

Willcraft

Model p07030 BMW

Stud repair tool kit

WILLCRAFT Stud Tool Instructions

These instructions are intended to guide an experienced mechanic or machinist in the proper use of the WILLCRAFT Stud repair tool. Since WILLCRAFT has no ability to control the use of this tool or the competence of the user, we cannot be liable or responsible for the outcome of its use. Read the instructions through completely before beginning the repair.

1. Remove the stripped stud by “double-nutting” it as shown in Figure 1. Do not use pliers or Visegrips on the stud.



Figure 1: Removal of stripped stud.

2. If the stud has been previously Heli-coiled, remove the Heli-coil. Sometimes this is best done by grabbing the end of the coil with needle-nosed pliers and twisting it out. It must be removed before proceeding.
3. Mount the WILLCRAFT Stud Tool body to the side of the case using two diagonally opposing studs as seen in Figure 2. Use flat washers at both ends of the

green tubes, and use head-nuts to snug the tubes, and thus the tool body, to the case. Don't over-tighten the nuts; snug will do.



Figure 2: Proper WILLCRAFT Stud Tool installation.

4. Wrap a piece of light-colored tape around the 12.5 mm drill bit, 58 mm back from the tip. You will need to drill the existing hole out to a depth of ~38 mm, measured from the face of the engine case. The left side upper front hole is blind at that depth. The right side upper front hole is through into the interior of the case. In either case the hole should be drilled 38 mm deep. Since the WILLCRAFT Stud Tool with the drill bushing installed is 20 mm thick, wrap the tape on the drill bit at 58 mm as seen in Figure 3.



Figure 3: Place a tape marker on drill bit 58mm from tip.

5. As shown in Figure 4, insert the .4925" drill bushing into the WILLCRAFT Stud Tool body and rotate it until it locks in place. Using an electric hand drill and the

12.5 mm drill bit, which has small flats ground on the cutting edge of the drill flutes to prevent grabbing, drill into the engine case until the tape touches the face of the drill bushing. The helical flutes of the drill will eject chips to the rear as you drill. However, on the right side of the engine where the stud hole is through into the case interior it is prudent to place clean rags inside the case to catch any stray chips that are pushed forward. It is best to drill with some cutting fluid such as a light oil or even **WD-40**, sprayed into the hole while drilling.

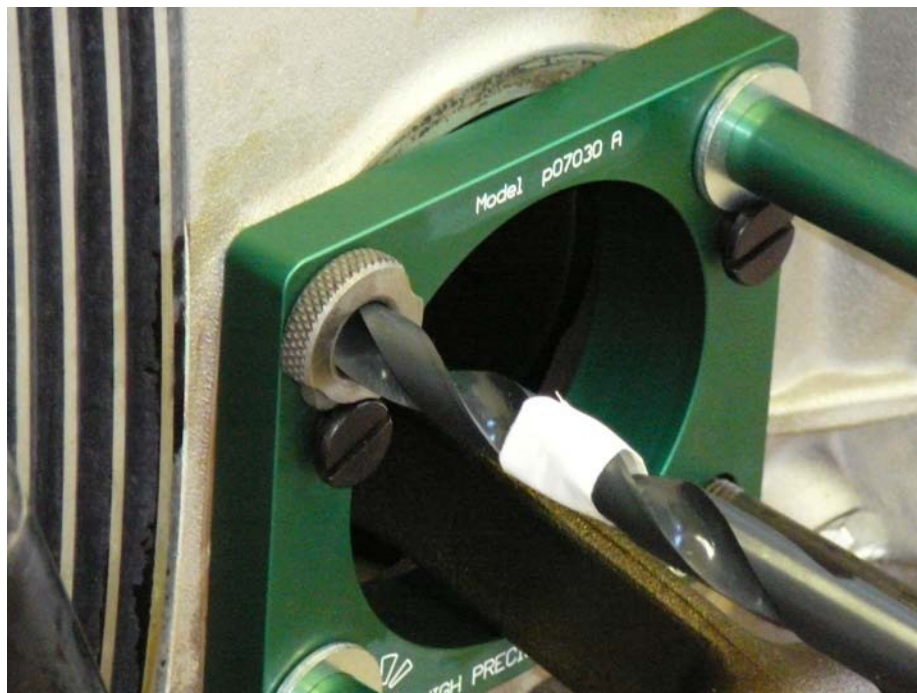


Figure 4: Drill pilot hole.

