Advantages of boring

To duplicate the large range of hole sizes that can be made with a boring head, a shop would have to be stocked with many special boring bars capable of boring the one size hole they were designed for. As a rule, this type of special consists of two, or more flutes. However, multi-flute tools present a problem if all flutes are not absolutely identical, even down to flute edge wear. The slightest variation could produce a less than perfect hole.

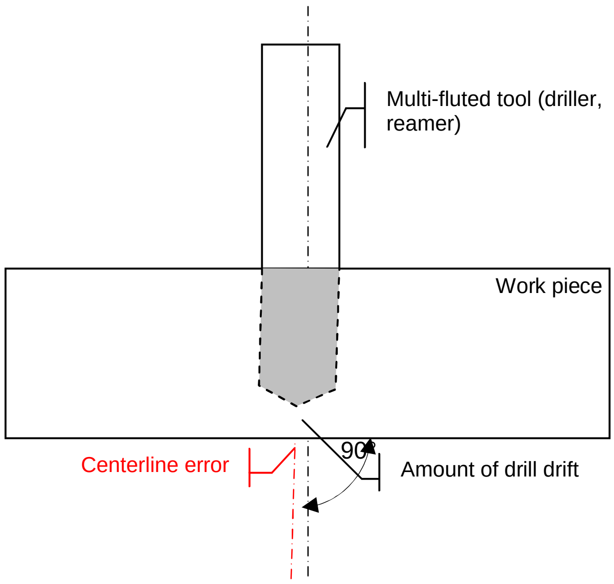
The advantage of this type of tool lies in its ability to form a perfect circle as it rotates around the centerline of the machine tool spindle. And because in a single-point tool the cutting edge is constantly equa-distant from the centerline, the hole it bores is true.

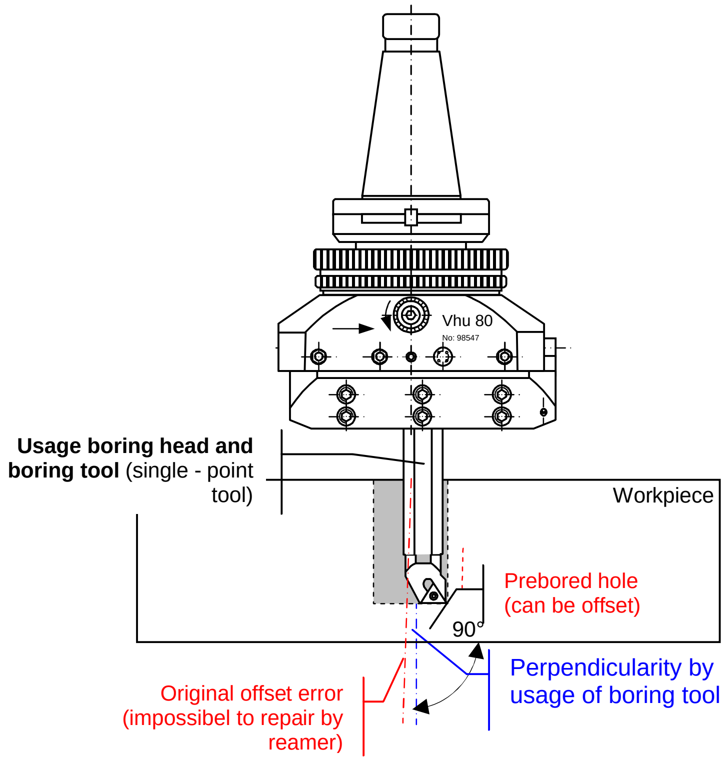
Suggestions For Better Boring Head Performance

1. Cutting edge of tool must be on centerline.
2. Tool sharpness for boring is more critical than for O.D. work.
3. Keep tool overhang to a minimum to maximize its rigidity.
4. Use power feed whenever available.
5. Make allowances for "spring" or deflection when taking a heavy cut. Additional material will be removed on finish cut even though an additional adjustment has not been made.
6. When using carbide, avoid reversing or stopping the spindle in the middle of a cut. This can cause chipping or breakage.
7. For best surface finish spindle should be turning while tool is being retracted from the bore.
8. Avoid "bottoming-out" in a blind hole. A boring tool is not designed for end cutting.

