, used with strings off, typically two or three times a year. https://www.taylorguitars.com/taylorware/guitar-care/taylor-fretboard-conditioner-2-oz

Taylor: it uses 0000 steel wool along the fretboard and never furniture polish. https://blog.taylorguitars.com/faq-how-should-i-clean-or-polish-my-guitar

Martin: clean the fingerboard at string changes and condition it and the bridge once or twice a year. https://www.martinguitar.com/blog-categories/tips-tutorials/blog-011823-guitar-care-tips.html

Sadowsky: oil a fretboard once or twice a year at most, avoid lemon oil, and use steel wool carefully. https://sadowsky.com/?p=928

D'Addario: Hydrate and lemon oil are for dark unfinished woods only, not maple. https://www.daddario.com/en-eu/collections/guitar-cleaners-polishes-cloths/products/hydrate-fingerboard-conditioner

Thomann: Dunlop Lemon Oil, a fingerboard cleaner and conditioner not suitable for maple fingerboards. https://www.thomann.co.uk/dunlop_lemon_oil.htm

Fender: Magic Fretboard Oil, a lemon-oil-free plant oil for rosewood, ebony and pau ferro. https://au.fender.com/products/magic-fretboard-oil

StewMac: condition rosewood and ebony sparingly, skip oil on finished maple, and know alcohol can dry boards. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-guitar-and-instrument-fretting-and-fretwork/polish-frets-like-a-pro/

Chapter 6: Fret Care

MusicNomad: FRINE fret polish removes oxidation and dirt and is safe on all metal fret wire. https://musicnomadcare.com/shop/guitar-surface-care/frine-fret-polish/

StewMac: polishing frets step by step, including masking, abrasive grits and how often to touch up. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-guitar-and-instrument-fretting-and-fretwork/polish-frets-like-a-pro/

Sadowsky: using 0000 steel wool with a vacuum, or a Scotch-Brite pad as a gentler alternative. https://sadowsky.com/?p=928

StewMac: fret erasers, abrasive rubber blocks in seven grits used in sequence. https://www.stewmac.com/luthier-tools-and-supplies/tools-by-job/tools-for-fretting/polishing-and-abrasives/fret-erasers

StewMac: fixing sharp fret ends, including rehumidifying first and filing the ends at the right bevel. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-guitar-and-instrument-fretting-and-fretwork/fix-sharp-fret-ends-like-a-pro/

MusicNomad: fret sprout signs and causes, how to file it, when to see a tech, and prevention. https://musicnomadcare.com/guides/the-complete-guide-to-fixing-guitar-and-bass-fret-sprout/

Premier Guitar (LeVan): fret wear, when to level and recrown versus refret, and why leveling can't be undone. https://www.premierguitar.com/articles/21914-guitar-shop-101-squeezing-more-life-out-of-worn-frets

Fender: re-fretting is a job for a luthier or guitar tech, and humidity swings cause fret buzz. https://www.fender.com/articles/maintenance/no-broken-necks-guitar-care-dos-donts

MusicNomad: protect the board with GRIP Guards or Fret Shield, and polish frets with FRINE at string changes. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

Taylor: 0000 steel wool along the board removes grime and oxidation from frets, after masking the soundhole. https://www.taylorguitars.com/support/maintenance/properly-cleaning-your-guitar

Martin: optional minimally abrasive steel wool along the fingerboard and fret wire. https://www.martinguitar.com/blog-categories/tips-tutorials/blog-011823-guitar-care-tips.html

StewMac: thin stainless steel fingerboard guards that protect the board while filing or polishing frets. https://www.stewmac.com/luthier-tools-and-supplies/tools-by-job/tools-for-necks-and-fingerboards/stewmac-fingerboard-guards/

MusicNomad: GRIP fretboard guards in three fret sizes, and FRINE for polishing frets with strings off. https://www.musicnomadcare.com/FAQS/MN144-FAQs

Chapter 7: Humidity and Temperature

MusicNomad: safe humidity and temperature, signs of a dry or wet guitar, hygrometers, humidifiers and storage. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-humidity/

MusicNomad: using the Humitar soundhole humidifier, including the touch test and distilled water. https://musicnomadcare.com/shop/humidity-care/the-humitar-acoustic-guitar-soundhole-humidifier/

MusicNomad: the Case Humitar mounts in an adhesive holster inside the case. https://www.musicnomadcare.com/Products/Case-Humidifier/

