Reamer Basics

Reamers are available in a variety of types, materials, flute styles and sizes. The typical reamer is a rotary cutting tool designed to machine a previously formed hole to an exact diameter with a smooth finish. But other types are used to remove burrs from the inside of pipes & drilled holes and to enlarge and align holes for fasteners.

Fixed vs. Adjustable vs. Expansion

**Fixed Reamers**
- The reamer size is fixed and any size reduction due to wear or sharpening cannot be reclaimed.
- Constructed from a single piece of material or with permanently attached cutting edges (e.g. brazed carbide inserts).

**Adjustable Reamers**
- The blades of an adjustable reamer are separate from the body and are fitted into ramped grooves in the body. As the blade slides along the groove the cutting diameter is changed.
- Captive nuts located at each end of the blades lock them in a fixed position.
- The cutting diameter can be adjusted by loosening one nut while tightening the other.
- Each reamer has enough adjustment to cover the complete range from next smaller size to the next larger size.
- They are used mostly for repair work in the field.
- Not intended for high production work.

**Expansion Reamers**
- The expansion reamer has longitudinal cuts between some of its flutes.
- It is hollowed out and threaded to receive a tapered screw plug.
- The diameter of the reamer is increased by screwing in the tapered plug.
- Maximum recommended expansion is around 0.010" (per Chadwick & Trefethen Inc)

http://www.tools-n-gizmos.com/info/Reamer_Basics.html
NOTE: Some sources of reamer information (e.g. TM 9-243) imply (or state outright) that expansion reamers are just another form of adjustable reamer (with a smaller adjustment range). Whereas, several manufacturers (e.g. Super Tool inc.) state that expansion reamers are not adjustable reamers. The expansion screw should NEVER be loosened or tightened in an attempt to use the reamer for a size other than that which it was finish ground. Expansion reamers are beneficial when the diameter wears down to the low limit. It can be expanded oversize and reground back to its original size. This can be done many times making the expansion reamer a very cost effective tool.

Hand vs. Chucking vs. Shell

Hand Reamers
- Have a square at the end of the shank, similar to a hand tap.
- The reamer can be turned with standard tap wrench or even an adjustable hand wrench.
- It can also be driven by many Tap/Reamer chucks and heads which use the square end for positive drive.
- Constructed with a tapered leading edge on the cutting head to help the user push the tool into the workpiece

Chucking Reamers
- Intended for use in drill presses, lathes and screw machines
- Most commonly used style for reaming holes to a tight tolerance
- A variety of shanks are available including: Straight (round, hex, keyed, etc.), Morse Taper and other machine tapers.

Shell Reamers
- Similar to the cutting portion of a chucking reamer.
- Supplied without a shank and has a hole through the center
- A arbor is used in conjunction with the shell reamer, the slots in the reamer engage lugs on the arbor for driving power.

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Aligning Reamers

- A pilot is used to align the reamer when two holes must be reamed in line with each other
- Many Aligning Reamers use a "floating" tapered pilot sleeve.
- The sleeve is seated in one hole, guiding the reamer as it reams the other hole.

Flute Styles:

**Straight Flute**
- The most common reamer
- 45° Chamfer angle to ease the reamer into the existing hole
- With straight flutes, chips are forced forward into the hole, and should be used in through-hole applications only

**Right Hand Spiral/Right Hand Cut**
- Pulls chips out of the hole
- Ideal for blind-hole application
- Adds extra shear to the finished hole

**Left Hand Spiral/Right Hand Cut (LHS/RHC)**
- Pushes chips forward into the hole.
- Ideal for through-hole applications
- Provides the finest hole finish

**Angle Blade**
- The blades in some adjustable reamers are set at a slight angle.
- Blade angle eliminates chatter.
- improved surface finish vs. straight flutes

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Rose reamer
- Rose Reamers are primarily used for roughing prior to final reaming.
- The flute cutting edge has no relief giving it extra strength.
- To prevent binding they have a slight back taper.