Drill drift

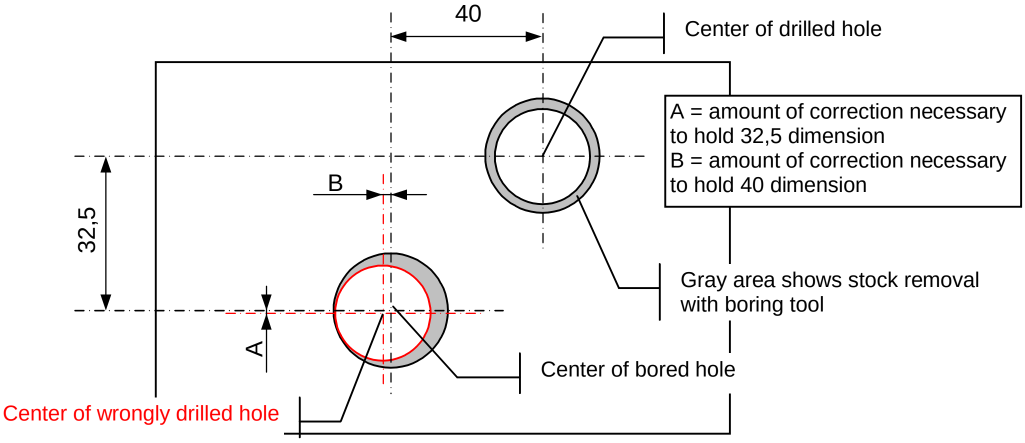
Drill drift can be the result of a poorly ground multi-flute tool or may occur when one of the flutes becomes dull. As the cutting edge breaks down, greater pressures are exerted on the dull flute. This forces the tool to drift in the direction of the freer cutting flute. A well ground reamer may correct some of this condition. However becaues it is also a multi-flute tool,it will have a tendency to follow the original hole.
Drift can be corrected only with a single-point tool such as used in a boring head.





True position

One of the great advantages of using a boring head with a single-point tool is its ability to establish the true position of a hole or a series of holes. This is possible only because a single-point tool can remove more stock from one side of a hole than the other.



In the illustration, the original drilled hole is out of print tolerance. In other words, the centerline distance between the holes is not correct. By simply dialing in the correct centerline distance the hole can be re-bored to its true position. However, this operation can only be successful if there is sufficient stock remaining in the hole for a 100% cleanup.

Boring tools

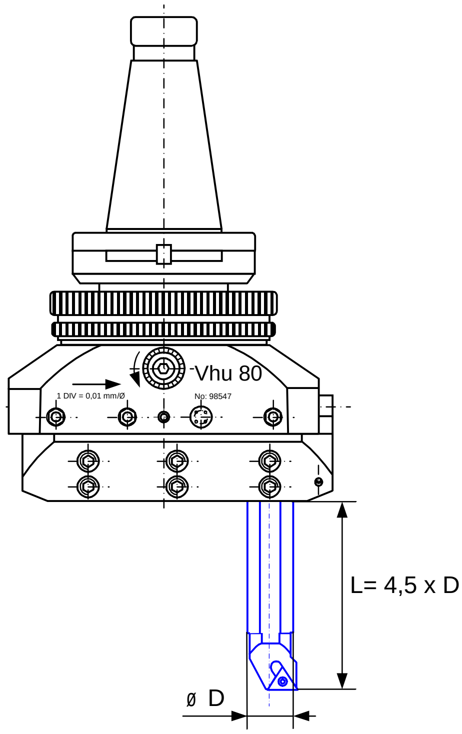
The prime factors to be considered for successful boring are:

1.Tool Overhang
2. Geometry
3. Speeds and Feeds
4. Chip Control
5. Coolant

Let's take these factors one at a time and see how we can work with them.