MusicNomad: Humitar FAQs on replacement sponges, distilled water and fixing a hard sponge. https://www.musicnomadcare.com/FAQS/MN301-FAQs/

Taylor: using a guitar humidifier at 45-55% RH, digital hygrometers, and Humidipak layout and life. https://taylorguitars.com/support/maintenance/using-guitar-humidifier

Taylor: dry guitar symptoms, how a spruce top moves with humidity, and restoring a dry guitar slowly. https://www.taylorguitars.com/support/maintenance/symptoms-dry-guitar

Taylor: wet guitar symptoms and ways to dry a guitar out, including a dehumidifier. https://www.taylorguitars.com/support/maintenance/symptoms-wet-guitar

Taylor: let a cold guitar warm up in its case, away from heaters and fireplaces. https://www.taylorguitars.com/support/how-treat-extremely-cold-guitar

Taylor: car heat can soften glue and loosen the bridge. https://blog.taylorguitars.com/guitar-care-tips-for-summer

Martin: 45-55% RH and 72-77°F, how heat and fast temperature change cause damage, and storing in the case. https://martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/pdf/2020-care-and-feeding-guide.pdf

Martin: 45-55% RH and 72-77°F, with a room or case humidifier in colder months. https://www.martinguitar.com/faqs.html

Fender: 35-50% RH, types of humidifiers, and why humidity swings cause problems. https://www.fender.com/articles/maintenance/asked-and-answered-do-i-need-a-humidifier-for-my-acoustic-guitar

D'Addario: Humidipak holds 45-50% RH and should be replaced within three months. https://www.daddario.com/pages/humidipak-two-way-humidification

Boveda: 49% packs for wood instruments, how many to use, where to put them and when to replace them. https://bovedainc.com/wood-instruments-music/

Boveda: replace B49 packs every 3 months. https://help.bovedainc.com/length_of_boveda_in_case

Boveda: its FAQ asks whether your hygrometer is calibrated. https://help.bovedainc.com/music

Oasis: humidifier FAQ on distilled water, replacing crystals, when to restart, the two-year warranty, and when to replace the unit. https://oasishumidifiers.com/faq/

Oasis: guitars are stable around 40-45% RH at about 70°F, and which model suits which room. https://oasishumidifiers.com/humidification-of-wooden-instruments/

Yamaha: storing at 45-55% RH, away from sun and air conditioning, and loosening strings for long storage. https://www.yamaha.com/en/musical_instrument_guide/acoustic_guitar/maintenance/maintenance002.html

Yamaha: 40-50% RH and 66-77°F, how sun and heat harm a guitar, and safe use of stands. https://hub.yamaha.com/guitars/g-how-to/essential-guitar-maintenance/

Chapter 8: Hardware and Electronics

Martin: preamp batteries, and leaving pickup installation to an authorized service center. https://www.martinguitar.com/faqs.html

Martin: lubricating tuners, checking button screws, and handling bridge pins and endpins with care. https://martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/pdf/2020-care-and-feeding-guide.pdf

MusicNomad: TUNE-IT lubricant for nut, saddle, string trees and open-gear tuners, used sparingly. https://musicnomadcare.com/shop/guitar-surface-care/tune-it-string-instrument-lubricant/

Fender: setting up a Strat tremolo and lubricating its pivot, string trees, tuners and saddles. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

MusicNomad: cleaning tuners, pins, saddle, pickups and the input jack on an acoustic. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-everything-on-an-acoustic-guitar/

Taylor: Expression System 2 battery life, signs of a low battery, and removing the saddle safely. https://www.taylorguitars.com/support/electronics/taylor-expression-system-2

Taylor: what to check, in order, when a guitar makes no sound when plugged in. https://www.taylorguitars.com/support/electronics/no-sound-when-plugging

Taylor: strap lock options, and why a tech should do any drilling. https://blog.taylorguitars.com/how-to-use-strap-locks-with-your-taylor-acoustic-guitar

Fender: fixing a loose output jack without letting it twist or fall inside the guitar. https://fender.com/articles/tech-talk/fixing-a-loose-instrument-jack

Fender: cleaning crackly pots and switches with contact cleaner before replacing them. https://www.fender.com/articles/maintenance/control-crackle-cleaning-your-pots-and-switches-can-help

MusicNomad: JackPot contact cleaner goes on a brush, one or two drops per jack or pot. https://musicnomadcare.com/shop/guitar-surface-care/jackpot-music-gear-contact-cleaner/

