

DRILL-OUT®

MICRO POWER EXTRACTOR

WARNING: To prevent serious eye injury, always use protective eye wear when working with or near cutting tools.

CAUTION: To prevent personal injury or product damage, read all the following instructions before first use of this tool.

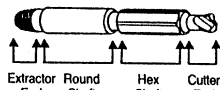


Figure 1 - Extractor

1. Obtain a corded or battery powered variable speed reversible power drill (1/4" or 3/8"), and set and keep it in **reverse** (counterclockwise) for all extractor operations. **Note:** Impact or high horsepower drills may damage extractors.
2. If you are sure of the screw size, choose the same size extractor. If you have to measure the screw diameter, use the table below to choose the correct extractor.

Screw Diameter (Inches)	Micro Extractor Size
.11 - .14	#5, #6 M3
.15 - .17	#8 M4
.18 - .21	#10 M5
.22 - .26	1/4" M6

3. Unplug drill. Insert round shaft into drill chuck and tighten chuck jaws securely. See Figure 2.

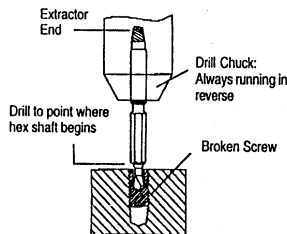


Figure 2 - Drilling

4. Plug drill in. Make sure drill is set to reverse.
5. Place tip of cutter on the center of the broken screw and begin drilling at very low speed, approximately 70 to 100 rpm. When drilling, never let cutter revolve against the bolt without cutting.
6. After you have started the hole, stop drilling and make sure that you are drilling into the center of the broken screw. If you are not centered, angle the cutter tip toward the center of the screw and drill until the hole is on center. **The most important concern in extracting a broken screw is to drill the hole on center and straight.**
7. Once you are satisfied you are drilling on center, hold the drill parallel to the axis of the broken bolt and continue drilling at very slow speed. **DO NOT** drill at medium or high speed.
8. Stop drilling every 10 seconds, or 1/16" (2mm) of depth, to clean out chips and add cutting oil to hole. Verify each time that you are drilling on center and straight.
9. Stop drilling when you reach the point where hex shaft begins.
10. Clean out chips from hole and apply penetrating oil around the edges of the broken screw to help loosen it.

11. Unplug drill. Remove the extractor from the drill chuck, turn it around, insert hex shaft into chuck jaws and tighten securely.
12. Plug drill in. Holding the drill firmly with both hands, place extractor end into the drilled hole. Apply pressure to wedge the extractor end into the hole. Then slightly touch down on the drill trigger while applying pressure toward the broken screw—the screw is automatically extracted!

See Fixture 3. Use **only extremely low speed** when extracting, approximately 30 to 70 rpm.

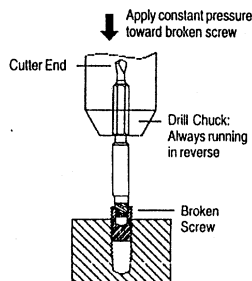


Figure 3 - Extracting

13. To remove extractor from extracted bolt, firmly tighten screw in a vise. Using a wrench on the hex shaft, remove the extractor by turning it **clockwise**.
14. If drill stalls during extraction, hand removal of bolt is possible.
 - a. Leave extractor lodged in bolt, loosen chuck, and remove drill from extractor.
 - b. Look to see if you have drilled exactly on center. If so, use a wrench on the square collet head. Turn it **counterclockwise** to remove the broken bolt. **Do not** apply excessive force, or you may damage the extractor.
 - c. If you get a lot of resistance when turning the wrench, you may have drilled off-center, and the extractor cutter is biting into the surrounding metal. You may be in an impossible situation. If so, remove the extractor by turning the wrench **clockwise**.

Helpful Hints:

- Before drilling, center punch screw to help loosen it.
- Use penetrating oil or heat before drilling to help loosen rusted or chemically bonded screws.

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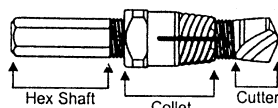


Figure 1 - Extractor

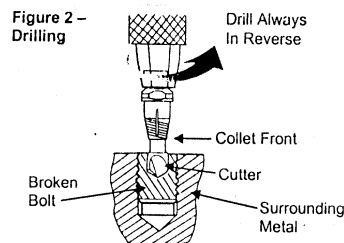
1. Obtain a corded 3/8" variable speed reversible power drill, and set and keep it in **reverse** (counterclockwise) for all extractor operations.

2. Measure the diameter of the broken bolt to determine the extractor size required. For example, if the broken bolt is 1/4" or 6mm, use the 1/4"-M6 extractor. **Note:** Impact or high HP drills may damage extractors.
3. Unplug drill. Insert hex shaft into chuck. Tighten chuck jaws against hex shaft flats. Jaws should enclose entire hex shaft **only**. **Do not** allow jaws to close beyond hex shaft flats.
4. Turn collet back against the drill chuck.
5. Plug drill in. Make sure drill is set to reverse.
6. Place tip of extractor cutter on the center of the broken bolt and begin drilling at the suggested speed listed in Table 1. When drilling, never let cutter revolve against the bolt without cutting.

