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Harley 12-volt 65A generator rebuild

A pictorial guide to rebuilding the 12-volt generator used on Sportsters 1965-1981.

The tips and tricks:

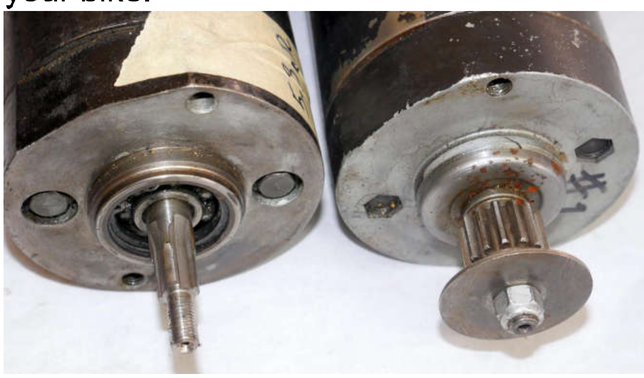
1. **The armature is what usually fails.**
2. **Aftermarket armatures cost between 22 and 120 dollars.**
3. **The field coils should measure around 5 Ω (ohms) resistance.**
4. **A shorted field can be caused by a cut paper washer inside unit.**
5. **You may need a puller to remove the gear.**
6. **If you have to tap the armature out of the ball bearing, put several nuts on the threads to protect them.**
7. **Seals often crack and leak due to heat damage.**
8. **A 7/16" nut-driver will hold a spinning bolt from the drive side.**

A video shows the rebuilding of a Harley Model 65A 12-volt generator. This article has more details. (Click for video.)

The Model 65A generator began with end bells made from steel. In 1980, the factory switched to aluminum end bells for two years, then changed to the Model 65B made by Hitachi. The Model 65B has 13-A output versus the 10-Amp output of the 65A. All aftermarket generators have aluminum end bells.

Most generator failures are from over-current. Early mechanical points voltage regulators often did not limit current. With only 10-Amperes output, an incandescent headlamp on high-beam, a brake light, and the ignition can bring the generator to nearly full output. At idle, no 65A will be able to charge the battery. You can see the charging system working at night. When the bike comes off idle, the headlight should get brighter, then stabilize. The lower the RPM this happens, the better shape your generator.

The Model 65A, part number 29975-65A. You can pull off the brush cover strap while on the bike. The big oil-slinger washer on the gear means you have to tilt the end down to get the generator out of your bike.

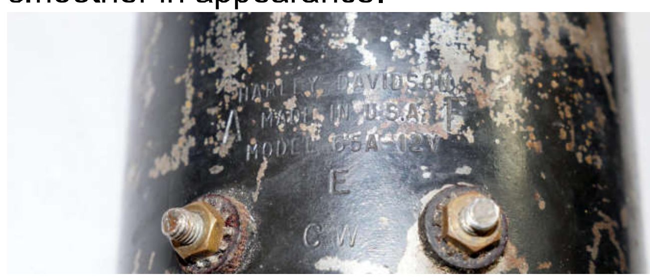


Pre-1980 production uses steel end bells as on the left. Aftermarket uses aluminum like on the right. The long bolts that hold the generator together are retained by serrated stakes under the head for the steel end bell. The aluminum end bell has hex recesses molded in that retain the bolt.

If the bolt spins on a steel end bell, a 7/16" nut-driver is the only tool with a thin wall that will fit in the recess. Sometimes you can wedge a screwdriver against the flat to keep the bolt from rotating. Since the serrations on the bolts wear out with removal and reassembly, it is best to leave the bolts connected to the steel end bell if possible. Sometimes the aluminum end bells are best left with the bolts in as well.

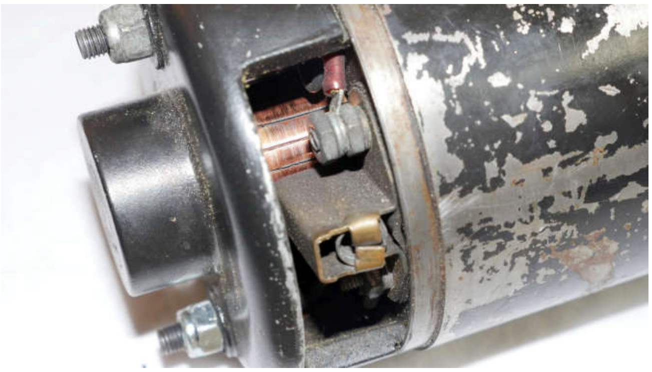
The other end bell will match the material of the drive-side end bell. The steel end bell on the left has a thicker section by the part number, and a sand-cast appearance.