MusicNomad: cleaning and caring for guitar pedals, including jacks, pots and knobs. https://musicnomadcare.com/guides/the-complete-guide-to-cleaning-and-care-for-guitar-pedals/

StewMac: a polishing cloth for chrome and nickel hardware. https://www.stewmac.com/luthier-tools-and-supplies/supplies/cleaners-and-lubricants/miracle-polishing-cloth/

StewMac: cleaning rusty hardware, and when parts are beyond saving. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-instrument-finishing-and-finish-repair/how-to-clean-a-guitar-that-really-needs-it/

Chapter 9: Choosing and Caring for Strings

MusicNomad: when to change strings, common gauges, and how gauge, sweat and coatings affect strings. https://musicnomadcare.com/guides/the-complete-guide-to-changing-your-guitar-strings/

MusicNomad: why strings go dead and how to clean steel, coated and nylon strings. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-and-bass-string-cleaning-and-care/

D'Addario: when to change strings, judged by look, feel and sound, and which strings last longer. https://www.daddario.com/blogs/guitar/when-to-change-guitar-strings

D'Addario: acoustic string types, from 80/20 and phosphor bronze to coated strings and gauge names. https://www.daddario.com/blogs/guitar/everything-about-acoustic-strings

D'Addario: electric string types, including nickel-plated steel, pure nickel, flatwounds and coated strings. https://www.daddario.com/collections/electric-guitar-strings

D'Addario: EJ26 Custom Light phosphor bronze strings and their VCI bag packaging. https://daddario.com/products/guitar/acoustic-guitar/phosphor-bronze/ej26-phosphor-bronze-acoustic-guitar-strings-custom-light-11-52

D'Addario: restring about every one to two months, and recycle old strings. https://www.daddario.com/blogs/guitar/how-to-restring-an-electric-guitar

Martin: acoustic string alloys, a gauge chart, tension effects and coated strings. https://www.martinguitar.com/blog-categories/from-the-factory/blog-100224-ultimate-guide-to-acoustic-guitar-strings.html

Martin: how often to change strings, safe gauge changes, and causes of string breakage. https://www.martinguitar.com/about/faq/strings-faq/care/

Ernie Ball: a buying guide to string alloys and gauges for guitar and bass. https://www.ernieball.com/blog/strings/ernie-ball-guitar-and-bass-strings-buying-guide

Ernie Ball: cobalt and other specialty string alloys. https://www.ernieball.com/blog/strings/ernie-ball-string-alloy-guide-find-your-sound

Elixir: coated strings keep tone longer and should be wiped with a dry cloth only. https://elixirstrings.com/elixir-strings-faq

Fender: factory setup specs assume stock strings, and the signs of worn strings. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

Gibson: change strings about every three months or 100 hours. https://www.gibson.com/blogs/gibson-gazette/how-to-change-electric-guitar-strings

Chapter 10: Restringing an Acoustic Guitar

MusicNomad: changing acoustic strings step by step, from pulling pins to wrapping, tuning and stretching. https://musicnomadcare.com/guides/the-complete-guide-to-changing-your-guitar-strings/

MusicNomad: the GRIP Puller, a metal-free rubber bridge pin puller. https://musicnomadcare.com/shop/string-changing-tools/grip-puller-premium-bridge-pin-puller/

MusicNomad: GRIP ONE combines a winder, cutter and bridge pin puller. https://musicnomadcare.com/shop/string-changing-tools/grip-one-all-in-one-string-winder-cutter-puller/

Taylor: changing steel strings, including slack, wrap counts and bridge pins. https://www.taylorguitars.com/support/strings/changing-steel-strings

Taylor: tying on and winding classical nylon strings, then stretching them. https://www.taylorguitars.com/support/strings/changing-nylon-strings

Martin: how the factory strings guitars, including pins, locking wraps, seating ball ends and stretching. https://www.martinguitar.com/blog-categories/from-the-factory/blog-080724-stringing-and-setup-at-the-martin-factory.html

Martin: restring one at a time to avoid tension swings. https://www.martinguitar.com/blog-categories/from-the-factory/blog-100224-ultimate-guide-to-acoustic-guitar-strings.html

Martin: leave a first big gauge change to a pro, and use string changes to clean and check. https://www.martinguitar.com/about/faq/strings-faq/care/

