THE HOLE STORY

Understanding bimetal holesaws and their features and failure modes

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As the name suggests, a holesaw is a power tool accessory used to make annular cuts. To make the cuts, holesaws have a saw tooth on one end of a cylindrical, cup-shaped body and are generally made out of a bandsaw blade to cut a variety of materials. They're also distinguishable based on what tooth edge material is used, including carbon, bimetal (featuring a high-speed steel cutting edge with low-alloy steel as the backer), →

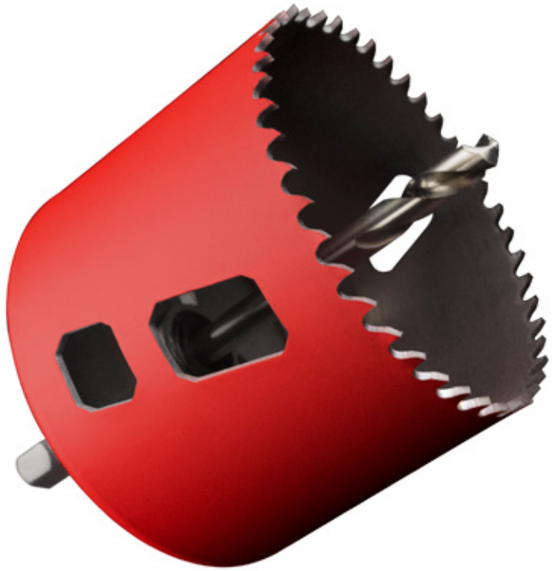
carbide-tipped (tungsten carbide), diamond grit and carbide grit.

AMPLE APPLICATIONS

Determining the right tooth edge material for the application is half the battle when it comes to overall holesaw performance. In fact, one of the leading causes for lower tool life is choosing incorrect tooth edge material.

In general, carbon holesaws are used in wood applications whereas bimetal holesaws are used to cut general-purpose metals, wood and plastics. Carbide-tipped, carbide grit and diamond grit holesaws are well-suited for handling difficult-to-cut materials, such as fiberglass, ceramics and stainless steel. The most commonly used holesaws, however, have a bimetal cutting edge because of the variety of materials they can cut at a lower cost.

Typically, bimetal holesaws are made by welding a tool steel edge wire to a low-alloy steel, which serves as a backer. However, when the cutting edge wire is improperly welded to the steel backer, it can cause the holesaw to fail. In fact,



Combined with an innovative side slot shape, the M.K. Morse tooth design offers easy slug removal.

a substandard weld zone is the leading cause of premature tooth failure. If the weld zone failure is recurring, using a different tooth edge material, such as a carbide-tipped holesaw, might be a good option.

Other considerations to keep in mind are the accessories that can be coupled with a holesaw. Generally, when

holesaws are used with a pilot drill, operators can benefit from ease of use and longer tool life. A holesaw without a pilot drill can move laterally (creating larger kerf, a condition called "walking") before engaging into the cut.

When a holesaw is attached to an arbor (via a pilot drill bit), it can be used on a drill press or on a cordless or corded drill. In a holesaw-arbor combination, a lower total indicative runout (TIR) is essential for long tool life and ease of cut. For most holesaw manufacturers, TIRs are determined using the ASME (B94.54-1999) standard. Regarding the standard, it's important to note that it does not recommend operators consider a holesaw as a precision tool.

TOOTH DESIGN

Along with the saw tooth edge material, the tooth design, such as the tooth spacing, tooth angles and →

gullet design, can affect the cutting performance. In a typical holesaw design, side slots are used to remove slugs from the holesaw with relative success. Recent research conducted at the M. K. Morse R&D lab has shown that the tooth design plays a critical role in slug removal.

To improve the cutting process, slug removal should be closely observed. In some applications, operators may notice that the cut time might be shorter than the slug removal time. In such situations, an operator should consider shifting to a holesaw with better slug removal system, such as one with M. K. Morse's new patent-pending tooth design.

Combined with an innovative side slot shape, the M.K. Morse tooth design offers the easiest slug removal feature in the market. In fact, tooth design has a significant effect not just on the slug removal, but also on the ease of cut, tool life and cut surface finish.

Another option to make slug removal easier is by not using a pilot drill. As mentioned earlier, the pilot drill is used to prevent the holesaw from walking. However, by not using the pilot drill, the large kerf (caused by walking) can be increased, which, thereby, reduces the slug diameter. A smaller or reduced slug diameter will make the slug removal process easier and quicker. →

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Cutting conditions and workholding can have a significant effect on everything from vibrations and harmonics to tool life and cut finish.

MEETING EXPECTATIONS

In general, holesaw performance is evaluated based on the cut time, tool life, ease of slug removal and cut finish. Although holesaws shouldn't be considered precision tools, often times, operators have high expectations. They expect a good cut finish and easy slug removal, which are influenced just as much by the type of material being cut as the tooth design.

Typically, to meet cut finish expectations, reducing the feed (plunge) rate is a good option. Remember, however, that there are a few expections to this rule, such as cutting thin metal sheets. As many operators know, achieving a good cut finish while cutting thin sheets of metal is a challenge. Therefore, using a rigid workholding device, proper drill extension, and a relatively high feed and RPM are recommended.

Selecting the correct cutting conditions (RPM and feed rate) is another essential approach for achieving better holesaw performance.

In some instances, cutting fluids can also improve the overall performance of a holesaw. A cutting fluid helps improve the cut finish and ease of slug removal while also giving the tool longer life and reducing vibration that can be harmful to an operator in the long run. A semisynthetic cutting fluid is recommended because it has the capability to reduce frictional resistance and temperature buildup.

Selecting the correct cutting conditions (RPM and feed rate) is another essential approach for achieving better holesaw performance. If an operator experiences higher vibrations or harmonics while using a holesaw, it can be an indication of incorrect RPM and feed (plunge) rate. However, higher vibrations can also be due to improper tooth design.

One way to reduce the vibration or harmonics is to reduce either the RPM or the feed rate. Also, the combination of the tooth design (angles and pitch) and the kerf variation will reduce the harmonics. The new M. K. Morse holesaw has been designed to optimize tool life and harmonics. Also, the patent-pending tooth design has been rigorously tested to prove that it has the best slug removal feature in the global marketplace.

In summary, a good holesaw should be able to make an annular cut with ease while also delivering on quick slug removal. Holesaw accessories, such as the pilot drill bit and arbor, play an essential role in holesaw performance. Furthermore, cutting conditions and workholding can have a significant effect on everything from vibrations and harmonics to tool life and cut finish. ■

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