The aluminum end bell on the right won't hold a magnet on the edge and is smoother in appearance.



The model number is stamped near the terminals, with "A" on the left for the armature (towards front of bike), and "F" for the field coil. Harley stamped their name here, as does Cycle Electric, who bought the tooling from Prestolite when they stopped making Harley generators.

A 7/16" wrench gets the brush cover off. Older bikes had a straight-slot screw like this. You can replace this 1/4-inch bolt with hex or Philips head. Use a clip nut so you don't need two tools to get the cover off.



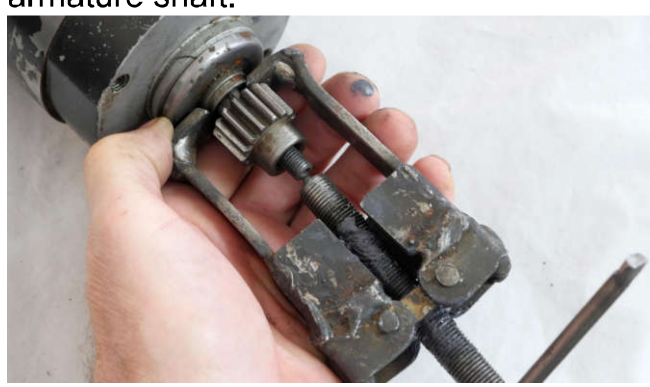
With the brush cover off, you can see the condition of the copper commutator on the armature. You can also see if the brushes are worn out as well as smell for a burnt odor. Most failures are bad armatures.

A 12-volt field coil should measure between 5- and 6-Ω (ohms). Six-volt generators are half that. Field coils rarely cause problems. If you have a good resistance reading, the problem is almost certainly the armature.

With a good meter, you can measure the resistance of the armature terminal to the case. Slowly turn the generator so different segments of the commutator come under the brushes. Here there is a bad reading, 99.50 kΩ.

Turning the generator a bit, gives a reading of 2.29 Ω. Even this is high, I often see 0.89 Ω, and that includes the 0.22 Ω of the test leads. The high resistance is caused by a melted wire in the armature, or the commutator copper being worn down below the segment insulation.

You can hold the gear with pliers while using a 1/2" wrench to remove the nut. The gear is hardened and tends not to scar. Don't use impacts, there is no torque control. and you don't want to strip the armature shaft.



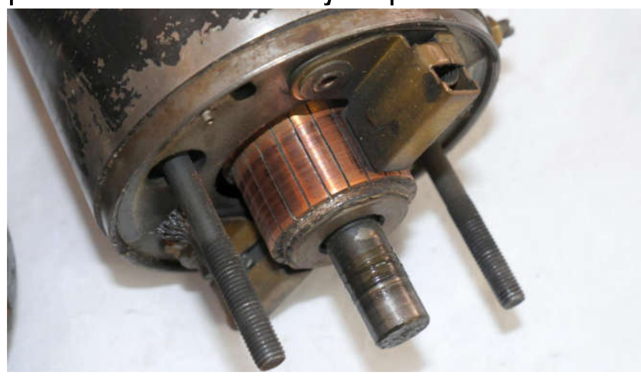
Some gears just slide off, others need a puller. I welded up a cheap Taiwan puller to keep it from twisting and popping off. Don't use a slide hammer.

Under the gear is an oil shield. There is a hole drilled in the shield, the design intent is to let engine oil in the gear-case get into the generator bearing for lubrication.

Get in the habit of using a container for all the parts. Even a soup bowl is better than scattering parts all over the bench.

With steel end bells you might need a 7/16" nut driver to hold the bolt if it is stripped out under the head. A 7/16" wrench removes the two nuts that hold the generator together. These nuts are prevailing torque, also called Nylocs. I prefer to replace them with 1/4-28 plain nuts and a flat- and lock-washer. I like fasteners that free-run. Replace lock washers with new ones, they wear out.