D'Addario: stringing an acoustic step by step, from setting up a workspace to stretching the strings. https://www.daddario.com/the-lesson-room/guitar/acoustic-guitar/care/how-to-string-an-acoustic-guitar/

D'Addario: new strings take a few hours to a day to settle. https://www.daddario.com/blogs/guitar/when-to-change-guitar-strings

Gibson: loosen strings before cutting them, and wear eye protection. https://www.gibson.com/blogs/gibson-gazette/how-to-change-electric-guitar-strings

Frank Ford (FRETS.com): seating ball ends under the bridge plate, on pinned and pinless bridges. https://mail.frets.com/FretsPages/Musician/Guitar/Setup/SteelStrings/Stringing/ststringing1.html

Frank Ford (FRETS.com): locking strings at the post, cutting ends close, and spotting misrouted strings. https://mail.frets.com/FretsPages/Musician/Guitar/Setup/SteelStrings/Stringing/ststringing2.html

Fender: how many wraps to put on standard tuners. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

D'Addario: about two wraps plus a partial, with the string wrapped under itself. https://www.daddario.com/blogs/guitar/how-to-restring-an-electric-guitar

Chapter 11: Restringing an Electric Guitar

MusicNomad: changing electric strings on different bridges and tremolos, plus wraps, trimming and locking tuners. https://musicnomadcare.com/guides/the-complete-guide-to-changing-your-guitar-strings/

MusicNomad: GRIP ONE's narrow winder head fits close electric tuner posts. https://musicnomadcare.com/shop/string-changing-tools/grip-one-all-in-one-string-winder-cutter-puller/

Gibson: changing electric guitar strings, step by step. https://www.gibson.com/blogs/gibson-gazette/how-to-change-electric-guitar-strings

Fender: stringing and setting up a Strat, including locking tuners, wraps, stretching, tremolo float and intonation. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

D'Addario: restringing an electric step by step, including slack, wraps, stretching and recycling. https://www.daddario.com/blogs/guitar/how-to-restring-an-electric-guitar

Ibanez: changing strings on a locking tremolo one at a time, with fine tuners centered. http://www.hoshinogakki.co.jp/pdf/ibanez/manual/en/eg/01_EN_FEB161022_Lopro_edge.pdf

Floyd Rose: tuning a Floyd Rose tremolo step by step, from loosening the nut clamps to fine tuning. https://www.floydrose.com/blogs/tech-talk/string-tuning-instructions

Floyd Rose: troubleshooting tips, including tight clamps and bends that flatten other strings. https://www.floydrose.com/blogs/tech-talk/troubleshooting-tips

Chapter 12: Basic Setup Checks

MusicNomad: measuring neck relief, typical figures by guitar type, and adjusting the truss rod safely. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-neck-relief/

MusicNomad: measuring and adjusting action at the 12th fret, with typical figures by guitar type. https://musicnomadcare.com/guides/the-complete-guide-to-string-action-height/

MusicNomad: measuring nut height at the first fret, signs it is wrong, and when to see a luthier. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-nut-height/

MusicNomad: checking and adjusting intonation, and why acoustic saddles can't move. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-intonation/

MusicNomad: measuring and setting pickup height, with Strat figures and cautions. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-pickup-height/

MusicNomad: seasonal setups in September and March, and the effects of too much or too little relief. https://musicnomadcare.com/guides/the-complete-setup-guide-for-electric-acoustic-bass-and-classical-guitars/

MusicNomad: a .008" relief figure for Taylor guitars, measured at the 6th fret. https://www.musicnomadcare.com/FAQS/MN610-FAQs

Fender: factory specs for relief, string height and pickup height, given as minimums. https://support.fender.com/en-us/knowledgebase/article/KA-02007

Fender: setting relief, truss rod direction, intonation and pickup heights, and when to see a service center. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

Fender: check intonation after every string change. https://support.fender.com/hc/en-us/articles/42584627801243-How-do-I-intonate-my-instrument

Fender: how often to get a setup, including seasonal changes, gauge changes and new guitars settling in. https://support.fender.com/hc/en-gb/articles/42584722527003-How-often-should-I-have-a-set-up-adjustment-done-on-my-instrument

PRS: U.S. electric string height at the 1st and 12th frets, and the order of adjustments. https://support.prsguitars.com/hc/en-us/articles/4408310362523

PRS: SE acoustic string height at the 1st and 12th frets. https://support.prsguitars.com/hc/en-us/articles/4414761417627-What-are-the-factory-specifications-for-my-PRS-SE-Acoustic-guitar-setup