6. Remove the drill and the .4925" bushing, then vacuum out the hole and the surrounding area. DO NOT BLOW with compressed air. SUCTION ONLY!
7. Pack the flutes of the M14 x 1.5 mm tap with grease. The straight flutes of this tap will not eject the chips rearward as the drill flutes do. It is important to capture the chips that are created in the tapping operation so they don't fall into the engine (right side especially). Insert the .5610" drill bushing into the WILLCRAFT Stud Tool and use it to guide the M14 tap to thread the hole as seen in Figure 5. Again, using cutting fluid greatly helps the process. WD-40 works well, or a light application of some light oil is fine. This will tend to dissolve the grease in the flutes of the tap, but not so much as to be a problem if you use a light application of oil. Straight-flute taps require that you back off the tap every half-turn or so to break the chip. Continue to tap the hole to the bottom. This will create enough complete threads to accept the threaded insert flush to the face of the case.

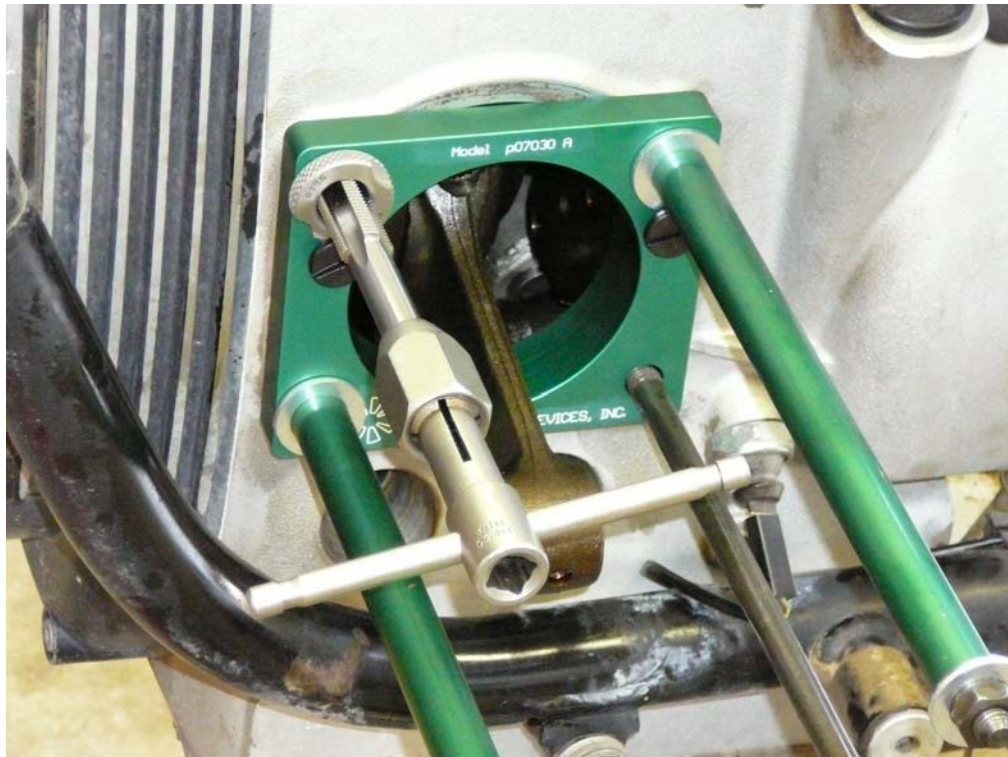


Figure 5: Tapping the hole.

8. Remove the WILLCRAFT Stud Tool from the engine case and clean the hole in the case fastidiously. First use solvent and a small brush, then vacuum out the hole, then more solvent, then finally some acetone or lacquer thinner (not paint thinner, which leaves an oil residue). Vacuum it out, too. The threads in the case need to be very clean if the Loctite that will hold in the threaded insert is to be reliable. All the while you must be careful not to get chips inside the crankcase. Clean, clean, clean!!!
9. Mount a threaded insert onto the head stud as shown in Figure 6 and illustrated in Figure 7. The head stud should be inserted shy of the end of the threaded insert by several threads, as shown in Figure 6, and not all the way flush with the end (this prevents extra Loctite from prematurely locking the stud to the insert). Note that the internal threads of the insert are counter-bored about 7 mm on one end. This is the end that will face out away from the engine centerline when the insert is installed. Snug the insert with the washer and head nut onto the head stud. It needs to be tight enough that the insert can be threaded into the case, using the stud as a handle. Test the assembly of the insert into the case by running it into the newly-threaded hole. The insert must go completely into the case with the counter-bored end of the insert perfectly flush with the face of the case. Using the washer in the assembly, as shown, lets you run the insert into the case until the washer butts on the face of the case. Un-thread the insert from the case and again verify that everything is spotlessly clean and oil-free.