The end bell might need some gentle persuasion but often just pulls off.



Examine the armature shaft for wear and damage under the needle bearing in the end cap. Also look for grooving caused by the seal.

This generator (left) had an aftermarket aluminum end bell that has been cost-reduced. There is no separate seal, instead, the needle bearing has an O-ring built into it. The center end bell is also aluminum aftermarket, but has the factory-style seal and a shorter needle bearing. The steel end bell is on the right with the seal and needle bearing still installed. I prefer running steel, but aluminum works.

On the left is the aftermarket needle bearing that has an O-ring seal. The middle bearing is stock. On the right is a mystery needle bearing that is longer, I think intended to use more of the shaft.

A seal puller can pry the seal out. Sometimes you can reuse the seal if it is not cracked or worn.

A 12mm works to pound out the bearing. You can drive the needle bearing out in either direction. It's better to use a press, but you get away with hammering as long as the socket is big enough to not curl the lip of the needle bearing.

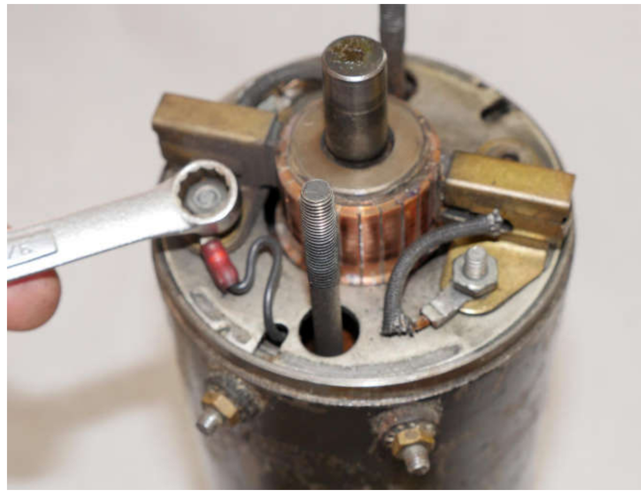
The cost-reduced aluminum end bell on the left versus the steel factory end bell on the right. A good seal and a bad one.

You can put the end bell back on to see how far the armature shaft extends into the end bell. This helps you judge whether to drive the needle bearing in a bit further to engage more of the shaft.

There is room to drive the needle bearing in further, as long as it clears the seal.

An empty can will hold the generator upright while you inspect the brush plate and commutator.

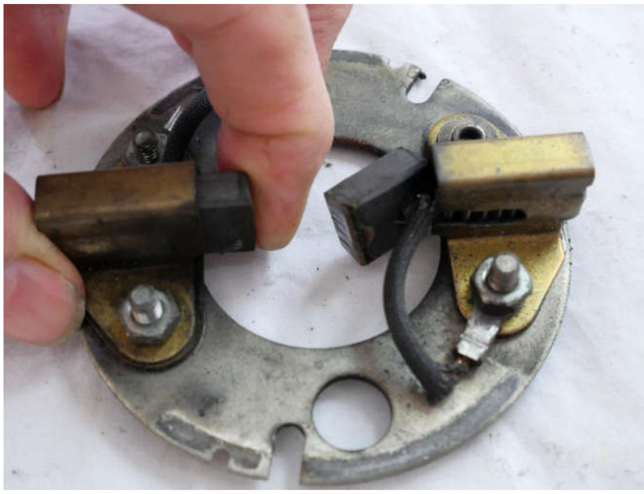
This is an aftermarket plate, with two slots for the armature wire to pass. The ground-side brush holder is riveted in one place. The armature brush terminal has a wire that goes to the external "A" terminal on the frame of the generator. The wires route so they don't rub on anything.



A 3/8" wrench will remove the armature wire.

Now you can lift off the brush plate.

Some folks leave the brush plate connected, just swinging it out of the way. Bottom and right are factory plates with one slot for the armature wire.