Tool overhang

Tool overhang is that portion of a boring bar or tool that extends out of the boring head or tool holder—the unsupported section. To determine the amount of overhang, we take the ratio of the diameter of that bar to the unsupported length of the overhang. This diameter-to-length ratio is of prime importance in a boring operation. The force required to deflect a boring bar decreases by the cube of its length--or, for each diameter the bar is extended, its resistance to deflection is decreased approximately eight times. This certainly is reason enough to keep the overhang to an absolute minimum. In addition to bar overhang, it would be worthwhile to note this same condition applies to the work piece.
To offer a rigid tool with a reasonable boring depth, Criterion tools are designed at approximately a 4.5:1 ratio. This, we believe, is a workable ratio that should produce excellent boring results. In working with a boring tool in a Criterion Boring Head we therefore suggest the following:



1. Use as large a shank or adapter as possible and insert it into the spindle of your machine with the boring head as close to the spindle bearings as possible.
2. Keep tool overhang to a minimum and use the largest diameter boring bar that will do the job and still permit adequate chip disposal.

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Tool geometry

Tool geometry must be considered one of the most important aspects of tool performance. Clearance and rake angles are more critical on a boring tool than on a turning tool. Information on redial and axial rake angles as well as side and front clearance angles can be obtained from charts published by most of the carbide manufacturers. Consult these charts and select the correct geometry for your job--taking into consideration the type of material to be machined, as well as the nature of the part.

When using throwaway inserts, you may find you must compromise between what is truly the best tool geometry and what is available. Some of the new N/P inserts now on the market bridge this gap rather successfully. It would pay to consider them.

Tool geometry, at the point of cut, is equally important in both high-speed steel and carbide tools. With carbide, of course, we can substantially increase the RPM and S.F.P.M. (surface feet per minute) and we can bore a more precision hole. Tools made of solid carbide have the additional advantage of stiffness (three times that of steel). This is most desirable when boring deeper holes, or where no deflection can be tolerated. Greater care, however, must be exercised when using carbide to prevent chipping. Mishandling when not in use can often be more destructive to a tool than actually using it. In use, two of the most common causes of chipping are:

1. "Dragging" the tool out of a bore upon completion of a cut
2. Entering the cut in the hand-feed mode and permitting the tool to "bounce".

Another important aspect of tool geometry is the lead angle. The three most commonly used are:

1. positive
2. zero
3. negativ

Positive or zero leads are used when boring to a shoulder, while negative leads are used only for a "through" bore or boring into a relief at the bottom of a bore. Although a negative lead tool will create greater pressures at the point of cut, it will produce a better finish while maintaining greater tool life.

Speed and feeds

In order of importance regarding the elimination of chatter, we consider the following:

1. Surface feet per minute (S.F.P.M.) or revolutions per minute (R.P.M.).
2. Feed per revolution, or inches per revolution.
3. Depth of cut.

Chip control

Chip control is always of prime importance when boring and especially so when going into a blind hole. Because this problem is difficult to completely eliminate, we must again resort to compromises. Bearing in mind our earlier suggestion that we must use as large a bar as possible, we should not plug up the hole to the point where it interferes with chip disposal. Along with good chip disposal, we shall also achieve better coolant flow. A through bore presents a somewhat better condition in that it permits good chip clearance and adequate coolant flow even when using a larger diameter bar.

Coolant

The problem coolants present is much the same as that encountered with chips. The difference being, with coolants we are trying to get the fluid in the hole and the chips out. When possible, the best condition is to flood the bore with coolant. This considerably lowers the temperature at the point of cut and at the same time helps "wash" the chips from the hole. Spray mist (coolant and air) is another good method of applying coolant.
However it is applied, coolant should be used whenever the material or the machine permits it. When selecting it, look into those brands that include some lubricating as well as cooling properties.