

# Pickup Winding with the Schatten Pickup Winder



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## REPAIR AND CUSTOMIZING JOBS FOR THE PICKUP WINDER

A pickup winder is a great way to make money in your shop. If you can fix a stock pickup there is no better way to maintain an instrument's vintage value. Use the pickup winder for these repair and customizing jobs:

### Rewinding dead pickups

- Rewind an entire pickup to original specs.
- Peel a pickup to find the problem, then rewind from the problem out.
- Rewind a pickup to custom specs (overwound, underwound, tapped output, etc.).

### Modifying pickups

- Make higher output pickups out of standard pickups.
- Make a "tapped" single-coil.
- Add wire to an existing coil.
- Reduce the output of overwound pickups by peeling, tapping the coil and rewinding. This gives the customer more tone options from one pickup.
- Add wire to one coil of a humbucker to get slightly mismatched coils (credited for some players' unique tone).

### Make pickups for custom/specialty instruments

- Make replacement components to replace damaged pieces of an existing pickup.
- Design and build your own pickups.

Pickup rewinding requires patience and study. Don't dive into rewinding vintage pickups until you've repaired and wound some cheap pickups. Most repair shops have collected a pile of dead pickups over the years—they're perfect for practicing. (Remember the luthier's golden rule: Practice On Scrap!)

## RECOMMENDED TOOLS AND SUPPLIES

Stewart-MacDonald has many of the parts, tools, and supplies you need for building and repairing pickups. Where applicable, item numbers for ordering from StewMac are included.

- Volt-Ohm meter (VOM)
- Soldering iron and solder (60/40 rosin core)
- Polarity tester #5127
- Gauss meter/Magnetometer
- Glue pot #0668—for wax potting pickups
- Paraffin and beeswax—available at many grocery stores
- Cooking thermometer—for monitoring the wax's temperature

## TROUBLESHOOTING

Here are some common pickup ailments. To isolate a problem, unsolder the pickup from the guitar so that other electronic components don't affect your tests.

### **Output is weak**

What is the DC resistance of the pickup?

- Normal DC resistance for a single-coil pickup is 6-8K Ohms; humbuckers are normally around 8-13K. If the pickup's DC resistance seems normal but the output is low, the magnets could be weak. See "Remagnetizing a pickup" later in these instructions.
- A low DC resistance could indicate shorts within the coil windings. A typical cause is corrosion of the coating on the magnet wire, causing the coil wraps to short out against each other. This can drastically reduce output, making the pickup a candidate for rewinding.

### **No output**

Is there DC resistance between hot and ground, or is there a dead short?

- If there is a reading for DC resistance, and it appears to be normal or close to normal, the magnets may be dead, or there could be a poor solder joint, which has oxidized where the ends of the coil wire connect to the output wires.
- If there is a dead short, then inner coil corrosion could be shorting out to ground, or there is a break in the coil wire. Before you do anything drastic like completely peeling or cutting the coil wire off of the pickup, make sure that the output wire solder connections to the coil wire are not corroded or broken.

## **TECHNIQUES**

### **Peeling**

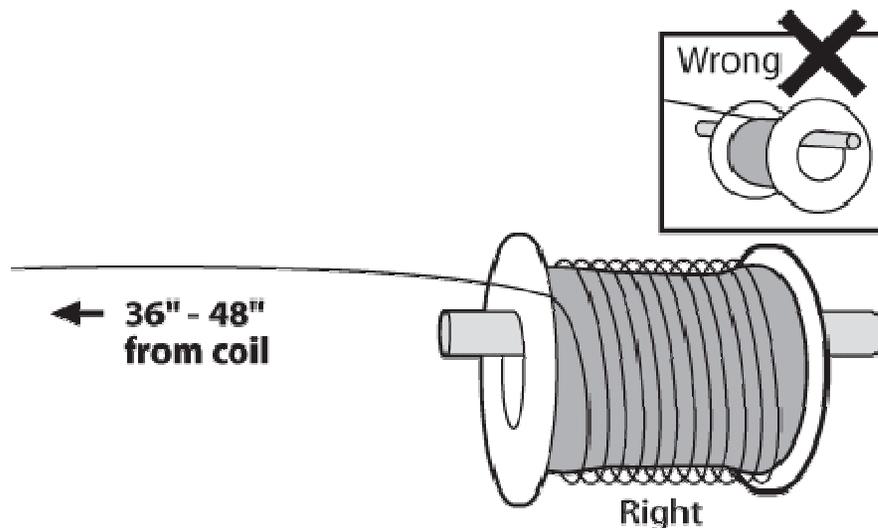
How a pickup has been manufactured and potted (coated with wax, lacquer, or epoxy) will effect how easily a coil can be peeled. Often, no matter how careful you are, a coil cannot be removed wind-by-wind. Age also can make the wire difficult to remove in one continuous piece. If you're not trying to retain the original wire or determine the number of winds on a specific coil, the quickest and easiest way to remove the coil windings is to cut through them with a sharp hobby knife.