PRS: setup step by step, with relief of .005" to .010" at the 8th fret and 1/8 turn adjustments. https://support.prsguitars.com/hc/en-us/articles/51636464576411-How-to-Set-Up-a-PRS-Guitar-Step-by-Step

StewMac: truss rod adjustment, usually 1/8 turn, letting it settle, and why forcing can shear the nut. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-truss-rod-installation-and-repair/dont-be-nervous-about-adjusting-that-truss-rod/

StewMac: basic setup, starting from a straight neck and fixing frets and nut before fine tuning. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-string-action-and-setup/basic-set-up-instructions/

StewMac: adjusting acoustic action at the saddle, and why raising it needs a shim or new saddle. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-string-action-and-setup/how-to-adjust-the-action-on-an-acoustic-guitar-/

StewMac: setup order, nut slot heights for wound and plain strings, and intonation with the 12th fret harmonic. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-building-instruments-and-kits/electric-guitar-and-bass-assembly-guide-part-5-setup/

Taylor (John LeVan): why setup order matters, and a warning against DIY neck resets. https://blog.taylorguitars.com/acoustic-guitar-setup-workshop-with-john-levan

Chapter 13: Tracking Down Fret Buzz

MusicNomad: finding the cause of fret buzz, from setup and nut to high frets, technique and humidity. https://musicnomadcare.com/guides/the-complete-guide-to-fixing-guitar-and-bass-fret-buzz/

Taylor: causes of fret buzz, how to diagnose it, and fixes a tech can make. https://blog.taylorguitars.com/how-to-fix-fret-buzz

MusicNomad: how low relief, a flat or back-bowed neck and a low nut cause buzz in different places. https://musicnomadcare.com/guides/the-complete-setup-guide-for-electric-acoustic-bass-and-classical-guitars/

MusicNomad: buzz from a sunken top or back-bowed neck when dry, and loose braces need a shop. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-humidity/

MusicNomad: repair shops find many guitars with loose tuner bushings. https://musicnomadcare.com/guides/the-complete-guide-to-changing-your-guitar-strings/

Taylor: a dry guitar shows lower action, a sunken top and sharp fret ends. https://www.taylorguitars.com/support/maintenance/symptoms-dry-guitar

StewMac: the fret rocker spans three frets and rocks to show uneven fret heights. https://www.stewmac.com/luthier-tools-and-supplies/types-of-tools/straightedges/fret-rocker/

StewMac: raising an acoustic saddle may mean a shop visit, and a rising fingerboard tongue means fret work. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-string-action-and-setup/how-to-adjust-the-action-on-an-acoustic-guitar-/

StewMac: forcing a truss rod nut can shear it. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-truss-rod-installation-and-repair/dont-be-nervous-about-adjusting-that-truss-rod/

Fender: see a service center when the truss rod meets heavy resistance or has no effect. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

Chapter 14: Travel and Shipping

U.S. DOT: the final rule implementing section 403 of the FAA Modernization and Reform Act of 2012. https://www.transportation.gov/airconsumer/final-rule-musical-instruments

U.S. DOT: the rule text on carry-on and checked instruments, buying a seat, size and weight limits, and fees. https://www.transportation.gov/sites/dot.gov/files/docs/Final_%20Rule_%20Musical_Instruments.pdf

U.S. DOT: the December 30, 2014 press release announcing the rule for U.S. carriers. https://www.transportation.gov/briefing-room/us-department-transportation-issues-final-rule-regarding-air-travel-musical

U.S. DOT: FAQ on the rule, effective March 6, 2015, covering carry-on limits and fees for instruments. https://www.transportation.gov/sites/dot.gov/files/docs/DOT_Musical_Instruments_FAQ_2_0.pdf

U.S. DOT: tips for flying with an instrument, including liability, insurance, packing and boarding early. https://www.transportation.gov/sites/dot.gov/files/docs/Musical%20instruments%20tip%20sheet.pdf

TSA: instruments are allowed in carry-on and checked bags after screening. https://www.tsa.gov/travel/security-screening/whatcanibring/items/guitar

TSA: carry-on instruments get a physical inspection, so confirm size with the airline. https://www.tsa.gov/travel/frequently-asked-questions/what-steps-are-taken-screen-musical-instruments