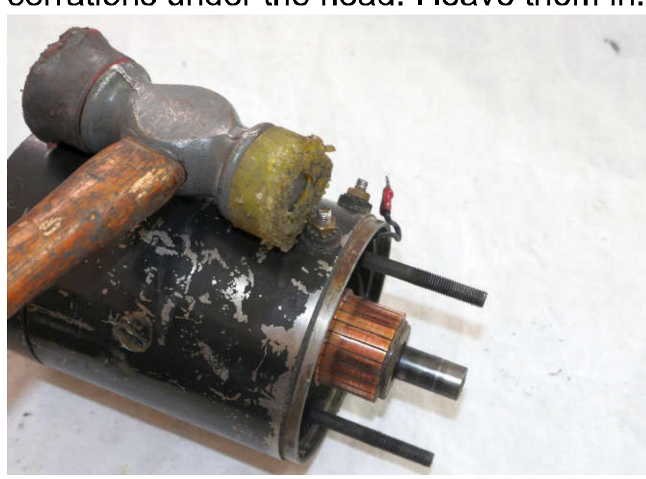
Feel the springs that push the brushes against the commutator. They should not bind and both should have the same force.

A dental tool can pull the springs out of the brush holders, don't over-stretch them. You can "unwind" them to reduce their diameter or push them from the back. They "tilt" in the holder and that lets them slide in or out.

The two springs should be the same length and in decent condition. Eight bucks for a new pair on eBay. Part number 30453-58.

A 3/8" wrench will remove the brushes.

You can tap on the bolts, or even the armature to pull the frame apart. Tapping the bolts might drive them out and strip the serrations under the head. I leave them in.



You can even tap the terminals to split the frame. I try not to tap on the bolts since it might drive them out and strip the splines that keep them from rotating.

The frame separates from the drive-side end bell, which still holds the armature.

The left terminal has a field coil and the armature wire attached. The right terminal has the other end of the field coil.

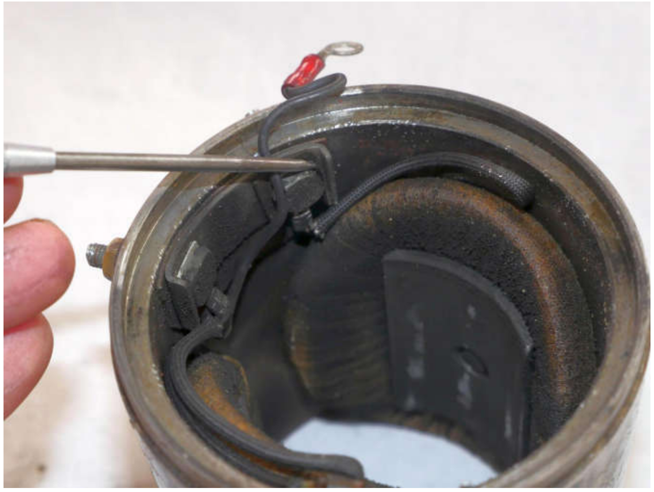
If the field coils are bad, you have to grind back this stake and impact out the screws.

A pair of field coils, but with one missing a ring terminal. You can't solder this, it gets too hot. A crimp connection would work.

A field coil connection terminal.

Over-torque on the field terminal will cut a corner into that black paper washer second from the right. This shorts the field.

Aftermarket terminals have sharp corners that cut the paper washer. A bike with zero ohms field coil measurement might be cured with a new square paper washer. You can loosen the field terminal then tighten it without letting it spin and fix the generator without taking it off the bike.



This is where that paper washer gets cut and kills the generator.

Some armatures fall out of the end bell. Otherwise, be sure to put some nuts on it to protect it from the hammer.

A press is even better than hammering, but use the backup nuts just in case.

The armature can go in the parts bin while you take apart the drive-side end bell.

Remove the snap ring, wear safety glasses, the rings can fly.

Use a socket to drive out the bearing from the inside. It is not a tight fit, light taps should do it. Socket fits inside the seal.

Old units have an open bearing, that gets splashed with a little engine oil inside the gear-case.

This unit has a shield on one side of the bearing, which should point inward towards the armature. Keep the open side pointing to the gear, so oil can get into the bearing from oil splashing around the gear-case.

If you reuse the bearings, put them in a bag right away to keep them clean. The roller bearing hardly ever fails. The needle bearing is more problematic. If the shaft is chewed up, toss the needle bearing.