### **Winding**

Here are some tips and a general outline for winding a pickup.

- When you disassemble and peel a pickup be sure to make notes on how the coil attaches to the lead wires.
- Quick sketches or a photo are very helpful in recording how a pickup comes apart, and more importantly, how it will go back together!
- File or sand any dings or nicks in the coil's flatwork. They should be smooth so they can't catch the coil wire.

- Make sure that there are no nicks in the edge of the wire spool or the traverse bar to snag the coil wire, so it comes off the spool cleanly.
- Pickup wire isn't meant to feed off a rotating spool. It's too thin to take the strain of turning the spool. Instead, let the wire feed off the end of the spool as shown below. Position the spool horizontally, at the same height as the coil being wound, and about three or four feet away from it.



- Be sure the pickup coil is well attached to the winding arm and that it runs true. Before attaching the coil wire, start the winder and see if there is a wobble or if the flatwork isn't spinning true and straight.
- Start the first 6-10 wraps by hand, turning the opposite arm of the winder. This insures that coil wire won't be pulled off of the bobbin when you start the motor.
- Set the traverse end-stops so they're just inside the inner faces of the flats.
- Set the counter to zero. Determine the number of turns you would like to put on the coil and log that as the "end" counter number on your log sheet ([click here](#) for example log sheet).
- Start the winder slowly, then increase the speed. Use your fingers or a doubled-over piece of felt to pinch and guide the wire along the traverse.

Variations in tension, and how the wraps align with each other are just two of the ways to affect a pickup's tone and response, so be

sure to experiment to see what works for your needs.

The term "scatterwound" refers to pickups wound by hand rather than by a machine. Machine wound pickups have a very even winding pattern, and a "distributed capacitance" (the capacitance between each successive turn and layer of a coil). Scatterwinding lets you control the space between your winds and layers, therefore changing the distributed capacitance. Many feel the reason hand-wound pickups sound better and have more harmonic content than their machine-wound counterparts is because there is less capacitance within the coil.

You can also tweak the number of windings for a custom sound. For example, winding a coil 5% under spec can give you a sound that is brighter while overwinding by the same amount can give you a warmer sound with less top end.

Don't wind a pickup too loose, but don't wind it too tight either!

- If a coil is too loose it will be microphonic and sloppy.
- If a coil is too tight you can actually deform the bobbin and it's even possible to cause the pickup to implode.

Wind until you reach the desired number of turns, the mass of wire you want on the coil, or until you reach the desired DC resistance.

You can check the DC resistance during the winding process by gently scraping off some of the protective coating on the coil wire with a hobby knife. Touch the "start" of the coil with one probe from your volt-ohm meter and touch the other probe to a portion of scraped coil wire just off of the coil (don't cut the coil wire!). When holding the VOM's probes on the wire, don't let your body's resistance affect the readings—there are VOM probes that have delicate little clips for clamping onto thin wire, and they are ideal for guitar electronics. If you need more wraps, put a drop of lacquer or nail polish on a paper towel and wipe a thin coating onto the bare portion of coil wire, let it cure for a few minutes, and continue winding.

Carefully cut the wire and solder it to either the solder lugs (single-coil) or lead wires (humbucker).

## POTTING

Potting a pickup is a technique used to help eliminate unwanted microphonics. Some pickups are not potted from the factory. While it's not necessary, potting is generally a good idea. Here are the common pickup potting materials.