Flute Material:

High Speed Steel (HSS, M1, M2, M7, M50)
- Combines good tool life and productivity with minimal cost
- Works well in free cutting and carbon steels, as well as soft, non-ferrous materials

Cobalt (M-35, M-42)
- Better wear resistance, higher hardness and toughness than HSS
- Very little chipping under severe cutting conditions, allowing the tool to run 10% faster than HSS
- With the right point angle and helix, cobalt is the most cost-effective for machining cast iron, heat-treated steels and titanium alloys

Solid Carbide
- For high-performance applications.
- Carbide can run faster and withstand higher temperatures, while providing good wear resistance
- Carbide is brittle and tends to chip when conditions are not ideal.
- heavy feed rates are more suitable for HSS and cobalt tools
- Used in abrasive and tough-to-machine materials: cast iron, non-ferrous alloys, glass, plastics and composites

Carbide Tipped
- Offers many of the advantages of solid carbide tooling at a reduced cost, especially in larger diameter tools

Special Reamers:

Bridge Reamers
- Designed for use in structural steel, in the building industry, bridge erection, and ship construction.
- The cutting end of the flutes is tapered, allowing the reamer to enter overlapping and badly misaligned holes
- Shanks come in a variety of styles for portable electric or pneumatic machines

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Car Reamers
- Short flute and overall length permit use in cramped quarters or where a Bridge Reamer would be too long.
- Primarily used to repair railroad cars and for construction work, especially fixing misaligned holes
- A special cutting chamfer allows for easy entry and fast cutting in badly offset and burnt holes

Pipe Reamers
- Used to prepare a hole for tapping with a taper pipe tap
- There are a variety of different types of taper pipe taps including; NPTF, Dryseal, and ANPT

Taper Pin Reamers
- Taper Pin Reamers have a taper of 1/4” to the foot. (standard Taper Pin sizes #7/0 to #10)
- Designed to ream holes into which standard taper pins will fit
- Helical Taper Pin reamers have High-Spiral construction so chips do not pack in the flutes

Morse Taper Reamers
- Morse tapper reamers are designed to ream holes for standard Morse Taper tooling.
- Helical flutes prevent chips from packing in the flutes

Center Reamers
- Designed for Counter Sinking Holes for Centers or for enlarging existing hole
- Odd number of flutes reduce chatter, while providing better accuracy than a single flute countersink
- Available in many angles e.g. 60°, 82°, 90°, 100°, 110°, and 120°

Repairman's Reamers
- Built for the removal of burrs in pipe and conduit, and for enlarging holes in sheet metal

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Reamer Sizes:

Standard Sizes (typical)
- Number sizes #70 through #1
- Letter Sizes A through Z
- Fractional sizes 1/32" through 1" in 1/64" increments
- Fractional sizes 1" through 1.5" in 1/16" increments
- Metric sizes 1mm through 25mm in 0.5mm increments

Over/Under Reamers
- Sizes 1/10th above or below standard sizes
- These sizes will allow the user to create a tighter or looser hole than the standard fractional size

Special Decimal Sizes
- Covers all sizes outside of the standard fractional, letter, wire and metric sizes
- Available off-the-self in increments of 0.0005"

Dowel Pin Sizes
- Readily available in standard dowel pin sizes

Taper Pin Sizes
- Readily available in standard Taper Pin sizes (#7/0 to #10)

Morse Taper Sizes
- Readily available in standard Morse Taper sizes (#1 to #6)

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Using Reamers

Using a hand reamer
- Secure the work in a vise so that the hole to be reamed is perpendicular to the top of the vise jaws.
- Using a tap wrench, tighten the handle to the square end of the reamer shank.
- Position the reamer at the top of the hole. Turn slowly clockwise until the reamer is centered in the hole.
- Straight-hole reamers have a slight taper at the end so they will fit into the hole easily.
- Turn the wrench clockwise with a steady, firm pressure until the reamer has been turned in the hole.
- When reaming steel, use cutting oil or machine oil to lubricate the tool.
- When reaming soft iron, do not lubricate the tool.
- Turning too fast or too slow will cause the reamer to chatter, producing an unevenly reamed hole.
- Remove the reamer from the hole by turning clockwise and raising the reamer at the same time.
  Note: Do not turn counterclockwise at any time - doing so dulls the reamer.

Using a chucking reamer
- Reaming feeds are usually higher than those used for drilling.
- The best feed rate varies with material; a good starting point would be 0.0015" to 0.004" per flute per revolution.
- Too low of a feed may cause glazing, excessive wear, or chatter.
- Too high of feed may reduce the accuracy of the hole, it may also lower the quality of finish.
- The best speed is found to lie around one half of the speed used for drilling the same material.

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