Table 1 - Drilling Speed

Extractor Size	Speed
1/4" - 6mm	Low to Medium
5/16" - 8mm	
3/8" - 10mm	
1/2" - 12mm	

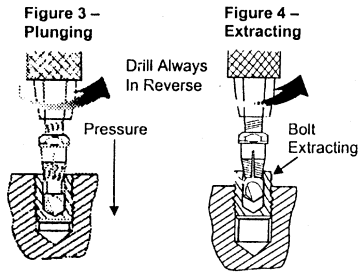
7. After you have started the hole, stop drilling and make sure that you are drilling into the center of the broken bolt. If you are not centered, angle the drill toward the center of the bolt and drill until the point of the drilled hole is on center. **The most important concern in extracting a broken bolt is to drill the hole on center and straight.**
8. Once you are satisfied you are drilling on center, hold the drill parallel to the axis of the broken bolt and continue drilling. Do not allow the collet to slip down towards the cutter while drilling. If it does, stop and unplug drill, and turn the collet back against the chuck.
9. Stop drilling every 10 seconds, or 1/16" (2mm) of depth, to clean out chips and add cutting oil to hole. Verify each time that you are drilling on center and straight.
10. Stop drilling just before you reach the front of the collet. **DO NOT** let collet touch the end of the bolt. See Figure 2.
11. Clean out chips from hole and apply penetrating oil around the edges of the broken bolt to help loosen it.



12. Unplug drill. Turn the collet five turns forward from the drill chuck.
13. Bring drill to suggested speed listed in Table 2. Faster speeds than listed may break the extractor. Holding the drill firmly with both hands, plunge extractor into the hole while applying pressure toward the broken bolt; the bolt is automatically extracted. See Figures 3 and 4.

Table 2 – Extracting Speed

Extractor Size	Speed
1/4" – 6mm	Low
5/16" – 8mm	Low
3/8" – 10mm	Medium
1/2" – 12mm	Medium to High



14. To remove extractor from extracted bolt, firmly tighten bolt in a vise. Using a wrench on the square collet head, remove the extractor by turning it **clockwise**.
15. If drill stalls during extraction, hand removal of bolt is possible. Leave extractor lodged in bolt, loosen chuck, and remove drill from extractor.
16. Look to see if you have drilled exactly on center. If so, use a wrench on the square collet head. Turn it **counterclockwise** to remove the broken bolt. **Do Not** apply excessive force, or you may damage the extractor.
17. If you get a lot of resistance when using a wrench, you may have drilled off-center, and the extractor cutter is biting on the surrounding metal; you may be in an impossible situation. If so, using a wrench on the square collet head, remove the extractor by turning it **clockwise**.

Helpful Hints:

- Before drilling, center punch bolt to help loosen it.
- Use penetrating oil or heat before drilling to help loosen rusted or chemically bonded bolts.

- When bolt is broken below-a-flange:
 - Reverse collet direction on shaft so that square collet head is flush to cutter; then perform Step 3.
 - Insert extractor through flange hole until cutter makes contact with broken bolt. Drill at rpm in Table 1 until hole is started. Collet head should help center the extractor in flange hole.
 - Unplug drill. Remove extractor from hole and drill. Reverse collet direction on shaft so that collet head faces chuck.
 - Perform extracting process beginning with Step 3 and following.

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SCREW OUT
Damaged Screw Removers

WARNING: Always wear safety glasses, gloves, proper fitting protective clothing and remove all jewelry when working near or with power tools. Never place yourself or another person in the path of the applied pressure to the damaged screw. Be certain your work is secured and could not spin free while using the SCREW OUT. Read your hand drill owner's manual for its proper use.

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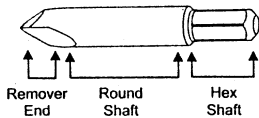


Figure 1 — Remover

1. Obtain a corded or battery powered variable speed reversible power drill (1/4" or 3/8"), and set and keep it in **reverse** (counterclockwise) for **all** remover operations. If your drill has a low speed, set it to low. Set torque control to maximum or to drilling mode.
2. If you are sure of the screw size, use the table below to choose the correct remover. If you are not, start out using No. 1 remover and move up in size if it does not remove the screw.

Screw Diameter	Remover Size
#10 — #14	No. 3
#8 — #10	No. 2
#6 — #8	No. 1

3. Turn drill **OFF**; unplug if corded. Insert hex shaft into drill chuck and tighten chuck jaws securely. The hex shaft will also fit a standard 1/4 inch bit holder (not provided). It can also be used with 1/4 inch hex holding screw-drivers.
4. Start drill running very slowly. Place the tip of the remover onto the center of the damaged screw. Apply firm pressure and add power at extremely low speed, approximately 30 to 70 rpm. Maintain a firm pressure towards screws. If the tool does not grab the top of the screw, apply more pressure to it and tilt the drill about 5 to 10 degrees from its centerline. Do not increase the revolutions of the drill. Properly used, the edges of the remover will dig into the screw and begin to remove it.

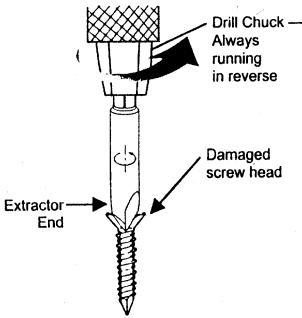


Figure 2 — Removing damaged screw

5. Once the screw starts to turn out, reduce the downward pressure as needed to prevent it from bending over. Push harder if the tip of the remover is slipping. It is important to use very slow drill rotation for the remover to work successfully and last longer.

Helpful Hints:

- If the screw does not come out, try using the smallest size remover, then work up in size.
- Push firmly and keep the drill running very slowly.

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