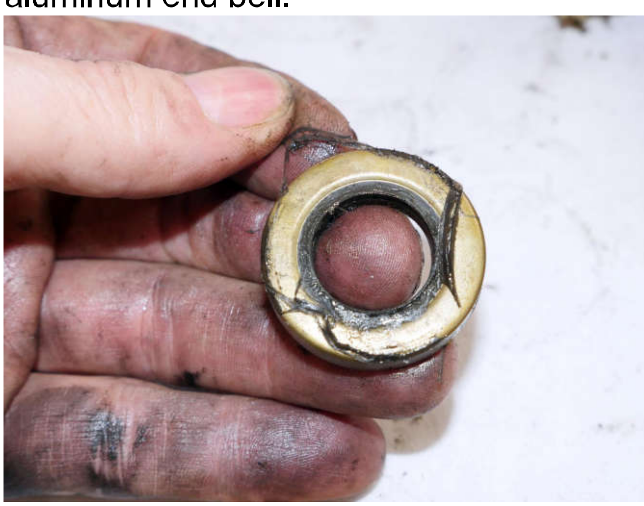
1980-81 factory and aftermarket aluminum end bells have this springy indented coil inside. It is for holding the bearing as the aluminum expands with heat.

Here is the spacer spring thingy "tolerance ring" used on aluminum end bells.

The aluminum end bell has a step in the bore, so be careful driving out the seal. The steel end bell has a smooth bore that does not hang up a big seal driver.

Now you get the second snap ring out.

Use a socket to pop the seal out. Too big a socket will hang on that ridge in an aluminum end bell.



The seal had silicone on it. Never ever use silicone around roller or ball bearings. It will make them skate, blue, and melt.

Heat tears up the seals pretty bad. The cracked seals on the left and bottom are from another generator.

All the parts in the bin keep things organized.

Parts cleaner solvent is ideal to clean the metal parts, but not the frame with the field coils. I can't see soaking the coils in anything, I clean the frame with wipes, by hand.

Small parts fit into a basket. No solvent on the brushes or bearings either.

The metal parts soak while you clean the frame.

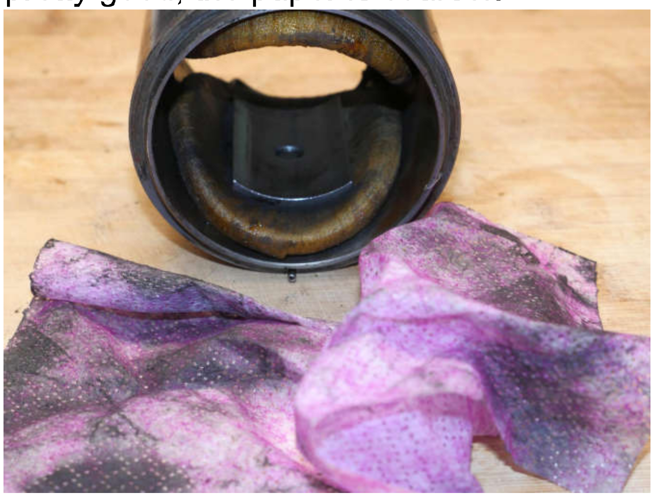
I got the solvent at the auto parts store, but it was crazy expensive, over 100 bucks. I think it is kerosene and soap.

If you want to take paint off, you can put the parts in Chem-Dip carb cleaner.

Engine degreaser is mild, but Chemtool, Brakleen, and Goof Off are strong. That brush is ideal to get into crevasses.

A shot of carb cleaner took the paint off the stamped label area. Wear gloves.

I got these when Clorox Wipes disappeared in the pandemic, they work pretty good, the paper is coarser.



The wipes were a handy way to clean the inside without soaking the field coils.

Now is when you clean the bin, spotless, since it will have clean parts in it from now one. One grain of sand can ruin that needle bearing and melt the shaft.

With the metal parts soaking, you can start to inspect and correct.

The commutator has a low spot. This usually means it must be replaced.

The shaft is decent, the threads are fine, and the area where the seals rubs does not have a groove in it.

Measuring across the commutator found several segments reading high.

A Dykem paint pen notes the 17 kΩ reading, it should be closer to 1 Ω.

Armatures with ruined bearing surfaces. Left and middle are obviously bad, even smooth wear on right is unacceptable.