### **Potting with wax**

*Pros:* Works for most pickups, it's non-toxic, easy to deal with, cheap, and you can undo it if something goes wrong. Wax has a traditional appearance, and it works great for humbuckers with metal covers.

*Cons:* If the wax is too hot you can warp or melt plastic bobbins. If the wax is way too hot you have a potential fire on your hands! Make sure that the wax never smokes—that's an indicator that it's getting too hot. Never try heating your wax on the kitchen stove or in a microwave oven because hot paraffin, and especially paraffin vapors, can ignite. It's best to wax pot outdoors until you have your methods refined and have eliminated any fire hazards.

*Application:* After a pickup has been wound, and the output wires are attached and assembled, suspend the pickup in canning paraffin mixed with 20% beeswax, heated to 145-150° Fahrenheit. After ten or fifteen minutes all of the bubbles should have risen out of the pickup, and all of the voids within the pickup should be filled with a coating of wax.

Pull the pickup out of the wax and suspend it over the wax pot letting the excess wax drip back into the pot. Then lay the pickup on a paper towel and allow it to cool to touch. Carefully remove any excess with a paper towel before the pickup completely cools to room temperature.

Stewart-MacDonald's Hot Glue Pot (#0668) has a thermostat designed to heat hide glue to about 145°. Keep the pot at least 2/3 or 3/4 full. It can operate with less liquid, but the wax may get too hot.

### **Potting with lacquer**

*Pros:* Good for plastic bobbins that may melt during wax potting.

*Cons:* Can react with some plastic bobbin materials. Doesn't stop microphonics caused by metal covers on humbuckers. It's difficult to peel a lacquer potted pickup. Lacquer has to be applied while winding, which slows down the process.

*Application:* Use a small brush and add a thin coating of lacquer every minute or so. You must wait a few minutes before you start the winder, or you'll fling lacquer all over the place.

### **Potting with epoxy**

*Pros:* Virtually bulletproof and won't degrade in damp or harsh conditions.

*Cons:* It's difficult to get epoxy to penetrate deep into a pickup's windings, and practically impossible to repair an epoxy-potted pickup.

*Application:* Because thin epoxies are difficult to obtain, and permanent, it's best to avoid epoxy potting.

### REMAGNETIZING A PICKUP

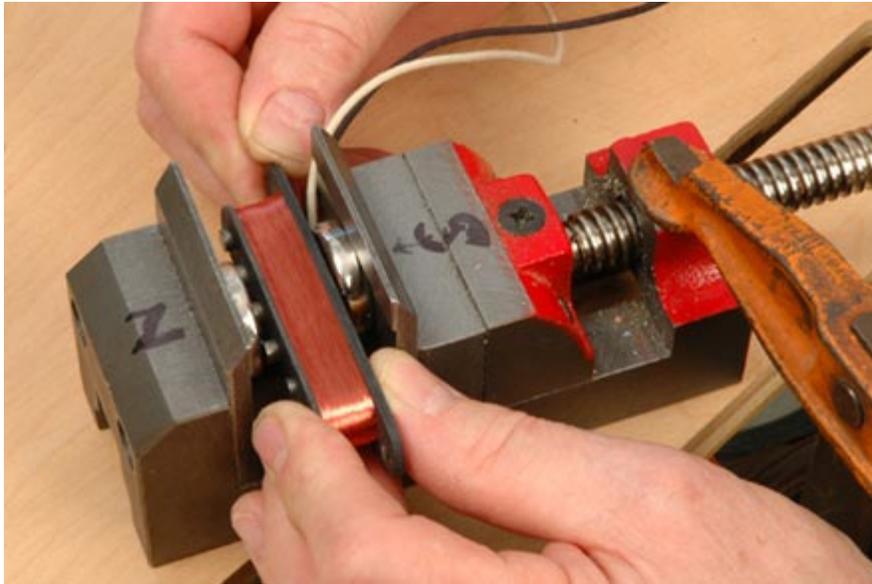
If a pickup has a good DC resistance, but is still weak, the magnet(s) may have lost their strength. If you don't have a Gauss meter or magnetometer it's difficult to know how strong a magnet is. However, if you have similar pickups in your shop, and one seems to pull on the tip of a screwdriver harder than the other, you can guess that the magnet is weak. A polarity checker (Stewart-MacDonald #5127) is a must for deciphering polarities.

