REAMER GUIDE

BASIC TECHNICAL INFORMATION FOR REAMERS

HANNIBAL CARBIDE would like to inform you of some basic technical knowledge regarding reamers. Following these guidelines will reduce overall set-up time, while increasing productivity. Selecting the right tool, proper stock removal and correct speeds and feeds are all important and covered here in the HANNIBAL Reamer Guide. Ream it right the first time with HANNIBAL.

.....from the Hannibal Technical Team

FLUTE STYLES

Straight:

Best suited for non-chip forming materials, i.e. cast iron, bronze and free cutting brass.
Preferred hole condition would be a thru hole.

Right Hand Spiral:

Designed to pull the chip out of the hole in a blind hole application.
Due to aggressive flute geometry, a right hand spiral may cut slightly oversized.
Effective in bridging interruptions, such as keyways, cross-holes, etc.
Excellent in highly ductile materials.

Left Hand Spiral:

Excellent in thru holes, as the flutes tend to push the chips out ahead of the reamer.
Effective in bridging interruptions, such as keyways, cross-holes, etc.
Good for reaming hard materials.
Should provide the very best size and finish.

Expansion Reamers:

Designed for high production runs in abrasive materials, when size or finish can be rapidly lost.
Expand the diameter by turning the screw clockwise.
The tool is now ready to be reground back to its original diameter and resharpened.
This process should produce like new tool performance.

COOLANT OPTIONS

Center Fed Coolant (axial):

Center fed coolant design is used for blind hole reaming.
Combine center fed coolant with right hand spiral for maximum chip clearing ability in highly ductile material.

Flute Fed Coolant (radial):

Flute fed coolant design is used for thru hole reaming.
Effective in a cavity large enough for chip clearance.
Flute fed coolant will flush the chips ahead of the reamer, providing the best hole size and finish.

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While developing optimum conditions will require some investment in time, it will be beneficial by reducing cycle times and getting the best possible tool life. There are several elements to evaluate in this section. These elements are key to maximizing tool efficiency.

OPTIMUM OPERATING CONDITIONS

Stock Removal:

2%-3% of the reamer diameter will normally be appropriate stock removal when reaming.

Example: a .500" diameter tool would remove .010"-.015" of stock.

Example: a 1.0" diameter tool would remove .020"-.030" of stock.

These examples cover finish reaming.

When your application calls for a rough ream, stock removal can be up to 5%

See "Pre-Ream Drill Size Chart" on page 28.

Runout (TIR) Concerns:

One of the most overlooked areas in reaming.

It is critical to the function of the tool to be running concentric with the machine spindle.

Some of the most important areas to consider include:

Tool Holders - precision collets and hydraulic chucks are widely used for straight shank tools. When using hydraulic chucks be sure shank diameter tolerance is acceptable. If using taper shank reamers make sure holders are free from dirt, grit and burrs that could cause the shank to not seat properly.

Tool Overhang - Use the shortest tool possible. Runout multiplies rapidly as the distance from the spindle increases.

Rigid Fixturing - Make sure the part piece is secure. Movement of the piece may cause tool breakage, oversized holes, poor finish and would shorten tool life.

Checking TIR - Check the reamer diameter with a dial indicator (at the circular margin). Ideally a reamer should run within .001" TIR.

Coolant feeding reamers:

Coolant induced thru the reamer should be utilitized when possible.

Benefits include better finishes, superior tool life and the ability to increase speeds and feeds.

Speeds and Feeds:

Reaming is a finishing operation and the correct combination of speed and feed is critical to tool life. Proper speeds & feeds must be run to achieve size, straightness and finish. See pages 8 and 9 for starting speed and feed information and further guidelines.

Tool Geometry and Carbide Grade:

Geometry may be altered to obtain optimum performance and extend tool life.

Material specific carbide grades are beneficial in reaming material of a specific hardness & condition. Hannibal offers stocked material specific reamers in most all styles.

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DEVELOPING OPTIMUM SPEED AND FEEDS

- Most reamer manufacturers will provide you with a starting point for speeds and feeds. It is very important to remember when optimizing your cycle that increasing feed will give you quicker cycles than running higher SFM at lower feed rates.
- With the surface feet per minute (SFM) at the manufacturers low range, begin trying to increase the feed rate. Increase in small increments, .001 - .0015 per revolution. Continue to increase the feed until an undesirable condition develops. This could be an unacceptable finish, a bell, tapered, or egg shaped hole, or poor size. At this point return to the previous feed rate. You are now at or close to the optimum feed rate.
- Increase the speed in increments of 10-20 SFM. Like the feed, increase until undesirable conditions appear, then return to the previous SFM. You should now be at or near the optimum speed and feed. It may also be necessary to fine-tune these numbers after a few runs to achieve the very best tool life.
- As you seek the optimum speed and feed for your application, look and listen for signs or sounds that could save you time. Listen for the reamer squealing upon entry—this means speed or feed is too high or alignment is poor. Examine the chip for size and color. Examine the finish for signs of chatter.

AVOIDING PROBLEMS – Common Problem Areas to Avoid.

- **Improper Tool** - make sure you are using the correct flute style and tool type.
- **Stock Removal** - HANNIBAL recommends 2-3% of the reamer diameter as a starting point for stock removal. 2% for steels and tough alloys, 3% for non-ferrous materials and cast irons. Solid carbide & carbide tipped reamers must have adequate stock to remove or they will rub in the hole and generate excessive heat, which leads to premature tool wear.
- **Improper Speeds & Feeds** - The right combination of speeds and feeds is critical to tool life and consistent size and finish. Getting the correct starting points is a key element. Reaming is a finishing operation and proper speeds and feeds must be run to achieve size, straightness and finish.
- **Poor Fixturing** - If the fixturing cannot hold the piece securely and in line with the spindle, then producing a good finish will be very difficult. A reamed hole is only going to be as good as the machine and fixturing used to machine and hold the part.
- **Excessing Runout (spindle or tool holder)** - Runout leads to poor finishes, oversized, tapered, and bellmouth holes, as well as poor tool life. Floating holders or bushings can sometimes be used to compensate for runout, but the best solution is to fix the problem.
- **Improper Coolant** - Make sure the coolant you are using is recommended for reaming your particular materials. Many coolants will prove effective for reaming if the concentration level is maintained with specifications. Take the time to check the levels on a regular basis.
- **Improper Sharpening or Geometry** - If a new tool works fine, but fails to perform after resharpening, the problem is obvious. However, depending on the hardness and condition of the material you are reaming, the tool geometry may need to be altered to get optimum performance and tool life. Geometries most often changed are the circular margins, radial rake, and the primary chamfer clearance.
- **Material Changes (hardness and/or condition)** - Castings lead the way in inconsistency. Hard spots, free carbides, and scale can all lead to inconsistent results when reaming. A heat treatment that varies just a few points from part to part can cause problems.