Taylor: travel tips, including not detuning to fly, keeping humidity at 45-55% RH, and avoiding hot cars. https://blog.taylorguitars.com/5-tips-for-traveling-with-your-taylor

Taylor: car heat can loosen the bridge, so park in shade and use a windshield shade. https://blog.taylorguitars.com/guitar-care-tips-for-summer

Taylor: warm a cold guitar slowly in its case, away from heaters and fireplaces. https://www.taylorguitars.com/support/how-treat-extremely-cold-guitar

Martin: traveling by car and air, including flight cases, airline policy, packing and temperature changes. https://martinguitar.com/on/demandware.static/-/Library-Sites-MartinSharedLibrary/default/pdf/2020-care-and-feeding-guide.pdf

MusicNomad: hardshell cases hold steadier humidity than gig bags, and the 24-hour rule after travel. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-humidity/

StewMac: how to ship a guitar safely, from detuning and padding to insurance and inspecting on arrival. https://www.stewmac.com/video-and-ideas/online-resources/reference/a-better-way-to-ship-a-guitar/

Chapter 15: Your Maintenance Schedule and When to See a Tech

MusicNomad: clean strings before and after playing, with users reporting longer string life from String Fuel. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-and-bass-string-cleaning-and-care/

MusicNomad: how long strings last by how often you play, signs they are worn, and checks at string changes. https://musicnomadcare.com/guides/the-complete-guide-to-changing-your-guitar-strings/

MusicNomad: how often to check humidity, and the damage that needs a repair shop. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-humidity/

MusicNomad: clean and condition the fretboard about every six months. https://musicnomadcare.com/guides/fretboard-cleaning-and-care-guide/

MusicNomad: seasonal setups in September and March, what triggers a setup, and steps to take before one. https://musicnomadcare.com/guides/the-complete-setup-guide-for-electric-acoustic-bass-and-classical-guitars/

Martin: an acoustic maintenance guide covering wiping down, oiling the fretboard, cracks and water damage. https://www.martinguitar.com/blog-categories/tips-tutorials/blog-050523-acoustic-guitar-maintenance-guide.html

D'Addario: there is no fixed interval, so change strings when they sound dull, feel grimy or won't hold tune. https://www.daddario.com/blogs/guitar/when-to-change-guitar-strings

Fender: have a tech check the setup about every six months, plus seasonal and gauge-change adjustments. https://support.fender.com/hc/en-gb/articles/42584722527003-How-often-should-I-have-a-set-up-adjustment-done-on-my-instrument

Fender: check intonation after every string change. https://support.fender.com/hc/en-us/articles/42584627801243-How-do-I-intonate-my-instrument

Fender: the jobs a setup includes, from strings and nut to truss rod, pickups, bridge and intonation. https://www.fender.com/articles/setup/what-is-a-setup-and-why-is-it-so-crucial

Fender: see a service center when the truss rod resists, needs constant adjustment or has no effect. https://support.fender.com/hc/en-us/articles/42584764005019-How-do-I-set-up-my-Stratocaster-guitar-properly

Fender: bring cables and accessories when taking an instrument for service. https://support.fender.com/hc/en-gb/articles/42584669915419-What-should-I-do-when-taking-my-equipment-to-be-serviced

Taylor: dry guitar symptoms, frets that may stay sharp after rehumidifying, and checking humidity daily. https://www.taylorguitars.com/support/maintenance/symptoms-dry-guitar

Taylor: fall care tips, including checking humidity more often, a digital hygrometer and keeping the guitar cased. https://blog.taylorguitars.com/6-guitar-care-tips-for-fall

Taylor (John LeVan): a seasonal setup is usually enough, and frets, saddle and nut wear fastest. https://blog.taylorguitars.com/acoustic-guitar-setup-workshop-with-john-levan

MusicNomad: how often to oil with F-ONE, depending on how much you play and the humidity. https://www.musicnomadcare.com/FAQS/MN144-FAQs

Martin: condition the fingerboard and bridge once or twice a year, depending on humidity. https://www.martinguitar.com/blog-categories/tips-tutorials/blog-011823-guitar-care-tips.html

Chapter 16: Smoothing Sharp Fret Ends

StewMac: fixing sharp fret ends: smooth-cut mill file, taping danger zones, 35 to 45 degree bevels (not under about 30), dressing the corners, and polishing with 0000 steel wool and micro-mesh. https://stewmac.com/video-and-ideas/online-resources/learn-about-guitar-and-instrument-fretting-and-fretwork/fix-sharp-fret-ends-like-a-pro