Recheck the field coil resistance. It should be between 5 Ω and 6 Ω for 12-volt units.

For such low resistance measurements, you can measure the leads and subtract.

A collection of frames shows factory and aftermarket terminals and coils. The air gap between the armature is critical.

This is where that paper washer gets cut and kills the generator.

Brushes are often OK, a new set is $11. Don't put them in solvent or wash them.

They say never to put a ball or roller bearing in solvent. I might be tempted, and then oil with 60-weight or lithium grease. It gets lubed with engine oil in the bike. Some aftermarket generators use sealed bearings, but this one has a shield one side and open the other. The open side goes towards the gear, the ball bearing is lubricated by engine oil splashing in from the gear case.

Assembly

Since this is a Harley generator frame, I want to build it with steel end bells. What came apart is on the left, a steel setup is on the right. I used the bearing and seal from the old aluminum end bell. Note a steel end bell does not use that springy clip "tolerance ring" around the bearing. Also the bore of the steel end bell is smooth, no step for that clip.

Install the inner snap ring. Put the sharper edge of the snap ring away from bearing. No ring spacer is used in a steel end bell, only aluminum aftermarket ones. There are three long bolts to choose from to replace the missing bolt. Since this is "on the cheap" I reused the best bearings and seals from the two end bells.

Anti-seize helps the bearing slide in.


A 1-inch socket works to drive in the bearing. Drive against the outer race, not the inner race, that hammers the balls. Sometimes you can't avoid it, like when tapping out the armature.


Install the outer snap ring. Face the sharper edge of the snap ring away from the bearing. This is probably not critical, just a personal quirk of mine.

The same 1" socket drives the seal in.


The old aluminum end bell on the left, the steel bell on the right. Be sure to wipe some oil or lithium grease on the seal and in the bearing.


I had three loose bolts. You can see the serrations under the head that are supposed to stake the bolt into the end bell.

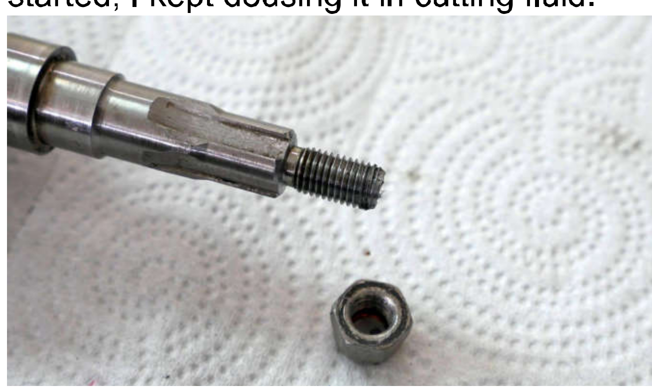
The old armature on the bottom had several commutator segments that measured 17 kΩ. The top armature has black wires, perhaps overheated, but the bearing surfaces and seal surface are pristine. Commutator measured ~1 Ω ohm

Only problem with the chosen armature was the threads were mashed.

Carefully sand the mashed part off with a belt sander or a file or a grinder. Try to leave a lead-in angle about the same as the die you will use to clean up the threads. It took a couple tries to get it right.

I set the die against a surface plate so I could push against it. One hammer tap on the armature shaft seated the die.

Tap Magic is great stuff, Once I got the die started, I kept dousing it in cutting fluid.



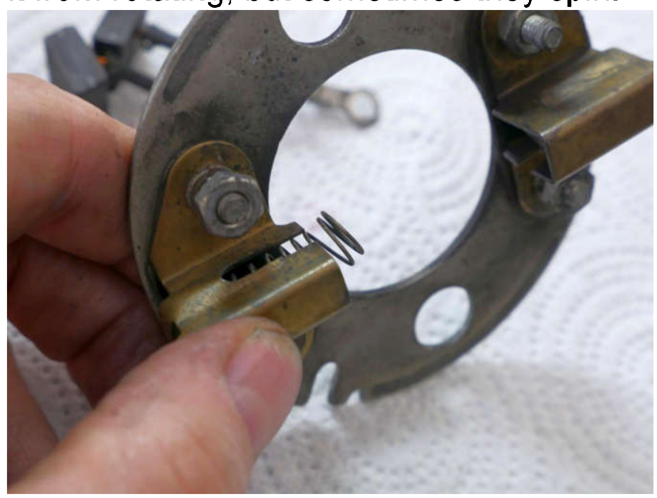
The new thread is not perfect, but it works well enough. If you are lucky, you might find an armature like this cheap at the flea market, and then be able to save it. Beware, most used armatures are burnt.

