

Coping with Broken Studs, Bungled Threads, and Busted Bits

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Over the years, we all pick up a few ideas regarding broken studs, bungled threads, and busted bits, and thus many of these may be familiar. Yet I hope something here will be of some use to someone. Most of these ideas refer to working with steel bolts embedded in aluminum housings.



Where did some of these ideas come from? Necessity is the mother of invention. As my brother teasingly put it, “He’s made every mistake that can be made.” Other ideas came from friends and colleagues.

Tools you will need: side cutters, vise grip, plenty of sharp right and left hand drill bits of various sizes, impact driver (it twists when hit), dies cut in half, tiny cutting wheel on die grinder, sturdy center punch with blunt tip, bolt cutter, nut splitter, sharp punch. Also, always use cutting fluid when drilling, tapping or using a die. It goes faster and prevents overheating and dulling of the tip.

There are many reasons for tightly threaded fasteners. They might have thread locking compound, corroded aluminum/rusted steel, crossed threads, galled threads, or stripped threads. Sometimes the threads are fine, but the bolt is just really tight. These differences become important as we will see later on.

In order to prevent further damage if bolts and nuts resist normal removal, keep in mind the following:

- Grab the head of the screw with side cutters held vertically. This allows more grip and force.
- Use a bolt cutter or nut splitter to cut the nut. If you are careful, you can preserve the bolt it is on.
- Some copper terminal bolts or rotor shafts have seized nuts on them. Shave two sides of a nut off with a cutting wheel (be careful not to

touch the bolt threads). Break the nut pieces free. Once you have the hardware off the bolt, use the two halves of a die and rejoin them on the good portion of the threads. Then put your die handle on to work upwards, restoring the damaged threads. This is sometimes easier than trying to get a regular die to ‘catch’ in the right way on damaged threads, working down.

- With a cutting wheel, cut slots in the bearing or bearing race so that your bearing splitter can grab it.
- On some Nippondenso alternator brush holder Phillips screws, sometimes the Phillips head gets stripped out, and/or the screw is rusted into the regulator or rectifier. Drill counter-clockwise until your drill bit grabs and backs the screw out, or until the head comes off. Sometimes the threads are loose underneath once the tension is off. But if you got the head off the screw, you can disassemble the alternator and get the broken stud out into the open better. Then use side cutters to grab the stud and turn it out.
- Use sharp new Phillips bits. I use a fat handled multidriver to give more leverage for my grip, and I can replace the bits often instead of buying a whole new screwdriver each time. All Phillips bits are not created equal. Some have a different taper to them. I sometimes grind a bit off the tip so the Phillips shape will fully grab instead of the point bottoming out and preventing the screwdriver from engaging properly, causing more screws to strip.
- Preheat screws, housings, and bearings frozen in housings. Aluminum expands more than steel at a given temperature.
- Soak in pail of water. Rust is created in the presence of water, so water will loosen old tight rust. In fact the wet rust is even a kind of a lubricant preventing galling.
- Loctite or Permatex will loosen its grip with heat—see your spec sheet. A torch with a built-in igniter saves fuel because it’s only on when you need it.
- On alternators and starters with

Phillips fasteners, clean the gunk out of the Phillips head before attempting removal.

- Some alternators have the through bolts exposed over the stator—Ford 1G and 2G for example. Cut through these so they will release the housings, but so you have a nice long stud to work with when you are ready to work it free. Can’t get at the one under the long spool with your cutting wheel? Gouge it through with a die grinder bit. All of this is to avoid snapping it off flush with the housing and then having to drill it out.
- Sometimes if a screw head is damaged, cut a slot in the screw with your die grinder. Then use a flat screwdriver on it. This will work on any kind of head, including some broken studs.
- Sometimes when working on rusty marine starters, I cut the heads off the starter through bolts rather than risk snapping them off too short inside. Once everything is apart, you can apply heat, penetrant, or whatever, but again, at least you have something to grab onto.
- Some Bosch alternators have the through bolts sticking right through the back of the housing. Use a thread chaser on these before attempting to remove the screw if those threads look damaged. This will prevent the damaged threads from advancing into the aluminum and galling it.
- Often it works to use a sharp punch to drive the screw head around bit by bit if the head has been mauled too badly to receive a screwdriver.

Field Pole Screws

To illustrate this next concept, there once was a farmer with an unusually stubborn mule. He finally put the mule up for sale, claiming it was a very obedient and compliant one, and his neighbor bought it. As soon as the neighbor had hitched it to the hay wagon, he realized he’d been tricked because the mule refused to budge despite everything he tried.

Frustrated, the neighbor called the farmer and said, “You told me this was an obedient mule. I can’t get it to do

anything.” The farmer replied that he would come over and take a look. On seeing the mule and the wagon, the farmer took a two by four, and with everything he had, walloped the mule on the back of the head. Then he said, “Giddap.” The mule obediently proceeded. The farmer explained, “Of course the mule is obedient, you just have to get his attention first.”