StewMac: fret beveling file set at 35 degrees, and the risk of a standard file skipping onto the fretboard. https://www.stewmac.com/video-and-ideas/tool-demo-videos/luthier-tools-and-supplies-videos/guitar-fret-beveling-file/

Chapter 17: Finding and Fixing a High Fret

StewMac: finding a high fret with a straightedge spanning three frets, leveling it with the Fret Kisser until a marker line is gone, and recrowning with a 300-grit diamond file at about 30 degrees. https://www.stewmac.com/video-and-ideas/tool-demo-videos/fix-fret-buzz-with-the-strings-on/

Chapter 18: Checking and Lowering Nut Slots

MusicNomad: nut height targets over the first fret for each string, and signs a nut is too high or too low. https://musicnomadcare.com/guides/the-complete-guide-to-guitar-nut-height/

StewMac: nut slot depths of .007" to .012" for plain strings and about .013" to .020" for wound strings. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-building-instruments-and-kits/electric-guitar-and-bass-assembly-guide-part-5-setup/

StewMac: using stacked feeler gauges to control slot depth, filing at a back angle, and finishing the slots. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-guitar-nut-and-saddle-setup-and-repair/using-feeler-gauges-to-control-nut-slot-depth/

StewMac: slots backfiled at a gentle angle toward the tuners, and why a steep angle leaves too little support. https://www.stewmac.com/video-and-ideas/tool-demo-videos/making-a-guitar-nut-3-tips-for-proper-slotting/

Chapter 19: Replacing a Pot, Jack or Switch

Fralin Pickups: soldering tips: temperature-controlled iron, no soldering guns near pickups, mechanical connections, tinning, and washing hands after leaded solder; staff reply on iron temperature. https://fralinpickups.com/2017/04/18/6-tips-help-get-better-soldering

Mojotone: soldering tips: temperature-controlled iron, rosin-core solder, and keeping lead fumes and residue away from you. https://mojotone.com/blogs/news/soldering-tips-tricks

Allparts: CTS 250K split-shaft audio pot with a 3/8" threaded bushing, and the warning that U.S.-size parts don't fit metric import guitars. https://allparts.com/products/ep-0085-cts-250k-split-shaft-audio-pot

Northwest Guitars: how a volume pot is wired, and the usual 250K single-coil and 500K humbucker pairing. https://northwestguitars.co.uk/blogs/blog/guitar-wiring-guide-part-2-how-to-wire-a-volume-pot

Chapter 20: Shielding a Control Cavity

StewMac: shielding must be in contact with ground; copper foil, shielding paint, pickguard foil and solder lugs. https://www.stewmac.com/video-and-ideas/online-resources/learn-about-guitar-pickups-and-electronics-and-wiring/understanding-guitar-wiring-part-8-grounding-and-shielding/

StewMac: shielding paint (three or four coats, about 12 hours each), naphtha cleanup, pickguard shielding, testing with a multimeter, and how shielding can change single-coil sound. https://www.stewmac.com/video-and-ideas/trade-secrets/how-to-upgrade-the-electronics-on-a-fender-squier-strat-and-fix-faulty-shielding/

Chapter 21: Checking Neck Alignment and Scale Length

MusicNomad: measuring scale length from the inside edge of the nut to the center of the 12th fret and doubling it. https://www.musicnomadcare.com/FAQS/MN802-FAQs

Sound Pure: measuring from the nut to the middle of the 12th fret and multiplying by two; why the saddle is angled. https://www.soundpure.com/a/expert-advice/guitars/how-to-measure-scale-length-on-a-guitar/

About This Book

This book shows you how to keep a guitar clean, stable, and playing right. It covers cleaning the body, finish and fretboard, fret care, humidity and temperature, hardware and electronics, choosing strings, and step-by-step restringing for acoustic and electric guitars. Then it walks through the basic setup checks in the order a tech does them, tracking down fret buzz, and travel and shipping.

Chapter 15 gives you a maintenance schedule and tells you when a job belongs with a tech. Part 2, Bench Jobs, adds illustrated steps for the jobs a careful owner can learn: smoothing sharp fret ends, leveling a high fret, checking and lowering nut slots, replacing a pot, jack or switch, shielding a control cavity, and checking neck alignment and scale length. Every chapter has drawings that show you what to look for, and a glossary and a list of sources are at the back.