Metalworking

4 Things You Need to Know About Honing

Kip Hanson | Mar 18, 2024

The first automakers quickly discovered that internal combustion engines function more efficiently when cylinder walls are not only smooth, round and straight, but have a lightly cross-hatched surface.

That's because the tiny peaks and valleys within such surfaces retain a small amount of oil, which helps to reduce friction and the resulting heat.

Initially, manufacturers produced cross-hatching by rubbing cylinder walls with abrasive-wrapped wooden sticks. But it wasn't long before an inventor named Joe Sunnen developed a spring-loaded tool that used a series of long, floating stones to accomplish the same thing, streamlining the work.

The honing process was born.

Automobiles to Airplanes

That was 100 years ago, and today, honing is used in everything from engines and transmissions to hydraulic or pneumatic pumps, compressors, valve bodies and pretty much anywhere this type of smooth yet cross-hatched surface finish is desirable.

Two types of honing exist—rigid and flexible—each with distinctly different purposes. Both use abrasives such as aluminum oxide and silicon carbide to generate the requisite surface geometry, and both rely on mechanically applied pressure to do so.

But where rigid honing can remove relatively large amounts of metal and improve hole straightness and roundness, flexible hones "follow" the existing bore and are therefore designed for ***finishing*** and deburring operations only.

The latter technique was invented by Brush Research Manufacturing more than 65 years ago and is a complementary process, since it removes just a few tenths (1/10,000-inch) of material, and creates a "plateaued" finish, says Elysha Cole, director of inside sales at the company.

The company's FLEX-HONE® tools are "typically used after rigid honing to knock down the peaks and create the cross-hatch pattern for which honing is known," she says.

Flexible Applications

While the lion's share of rigid honing is performed on dedicated machinery, FLEX-HONE tools can also be used on a hand drill, drill presses, CNC machining centers and even robots, Cole explains.

That makes them important and versatile devices that can be deployed in the field or incorporated into finishing operations at shops of all sizes.

"The FLEX-HONE has a twisted wire stem with a series of nylon filaments radiating outward and abrasive globules attached to the end of each filament," she says. "So where rigid hones open up due to internal spring pressure, a FLEX-HONE flexes down and inward."

Both rigid and flexible honing tools have their places, and it's important to know how and when to use each. There's a fair amount of overlap between the two, even though they are distinctly different from one another.

Following are some points to consider when you're starting a honing job:

1. Abrasive Types: *Choosing the correct abrasive* is crucial to success when using a FLEX-HONE, Cole says. Aluminum oxide, for example, is considered a cost-effective, general-purpose grade, often used for honing materials like aluminum, brass, bronze and other softer nonferrous materials. Silicon carbide, on the other hand, is both harder and "sharper" than aluminum oxide. These qualities make it a very effective choice for mild steel, stainless steel, cast iron and other softer ferrous metal applications. It's also more friable, meaning it's somewhat self-sharpening and less prone to loading. Cole points out that superabrasives such as polycrystalline diamond and cubic boron nitride are also available. As their "super" status suggests, these are slightly more expensive than the conventional abrasives just listed and intended for higher-volume work or in very hard or tough materials such as heat-resistant superalloys.
2. Bonds, Grit and Hardness: If abrasive selection were limited to which of the preceding materials to use, there'd be less need for countless books on the topic. Honing stone manufacturers have a variety of "bonds" available to them—typically vitrified, metal and resin—to hold the tiny bits of abrasive together. Each has different properties and price points, although vitrified bonding is probably the most universal, with metal bonding used for more demanding applications. Bond selection also helps determine the stone's hardness, or holding power. Rigid honing company Sunnen, for instance, rates its stones from 1 (soft) to 15 (hard). Whatever the manufacturer, soft stones are best for hard metals and vice versa. Grit is another important consideration. As with sandpaper, coarse grits down in the 80 range are designed for heavy stock removal and will leave a rough surface finish, while a 1200-grit abrasive is the exact opposite.
3. Coolants: Whether rigid or flexible, honing removes metal and therefore requires cutting fluid to keep the tool clean and cool. *Cutting fluids* also prevent corrosion of the workpiece and machine components while providing much-needed lubricity to the machining process. Neat oil is often the preferred choice, although Cole says many CNC machine tools are designed with water-soluble cutting fluids in mind. "Either type of liquid is fine, provided the machine has a 10- to 50-micron filtration system to remove any abrasive grit that might get into the coolant system," she says.
4. Different Strokes: Single-pass honing is just as its name suggests—one pass in and out. Unlike the spring-loaded hones described earlier, the tool diameter is fixed, so depending on the stock removal requirements, desired surface finish, workpiece material and other factors, progressively larger diameter tools might be needed to reach the finished hole size. Conventional or multi-stroke honing uses a reciprocating motion. It is a better option when removing larger amounts of material or machining length-to-diameter ratios greater than 1:1. Like flex honing, it generally provides a more consistent cross-hatch pattern than single-pass honing.

Keep in mind that honing is a technically complex process. Whether using rigid or flexible, multi-stroke or single-pass honing, it's wise to lean on experts like the Brush Research team or those at MSC Industrial or Sunnen when selecting a tool and determining process parameters.

For surface finishing, FLEX-HONE is an ideal choice, often used in conjunction with rigid honing, Cole says. Tool size selection is fairly straightforward: It's determined by bore size.

"If you're working on a 1-inch bore, you would order our 1-inch tool," Cole says. "It's slightly larger than that, however, and thanks to the nylon filaments, provides enough pressure against the sidewalls to do its job, whether that's deburring or surface finishing or both."

The FLEX-HONE is both self-centering and self-aligning, making setups easier, Cole adds.

"We cover hole sizes from 36 inches down to 0.16 inch (4mm), offer both conventional and superabrasives, and aren't affected by cross-holes or other interruptions," she says. "It's a great solution."

Which aspects of honing are most challenging for you? Tell us in the comments below.