Another reason for remagnetizing a pickup is to swap the magnetic polarity of a single-coil, so it will act as a humbucker when combined with another single-coil. Note: the coil must also be "reverse-wound" for this pickup to have the proper phase relationship and noise canceling humbucking properties.

You can make a simple fixture using a basic C-clamp. Remove the foot with a screwdriver and attach two of our 1" diameter Guitar Repair Magnets with #20 Super Glue. Orient the magnets so that they pull toward each other, and adjust the magnets so the pickup fits just between them. Identify and mark the north/south polarity for reference. You can then clamp the fixture into a bench vise as a nice holder while charging.

To swap a pickup's polarity, simply run the pickup between the two magnets a few times with the top aligned with the new desired polarity.

Our Nut and Saddle Vise #1816 makes for a sturdy charging station. Since the jaws are steel, the Guitar Repair Magnets hold themselves in place without glue. This lets you adjust for different pickups and different proximity by simply opening and closing the vise.



## PICKUP SPECIFICATIONS

<b>Gibson</b>	<b>PAF Humbucker</b>	<b>P-90</b>
Turns	5000-5050 per coil	10,000
Wire gauge	42 AWG plain enamel	42 AWG plain enamel
Wind direction/arm	Counter clockwise/left winding arm	Counter clockwise/left winding arm
Magnet/polarity	Alnico 2/south on adjustable coil	Alnico 5/north
Adjustable coil		

Start Finish	Black ground Green/series link	Black ground White hot
'Slug' coil		
Start Finish	Red hot White/series link	N/A N/A
Notes	N/A	Two bar magnets are used per pickup. Both north polarity edges are towards the adjustable polepieces.

<b>Fender</b>	<b>50s &amp; early 60s Strat</b>	<b>Late 60s &amp; 70s Strat</b>	<b>50s Tele Bridge</b>	<b>50s Tele Neck</b>
Turns	7900-8350	7600-7700	8000-9200	7800-8000
Wire gauge	42 AWG Formvar or plain enamel	42 AWG plain enamel or poly-nylon	42 AWG plain enamel	43 AWG plain enamel
Wind direction/ arm	Clockwise/ right winding arm	Clockwise/ right winding arm	Counter clockwise/ left winding arm	Counter clockwise/ left winding arm
Magnet/ polarity	Alnico 5/ south	Alnico 5/ south	Alnico 5/ south	Alnico 5/ south
Start Finish	Black ground White hot	Black ground White hot	Black ground White (or yellow) hot	Black ground White hot
Notes	Hand wound with staggered pole-pieces, wax potted. 1954-1957 were typically north polarity.	Machine wound with staggered pole-pieces. Eventually went to flat pole-pieces sometime in the 70s. Wax or lacquer potted, and	Hand wound, early 50s had flush pole-pieces, late 50s had raised D and A poles, and 60s have staggered pole-pieces, wax potted.	Machine wound with staggered pole-pieces. Eventually went to flat pole-pieces sometime in the 70s. Wax or lacquer potted, and

some may not be potted at all.

Copper plated steel baseplate. 1950-1951 were typically north polarity.

some may not be potted at all.

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<b>Fender Bass</b>	<b>Jazz 50s to 60s</b>		<b>Precision 50s to 60s</b>
Turns	9500		10000
Wire gauge	42 AWG plain enamel		42 AWG plain enamel use
Wind direction/ arm	BRIDGE Clockwise/ left winding arm	NECK Counterclockwise/ right winding arm	Reverse wound
Magnet/polarity	BRIDGE Alnico 5/ south	NECK Alnico 5/north	Alnico 5/Reverse polarity
Start Finish	Black ground White hot		Black ground White hot
Notes	Jazz Bass coils are reverse wound with reverse polarity, to allow for hum canceling when both pickups are combined.		Precision Bass coils are reverse wound with reverse polarity, to allow for hum canceling when both pickups are combined.

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