

TIP 20—Making and Using Broaches to Make Non-Round Holes/Rich Dean

Broaches are used when you need to make holes that are shapes other than round. A round pilot hole is first drilled, and then a broach of the desired shape is pressed through the hole to remove additional metal, leaving the desired shape. Square, hex, “D” and other shaped holes can be achieved in this manner. Broaches with multiple steps like the ones shown below take less force to use because only a portion of the shape is removed by each step as the broach goes through the hole. The first step is the size of the pilot hole and the last step is the size of the desired finished hole.



The broaches shown above are plain lathe turned, propane torch hardened and tempered in oil. You will have to decide the overall size, shank and dimensions to use for your particular project. Use W1, O1 or whatever drill rod (tool steel). No reason to be fussy.

MAKING THE BROACH—Turn or machine the profile required to full dimensions, full length. On one end, turn a pilot tip to fit the hole to be broached. If a full form cut is required, this will be the minimum diameter. Otherwise, make the hole oversize to broach only the corners out. That makes it easy on the broach. Next, cut chip slots which form the cutting edges a little smaller in diameter than the pilot diameter. The more edges you have, the less the chip load as the broach is cutting. Now set the lathe topslide (compound slide) to about a 3-5 degree angle to form the clearance angle behind each edge. The amount taken off of each edge is greatest at the pilot end and gets progressively less as you go toward the shank end. Divide 1/2 the diameter difference by the number of edges (minus 1) to find the amount of clearance to cut per edge. Leave the last edge for a full cut.

HARDENING—Using a propane torch, heat the working end to a cherry red in dim light and then dunk the heated part in oil. (An open gallon of motor oil is fine.) Polish a few spots to reveal clean metal and reheat slowly until you see the bright steel areas turn to a light straw color.

USING THE BROACH—To use, support the stock being broached close up to the hole, drop in the broach and push thru with an arbor press. Do Not hammer or jam thru by hand. Any misalignment will snap it off. Always, even with brass, lube generously with oil. Also, on full cutting broaches, chip accumulation may jam it, so extract, clean out and push thru for the final cut.

Happy trails,
Rich Dean