Put lithium grease or oil where the seal runs, anti-seize is where the bearing presses on. Grease would work on both.

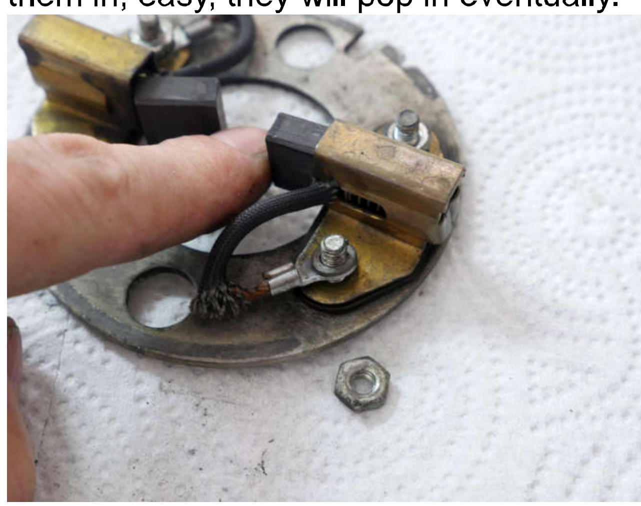
A 9/16" socket drives the inner race of the bearing onto the shaft. Don't hammer on the armature shaft.

The frame has a roll pin for end bell hole.

Some blue Loctite on the bolt should keep it from rotating, but sometimes they spin.

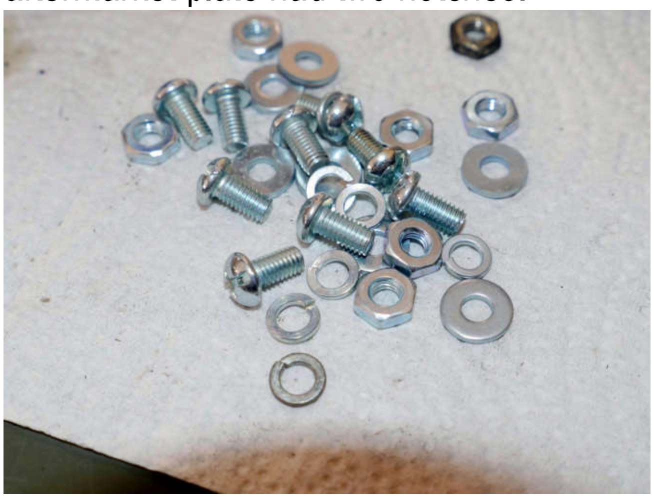


The brush springs kind of tilt as you push them in, easy, they will pop in eventually.

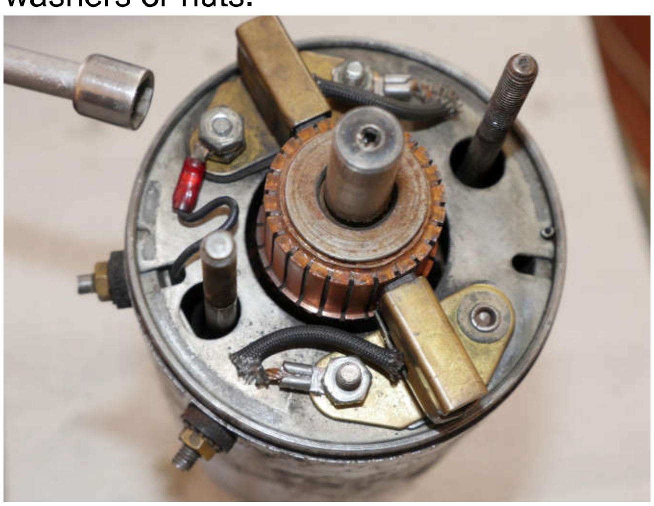


Brushes should slide smoothly. Wire goes in at back of the brush. Replace the #10 lockwasher. A 3/8" nut-driver snugs things.

