Motorcar Teck-Talk with Dick & Ron

When the Bolt Breaks Off . . .

This internet exchange was initiated by an operator who decided to replace a rusty bolt one day.

"Dummy (me) just was working on my M9-F out in the garage, drained the water, replaced the coil and plug, and noticed that the bolt (one of 4) that is on the bottom of the spark plug area of the engine (RO B #103579) housing was rusted, and so I thought I'd replace the 4 nuts with stainless ones—took the impact wrench to the one in the 9 o'clock position and removed it—only the bolt/stud broke (!) with the nut still attached, leaving the lock washer that was underneath it and the broken stud in place.

Should I leave well enough alone and go no further? Would it be safe to start and run it now to warm it up and then take it on a 55–mile run this week? If it does not leak, should I never touch it again, or should I stop everything and replace the bolt with (?) something (source ?) and the other three at the same time, and if so how do I remove the others? Do I have to remove the engine from the car to do it? Should I just take it to my friendly machinist?"

Dick Ray responded with little optimism:

The good news was that we know exactly what the problem is. The bad news is that it is very expensive to fix.

I have never removed a broken bolt successfully. Always optimistic though, I keep looking for the elusive reverse rotation drill bit as the magic cure. I get Easy–Out kits for Christmas and I have the unused portions of all of them left. Recall that the literal translation of Easy–Out is: "Extremely hard device which is inserted into the proper size hole and rotated until it snaps off flush with the surface in order to prevent anyone from attempting to ever put a bolt into that hole again."

I think it is time to take it to a professional. Even then if he shakes his head a little it is time to start backing out of there with the excuse that you have to pick up the kids from soccer practice. On the other hand if he says, "No problem man," it may be time to: a) sell some of the Microsoft stock to finance it if he knows what he is doing, or b) look for another engine if he does not know what he is doing.

If you must do it yourself there are some ways to improve your odds. Before starting you can help the nut release by soaking it in Kroil or PB Blaster. Liquid Wrench used to be good, but they changed the formula. Then heat and tap on the nut with a hammer to break the rust loose. Repeated treatments over several days will help. Putting a box wrench on the nut, taking up the slack and then tapping the wrench can help break the nut loose. When it comes loose work it back and forth with penetrating oil or other oil (Not WD-40).

The only good news here is that you have learned a lesson the hard way. Some never learn, thinking that enthusiasm in the form of an air wrench, is the best approach. Repeat after me, "IF IT AIN'T BROKE DON'T FIX IT." (This does not apply to maintenance procedures.)

Ron Zammit has had the same problem with a head stud and solved it with the following time–intensive and probably expensive procedure:

There are plenty of frustrated dummies, and I'm in there with you. My original car, a M-19, had–still has–a knock or tap. I now know it is piston slap from a worn engine, but, long ago I thought it was rod knock. I adjusted the big end via carb opening, then decided to pull the piston. Bad deal! One of the head studs broke off level with the block.

I had to remove the engine via the top of the car and haul it around town. I finally found a person who would look at it. He removed the stud with an electric discharge machine. The new stud fit loose, so I had to J–B weld it in. I used Never Seize on the new one to put the nut on.

Guy Lynn offered the following advice on a similar problem. Notice that he recommends pulling the engine:

I have found that a nutcracker (as in metal nut) helps avoid many of the broken stud problems associated with old engines. Also heating the nut will cause it to expand and may break the rust seal to the stud. After you get the nut off carefully inspect the base of the stud before trying to remove the stud.

I once got the broken studs out of an RO–C

hopper around the condenser and on the bottom petcock plate of the same engine. I managed to snap off all but one of the studs on the condenser. With the condenser off I noticed that there was about 1/2 inch of stud showing inside the hopper. I simply heated the broken end of the stud (and surrounding aluminum) and cooled the whole mess with WD-40. [Don't do both at the same time unless you are trying to set everything on fire and collect the insurance money if you live. RCR] I was able to reach the backside of the studs with a pair of channel locks and twisted the studs out through the inside of the tank. I chased the threads out with a tap and installed new studs.

In the case of the bottom petcock plate, I did not follow the proper practice and did it with the engine in place. Next time I would pull the engine and do it on the bench. I used a flat file on the remains of the one stud that snapped off and flattened the stud flush with the surrounding metal. I carefully center–punched the stud, then drilled out the stud starting with a 1/16–inch drill and worked my way up through the index. (Don't skip any bits to speed up the process). Keep the drill bit parallel in all aspects to the stud. You also must know what the ideal tap drill is for the threads on the stud. Do not exceed the tap drill diameter. As you drill with each larger bit, the stud will heat up and possibly loosen. In some cases the stud will screw itself into the engine without any additional work, or if you have a set of left–handed drill bits, it will screw itself out of the engine.

If the remains of the stud are still there when you reach the tap drill, then you already have the hole drilled to the proper size. You can try to collapse the remains of the stud with a sharp center punch or a small chisel. If that fails, go ahead and try to tap the hole out. If that works, simply install a new stud. If the stud is loose, you can mount it with J–B Weld. In extreme cases you may have to have a HeliCoil installed. In my case I installed the new stud with Teflon tape and have had no further problems with it.

You can get studs from:

Suburban Industries, Inc.
1090 E. Green St.
Franklin Park IL 60131
Ph. (630) 766-3773 FAX 1364

Use stainless for greater strength and less corrosion if you think the car may outlive you. You want to specify a Class 5 or 5A fit into the block which is an interference fit, so it will stay in the block. The other end—which might have to be fine threaded—wants to be a 3A fit. Use blue Locktite on the block threads unless you get a really good fit. Do not use red Locktite unless you have a poor fit and loose threads. If you have to buy a whole box of studs, simply package the excess up and bring it to meets. Many owners will buy a set and put them in stock for the future. [Or just send them to me for Y2K compliance inspection and safekeeping! RCR] A proper torque for head studs is around 30 foot–pounds to start if you have a good gasket. If leaks occur, carefully go up to 50 foot–pounds maximum.

OK now where does one get the special tools? Left handed drill bit sets are listed in the Northern Tool and Equipment catalog for $25 to $55. Some say that individual bits are available at any good tool store. Another item found at good tool stores is diamond tipped bits for a Dremel tool. These are useful for removing the broken Easy–Out or grinding the end of the broken stud flat, and cost about $10 each. Nut splitters are a common item at J. C. Whitney at about $10.