To fix the insert in place use **Loctite 262 permanent threadlocker** (or equivalent such as **Permatex Red threadlocker**), but not a removable threadlocker in any case). **Loctite 262** may be purchased from McMaster Carr company (609-6893415 or www.mcmaster.com). Their part numbers are:

0.02-oz. (0.5 ml) Capsule	p/n <u>91458A560</u>	\$1.70 or
0.34-oz. (10 ml) Bottle	p/n <u>91458A170</u>	\$12.39

Squirt an ample bead of threadlocker all around the outer end of the female thread in the case. That way, when the male threaded insert is threaded into the case, the excess threadlocker will precede the insert, coating the inside of the female thread and thus the threaded joint (if you were to put the threadlocker on the male thread, the excess would be squeegeed back along the male thread, starving the inner part of the joint and making a big mess on the outside).

Now, using the stud as a handle, thread the insert into the case until the washer comes flush with the face of the case. Snug it up gently, then leave it alone for about an hour, during which time the threadlocker will take an initial set. After an hour you may come back and break loose the head nut securing the insert, then carefully unscrew the stud from the insert. Using a small straightedge check that the end of the insert is truly flush with the face of the case. It is best to leave the assembly at this stage for at least another hour or two to ensure that the threadlocker has cured enough that subsequent steps don't upset the insert.



Figure 6: Installation setup for threaded insert.

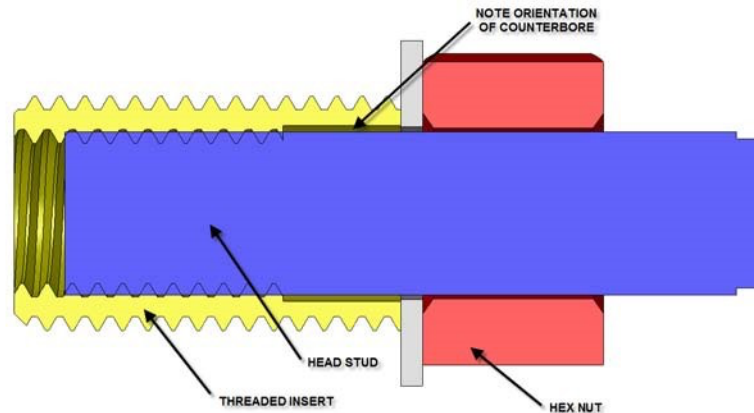


Figure 7: Schematic of threaded insert install setup.

10. This step and the next one concern the re-opening of a blocked oil passage when repairing a pulled upper stud. The oil to lubricate the rocker gear is supplied by an oil gallery in the crankcase that feeds the area surrounding the two upper studs via angled passages that intersect the stud bores. This passage will be blocked by the new threaded insert and must be drilled through after the new insert is installed, otherwise the rocker gear will be starved for lubrication. Remove the stud directly below the repaired one. Re-mount the WILLCRAFT Stud Tool to the face of the engine using the two remaining studs to hold the tool in place as shown in Figure 8. It is only necessary to snug the tool in place for this operation. Don't use excessive force.