Another roll pin fits the plate. This aftermarket plate had two notches.



For less than a dollar, you can get some #10 hardware so you can replace lock-washers or nuts.



With two notches I put the plate in wrong, and had to rotate it for the armature wire.

The aluminum end bell on the left has a tiny O-ring seal inside the needle bearing.

Make sure the socket fits the bore, and drive in the seal. This seal is rubber on the outside, so I did not lube it. I had a seal pop out once on my 1962 Sportster.

I like to drive the seal a little below the surface. If there is a groove worn in the shaft from the seal, put the seal where it misses the wear groove, preferably a little further in rather than hanging out.

Note that roll pin also aligns the needle bearing end bell.

You can trial-fit the end bell to see if you can drive the needle bearing in a bit more.

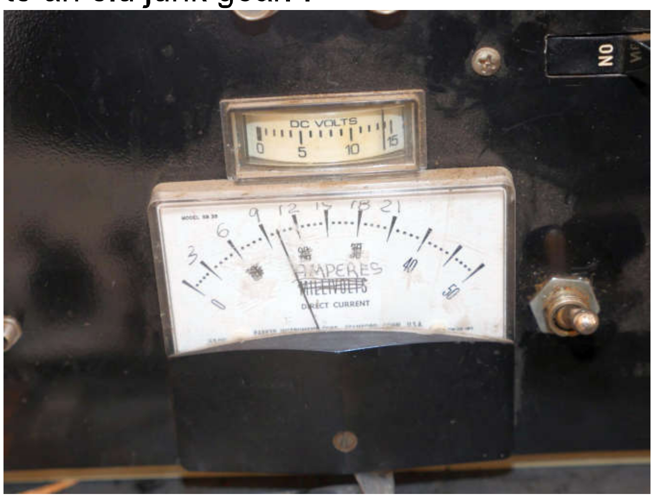
I replace the 1/4-28 UNF prevailing torque Nyloc nuts with a flat-washer, lock-washer, and free-running nut. Just my preference.

I bolted on the gear and the generator was bound up tight, no spinning it. Turns out the oil shield was too recessed, and the gear would press the shield into the end bell. Shield on the right extends more towards the bearing and solved the problem. Aftermarket parts are different.

I rather use pliers than an impact, my preference. With anti-seize on the armature threads, I want to feel the torque.

The 10-32 terminals needed cleaning up with a cheap die. You can flip it over to chase the threads all the way to the nut.

Thanks to a YouTube comment, I realized I could drive the generator in my test rig with a 1/4" drive setup to a socket welded to an old junk gear. .

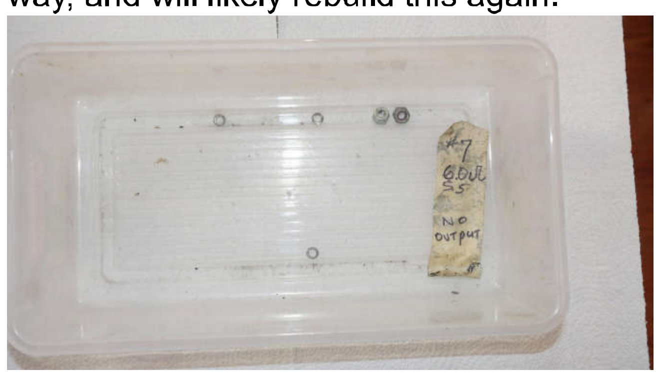


Even with all used parts, the generator puts out 10 Amperes at 14 Volts, perfect.

I replaced the straight-slot screw on the brush cover with a Philips-head. It's a pain since you need two tools to loosen the bolt. A clip nut (U-nut) would be ideal here.

I snug the brush cover on, where the gap is over solid metal, not the brush opening.

All done and ready for service. I did not paint the generator since this was for demonstration only. I could lay down some primer and gloss black even after it is all together. I have new armatures on the way, and will likely rebuild this again.



The bin helps keep track of the work. There are the three #10 lock-washers from the brush plate that I replaced, as well as the two 1/4-28 prevailing-torque nuts I replaced with plain ones, lock-washers and flat washers. The old label gets changed from "No output" to "Works fine"