



Restoring the Valve Bore: REAMER TECHNIQUE

by Maura Stafford

Sonnax offers various custom reamers and reamer bushings to simplify the repair of worn out valve body, pump, and transmission case bores. Each application may require minor adjustments to reaming speed and feed rate to achieve the proper surface finish and bore size. Some variables that contribute to how a reamer performs and the quality of the reamed hole are:

- The size of the bore being reamed.
- The type of material being reamed.
- The amount of material being removed.

Basic Instructions

The first step is to adequately prepare the valve bore so that it can be worked on properly. After removing the valves from the bore to be reamed, clean the bore thoroughly in a solvent tank. After it has been cleaned, clamp the valve/pump body horizontally to the bench with the open circuits up. Make sure not to clamp directly over the bore to be reamed, as it may cause distortion. Next, fill the bore with cutting fluid such as Kerosene or Tap Magic®.

Some Sonnax reamers are piloted by the existing valve bore, while

others require a drill jig or reamer bushing to align and guide the reamer in the bore. Before inserting the reamer, soak the fluted end of the reamer with cutting fluid. Next, insert the reamer into the bore until the reamer tip contacts the first bore to be cut. The lead chamfer or guide tip on the reamer will help stabilize

and center the reamer. With the reamer carefully and securely positioned, use a speed handle to ream the bore in as level a manner as possible. The reaming action should be clockwise in a smooth and continuous motion, at approximately 1 to 1½ revolutions per second. The reamer should actually pull itself through the bore, so little or no forward feed pressure should be applied to the reamer or the speed handle.

Continue reaming until the specified stop for that reamer is reached. Spin the reamer five to ten more times to allow for the removal of any excess material and for better surface finish. Using low air pressure, blow the chips free before removing the reamer from the bore.

To remove the reamer, continue turning clockwise while slowly pulling outward on the reamer. Remove any remaining debris from the bore with low air pressure and another cleaning in the solvent tank. Lubricate the bore and replacement valve with ATF. If the valve-to-bore

fit is snug,

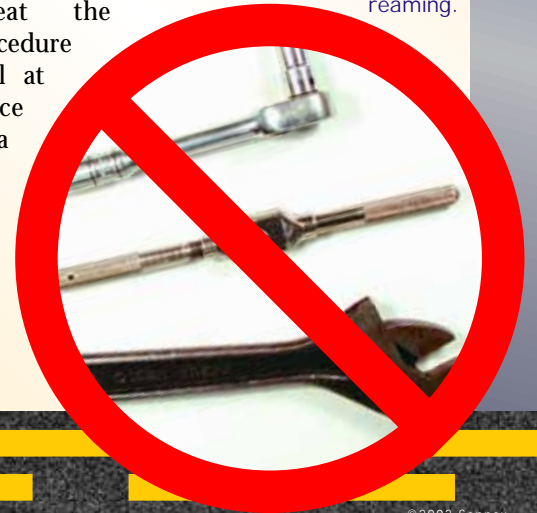
repeat the

reaming procedure with an air drill at 500 RPM. Once you've reamed a few bores and get a feel for the technique, the procedure can be fine-tuned to best suit your particular needs.

Make sure to use a light oil when reaming, such as Tap Magic® or Kerosene.




Don't use these tools for reaming.



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Continue to lubricate the reamer throughout the process.


reamer after each use. Inspect the cutting edges of the reamer frequently for burrs, and if necessary remove them with a hone. A burr left on the cutting edge will cause rough surface finishes.

It is also important to periodically inspect the reamer for signs of wear. Signs of wear to look for include cutting edges that are worn or rounded, jagged or rough; increased difficulty and more force required to ream a hole; a rough surface finish or undersized finished bore. If the reamer gives a rough surface finish or cuts undersized, the valve may not fit. At this time the reamer would need to be sharpened or replaced.

Reamer Care

Never turn the reamer backwards or drop or roll a reamer on a metal surface, as it will ruin the cutting edges. Pushing with too much forward force on the reamer while reaming will result in poor surface finish, inadequate and sporadic material removal, and material being left behind as the reamer exits a bore.