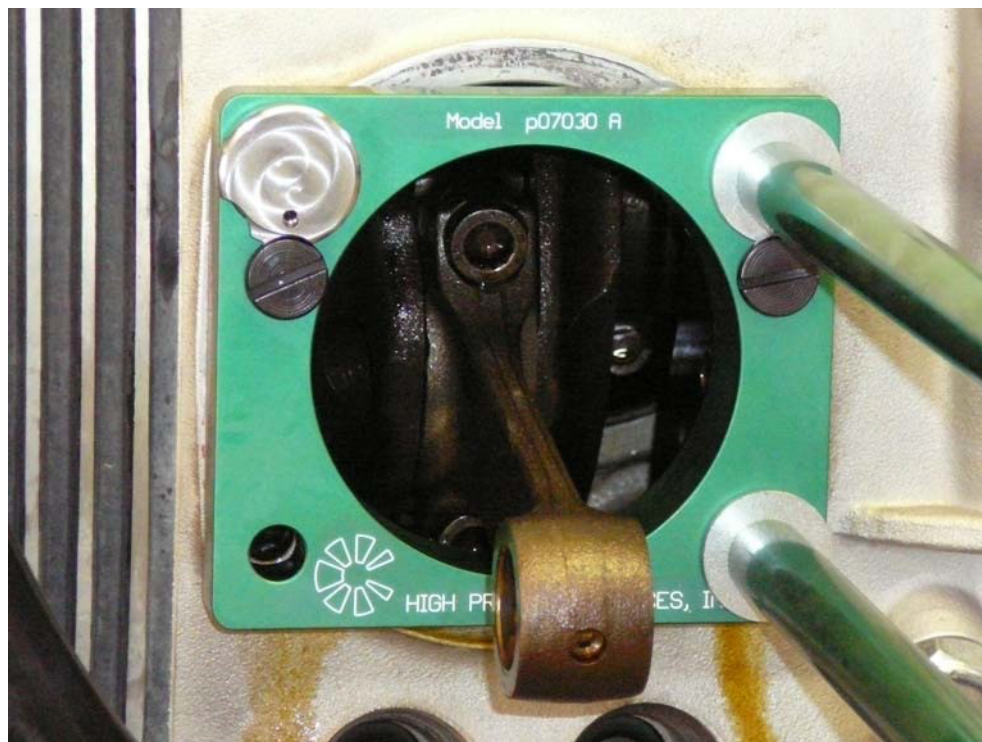


Figure 8: Mounting configuration for oil passage drilling.

11. Install the special angled-hole drill bushing into the WILLCRAFT Stud Tool body as seen in Figure 8. This bushing, when rotated clockwise into the locked position, aligns a 2.5 mm bore with the oil passage in the crankcase (now obscured by the new threaded insert) as illustrated in Figure 9. Hold the drill bushing in the clockwise, locked position, and using the 2.5 mm drill bit, drill up into the case until the oil passage is penetrated. If available, a small right-angle electric hand drill may be used for this operation avoiding the need to remove the bottom stud. Again, this passage provides oil to the rocker assembly, which travels along the head stud through the cylinder, through the head, and into the rocker assembly. This oil passage hole must be drilled or the rocker assembly will be starved for oil and will be damaged.

Clean everything well using a vacuum and solvent, then acetone or lacquer thinner.

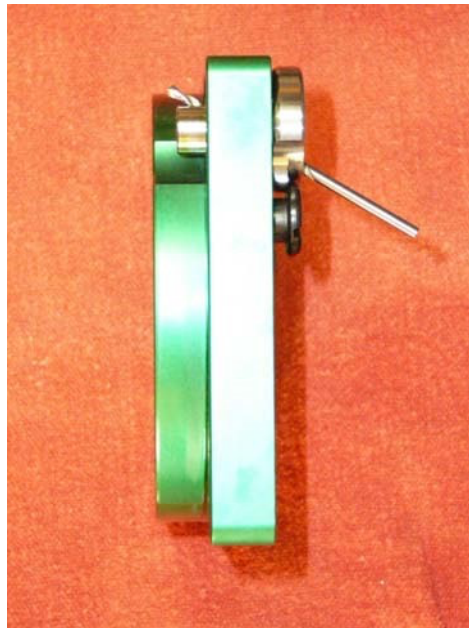


Figure 9: Oil passage drill setup.

12. Now reach into the female threads of the threaded insert and apply a ring of threadlocker with a toothpick or match stick. Double-nut the head stud and thread it into the new threaded insert until the stud extends from the face of the case the same distance as the other studs (approximately 10" or 254 mm). It doesn't need to thread in until it's tight; the threadlocker will prevent the stud from unscrewing once it has cured. To hold the stud perpendicular to the face of the case while the threadlocker is curing, slip a flat washer over the stud, then a green tube, then another washer, and finally a head nut as shown in Figure 10. Finger tighten and leave it in place for one or two hours.



Figure 10: Installation of head stud.

13. Before reassembling the engine, clean the face of the engine case to remove any threadlocker that has seeped out of the threads. The base of the cylinder must sit perfectly flush against the face of the case so that oil doesn't leak out. Now reassemble the engine in the normal manner, tightening the studs to the recommended torque of **25 ft. lbs. maximum!**
14. The WILLCRAFT Stud Tool comes with two (2) high-strength aluminum threaded inserts. More inserts may be purchased at any time from WILLCRAFT.
15. Have fun. Ride safe.