All that to say you can remove field screws by hand with a simple screwdriver if you get their attention first. On an overly tight field case or solenoid screw, use a large hammer and punch down the center of the head with a blunt punch specially ground so it doesn't damage the Phillips shape. This will stretch the bolt, loosening it.

After that, they usually come out easily, and you don't even have to break any bits doing it. If it turns out that the threads are wrecked, you can drill into the head with a bit slightly bigger than the shank of the screw so that the head will pop off when you get deep enough. With the headless stud sticking up after the other hardware is all removed, you have plenty of access to grab it with vise grips and work it loose. This method also works with Bosch solenoid screws too, but of course you have to use a smaller punch.

Try these cure techniques when broken stud is loose:

- Flip the housing over and drill. This would then be counterclockwise, and when the bit grabs, the screw will feed right through. In some cases it doesn't matter if you make a 'blind' hole into a through hole, and thus save yourself some time.
- Drill two small holes in the stud, and slice a flat screwdriver so it has two tips, then unscrew the stud.
- Cut a slot into the stud. In some applications it doesn't matter if you go a little bit into the aluminum, then use a regular flat screwdriver to back it out.
- Weld a rod onto the stud, bend it into an 'L' shape and back it out. Be careful not to arc the aluminum.
- If your drill press is not reversible, you can 'cheat' by putting a half twist in the belt.

Try these cure techniques when

broken stud is galled:

- With a sharp center punch, punch dead center and make sure your drill press table is exactly perpendicular.
- To decide on the size of the bit you will have to use, take a bolt of the same size as the broken one, and hold it up to the light with a drill bit in front of it. Only the threads on the bolt should be visible.
- Then use a smaller bit to drill a pilot hole. This bit should be the size of the bigger bit's web. If you drilled your stud off center (aluminum is softer so the drill bit might wander), don't feel bad, using a helicoil requires an oversize hole anyway.
- Chisel the crescent shape out if it is at all loose, but if it is completely galled, it may be OK to leave it. When you run your tap into the hole to make new threads, if the old bolt piece moves, you might pinch the tap, and then get into more trouble, so watch out! If the hole is too big for even a heli-coil, consider using an insert.

Try these cure techniques when stud is rusted:

- Work stud back and forth, working in the penetrant as you go. This will reduce galling.
- If a steel stud is broken off in a steel housing, or a steel nut on a steel shaft, heat both red hot, then remove with an air tool while hot.

Alternately, you could quench it with water before you unscrew it. The water acts as a loosening agent on the rust, while the heat activated the dried out rust.

Joe Davis posted this one on the Electrical Rebuilder's Association Web site a couple of months ago. Punch the screw through, threads and all, supporting the housing from behind with a piece of steel that has a hole in it to receive the stud. Then tap the hole for an oversize screw, or install a heli-coil or insert.

Try these techniques when your drill bit, extractor or tap breaks off in the hole:

- Has it ever happened to you where the drill bit broke off inside the broken stud, and you know if you could grab it and work it back and forth you could get it out? Take a drill the size of the broken stud, and

cut an eighth-inch slice out of the web of it with a die grinder so it's like a two-tined fork. The slice should be a little wider than the broken drill bit diameter. This will behave like a circle cutter to trim back the broken stud enough so you can grab the broken drill bit with needle nosed pliers. Go gently, your drill bit has been weakened.

- Use a plasma cutter to zap the old steel stud out.
- If the hole is too badly egg shaped or ruined to put a fastener in, fill in the hole with aluminum welding, and then resurface the outside, drill a new hole, and tap it. Some say you could use a metal mend epoxy, but I don't trust that method too much.

Miscellaneous Ideas

- Everyone has their favorite penetrant. I prefer to use methods which don't require me to wait a long time.
- Glass beading causes a lot of problems with threads. Blow the dust out of all threaded holes. Stick a little screwdriver in a blind hole to make sure the hole is clean right to the bottom. Use a little grease on the screw to keep it from galling on the newly cleaned surface. In some cases, you can make an ordinary screw into a self-tapping screw by simply cutting a little diagonal slot at the tip of it with your die grinder. When you install the screw, work it back and forth, like you would a tap.
- Saw the terminal bolt off just below the damaged threads, and then put an extension stud on. We used to use these on the old Ford starters.
- Use a thread file or a thread chaser.
- I have bought some rotor shaft thread dies from Dick Vensel. They do a great job. Again, if the shaft is too badly damaged right on the end to get a good start, cut the die in half first, combine the halves on the good part of the threads, put your die handle on them, and then work up over the bad threads.
- If you have to repair brush holder insulators, you can remove the brush holder rivet heads with a 6-inch cutting wheel, which fits nicely in between all the other hardware.

Then, with a proper backing support, punch the rivets through.

Of course, we would all be happier if we didn't need to use any of these methods, but if the world was perfect, then things could all be done by machine, and they wouldn't need you or me. Even if you are in a hurry though, you will probably save time with the prevention methods if a screw is overly tight.

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