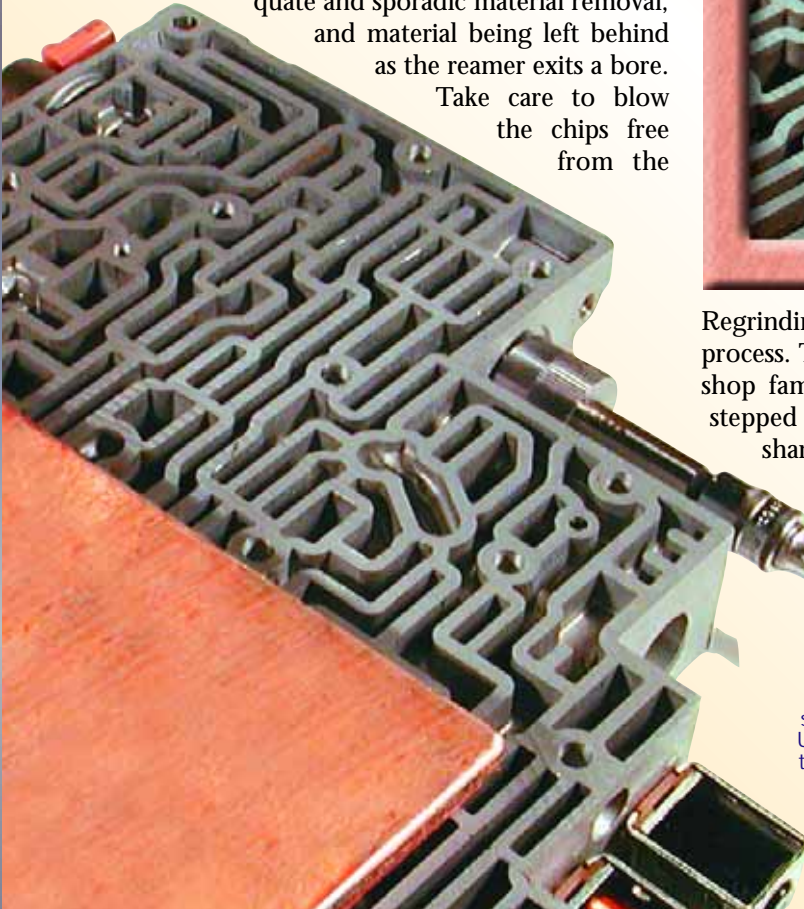
Take care to blow the chips free from the



Reaming a valve body produces a lot of chips. Make sure you never rotate the reamer counter-clockwise to remove the reamer. Doing so will damage the flutes of the reamer.

Regrounding or sharpening of a reamer is a highly skilled process. The reamer should be taken to a cutter/grinder shop familiar in the technique of reshaping multi-stepped reamers. Only the chamfer reliefs should be sharpened, and should match the existing relief angle and width. On multi-stepped reamers, critical axial lengths need to be maintained and some face grinding may be necessary. On no account should free hand grinding be performed to sharpen a reamer.

(continued)

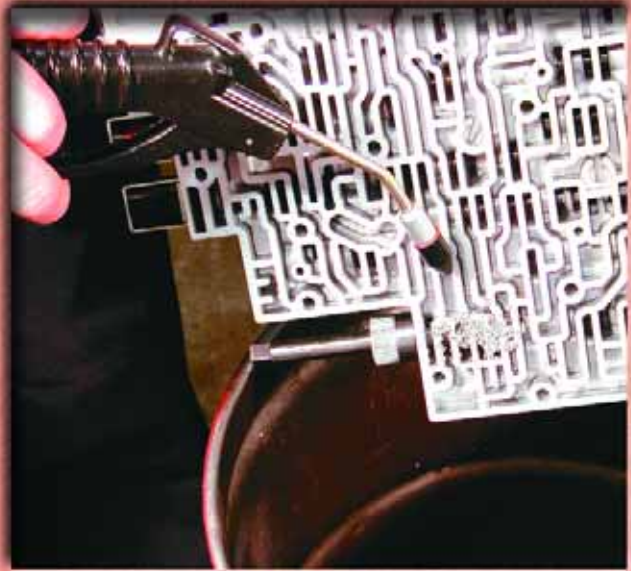


Use a speed handle to spin the reamer. Use smooth, steady turns of 1 - 1½ rotations per second.

Some helpful hints that will prolong the reamer life and make cutting easier are:

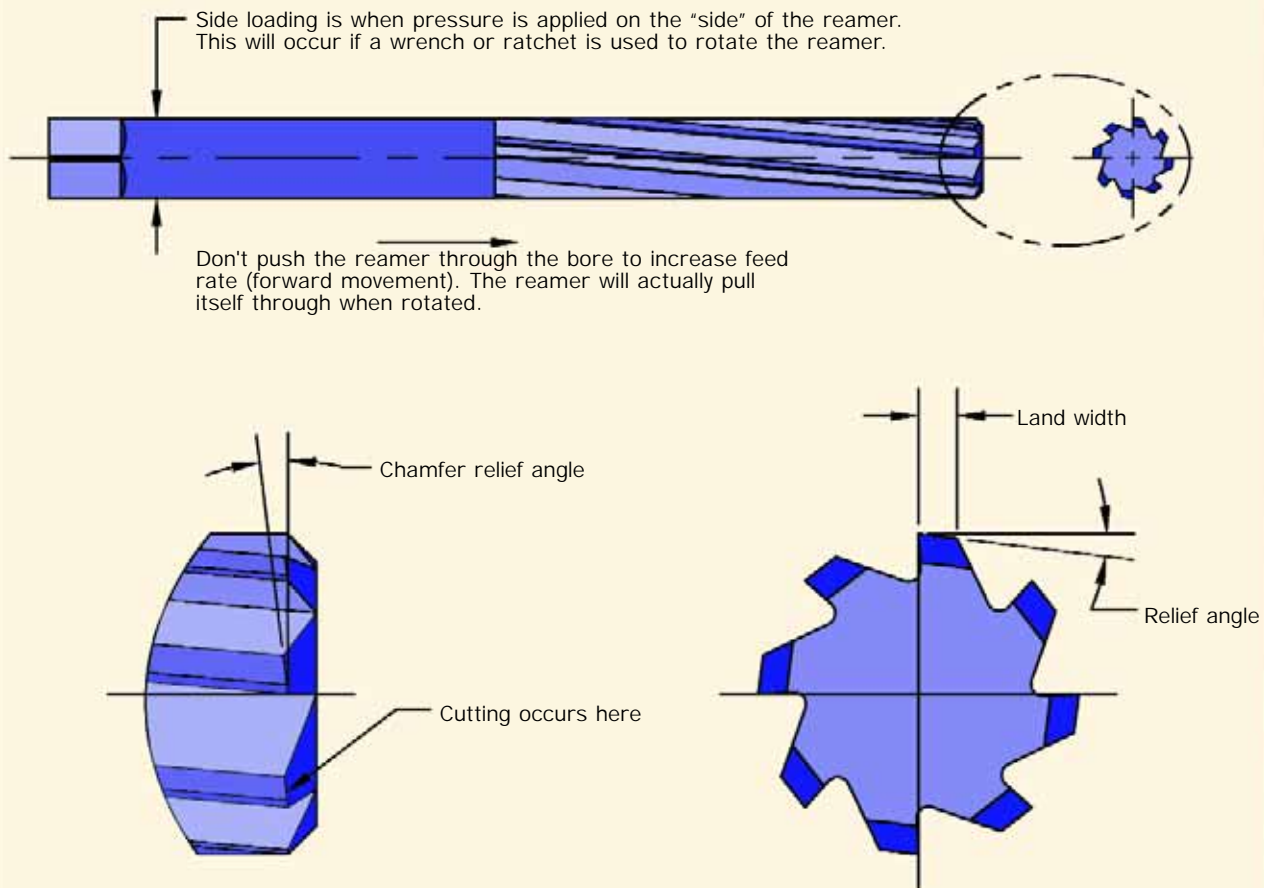
- Resharpener a reamer before it becomes severely dull.
- A well cared for reamer should get approximately 50 uses before the need for resharpener.
- Tracking the approximate time required to ream the bore each time will help signal when a reamer is becoming dull.
- When a reamer is cutting more than one bore simultaneously, the feed rate will slow down significantly.
- A stalled reamer will turn the cutting fluid dark in color.

It is important to remember that a reamer is a finishing tool and should be handled carefully. After use, the reamer should be oiled, especially the cutting edges, to prevent rusting. Always store the reamer separately in its plastic tube to prevent the cutting edges from being nicked or burred.



Remove as many chips as you can, with the reamer still in place.

Reamer Geometry



Reamer Troubleshooting

Problem	Probable Cause	Possible Solution
Undersized holes	<i>Dull or improperly sharpened reamer</i>	Reground or replace reamer.
	<i>Excessive heat</i>	Use cutting fluid, making sure it reaches all bores and drenches reamer. Use appropriate cutting fluid (i.e. Tap Magic®). ATF is not considered a cutting fluid. Increase flow of cutting fluid. Reduce feed rate and/or rotational speed.
	<i>Excessive feed rate</i>	Check bore entrance and exit lips for burrs or stock not removed. Reduce feed rate.
	<i>Poor finish in holes</i>	Use speed handle for reamer rotation. Do not use a T-handle, wrenches, or ratchet.
	<i>Valve issues</i>	Check valve spool edges for nicks or burrs. Try a different valve.
	<i>Side loading</i>	Clamp valve/pump body securely to bench in horizontal position. Use speed handle only. Do not use a T-handle, wrenches, or ratchet.
	<i>Improper reamer size</i>	Change reamer.
Oversized holes	<i>Runout of reamer chamfer</i>	Reground or replace reamer.
	<i>Dull or improperly sharpened reamer</i>	Reground or replace reamer.
	<i>Damaged reamer</i>	Reground or replace reamer. Always store reamer in it's protective tube.
	<i>Side loading</i>	Clamp valve/pump body securely to bench in horizontal position. Use speed handle only. Do not use a T-handle, wrenches, or ratchet.
	<i>Valve issues</i>	Valve may be undersized. Try a different valve.
Poor finish in holes	<i>Dull or damaged reamer</i>	Reground or replace reamer.
	<i>Excessive feed and speed</i>	Reduce feed rate and/or rotational speed. Do not push reamer through the bore.
	<i>Tool marks</i>	Reduce feed rate and/or rotational speed. Do not push reamer through the bore.
	<i>Chip dragging</i>	Blow out chips periodically during reaming, while leaving the reamer in the bore. Increase flow of cutting fluid.
	<i>Not enough cutting fluid</i>	Increase flow of cutting fluid.
	<i>Poor hole preparation</i>	Clean bore thoroughly prior to reaming.
	<i>Wrong equipment</i>	Use speed handle only. Do not use a T-handle, wrenches, or ratchet.

