



Specialist drill bits for tricky jobs

Just as it seems there is a specialist tool for most jobs these days, there is also a specialist drill bit for every kind of drilling job you could imagine. By **Josh Giumelli** and photos by **Ben White**

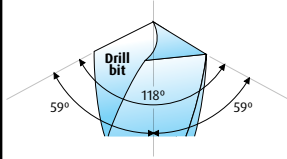
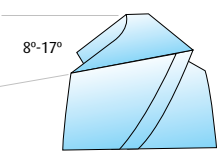
If we listed every type of specialist drill bit, it would be a pretty long list, but a good knowledge of what drill bits are available when a tricky drilling job presents itself is a useful thing.

In this month's Workshop, we have attempted to cover all of the main types, for a range of materials including steel, timber, concrete, glass and ceramics. Not all drill bits are suitable for use in your standard hand drill, and must be used in a drill press, magnetic base drill or even a metal lathe.

A good set of metric and imperial sized HSS twist drills will probably cover the majority of drilling jobs around the farm, but did you know they can be custom sharpened for different materials? (See Table 1.) Most farmers will also benefit from a set of cobalt drill bits for the times when that piece of steel is a lot harder than it initially looked.

Tools sourced from Toolmart where available

Table 1. Drill bit sharpening angles for common materials

Material	Drill point angle	Lip clearance angle
Sharpening angle		
Mild steel (general purpose)	118°	8-12°
Tough steel	140°	7°
Cast iron	118°	12°
Stainless steel	135°	9°
Copper and copper alloys	100°	12°
Aluminium, brass and bronze	118°	15°
Plastics	118°	17°
Wood, hard rubber, fibre	60°	12°
Deep holes	130°	9°

HSS TWIST DRILL



High speed steel (HSS) twist or 'jobber' drill bits are the standard, multi-purpose drill bit used day-in, day-out for a wide range of drilling tasks in a range of metals, plastics and timber. The split-point design can be hard to centre when drilling with a hand drill, and a centre-punch mark will generally stop the drill bit from wandering. Points are ground to 118 degrees, which is suitable for general drilling, including mild steel, but points can be custom-ground to alternate angles for different materials (see Table 1).

TiN-COATED DRILLS



The gold-coloured coating seen on many drill bits is titanium nitride (TiN), which increases the surface hardness, improves abrasion resistance and helps prevent the tendency for metal chips to cold-weld themselves to the surface of the bit. The TiN coating is supposed to reduce friction, allowing the bit to be used at speeds of up to 20 per cent over that of a standard HSS drill bit, or alternately an increased feed rate.

COBALT DRILL



Cobalt drill bits have five percent cobalt added to the HSS alloy, resulting in extended cutting life between sharpening. They look similar to standard HSS drill bits, but are often marked with 'HSS Co' on the shank, and the split point is ground to 138 degrees. They are primarily used for drilling tougher materials including stainless and high-tensile steels, and cast materials which may have a hard surface skin. They can cost up to three times the cost of standard HSS drill bits.

LEFT-HAND DRILLS



Left-handed drill bits are specifically designed for drilling out broken bolts and studs, and are used with drills set in reverse rotation. The contra-rotation of the drill bit often helps to loosen the stub of broken bolts. They are available in standard lengths, or short lengths as pictured, which have less tendency to snap. The blue colour, which is common to some HSS drill sets, is a ferric-oxide coating, which helps reduce chip welding and heat build-up, in a similar fashion to TiN coatings.

RIVET BITS



Rivet or thin section drill bits are suited for drilling shallow holes in thin materials such as sheet metal and are available in bright, blue and titanium nitride coated high-speed steel and cobalt-steel alloy. The 135 degrees point angle minimises breakthrough damage on the drill lip edge, and reduces wandering. Sizes to suit 3mm, 4mm, 1/8, 5/32 and 3/16 inch rivets are commonly available in double-ended, single-ended and stub drill configurations.

QUICK-CHANGE DRILL BITS



Drill bit sets are now commonly available with a 1/4 inch hex shank for quick attachment when using an impact driver. With the popularity of cordless impact drivers for installing fasteners including tek screws and bugle-head screws, a pre-drilled pilot hole is sometimes needed. The hex shank allows the impact driver to both drill and drive the screw, without the need for a cordless drill standing by. These bits are limited to smaller sizes (up to 6.5mm), as the high unloaded rpm of the impact driver is unsuitable for larger drill sizes.

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CENTRE DRILLS



Centre drills are used extensively in machine work where holes are needed to centre and support work turned in a lathe. The conical hole formed by the drill perfectly suits a live- or dead-centre in the lathe tailstock. They are also used to drill a starting or locating hole for a larger drill bit and are useful for starting holes on round or angled surfaces. The fine point on the end of the bit is sharpened to 118 degrees and the larger countersink section is sharpened to 60 degrees. Care is needed when using a centre drill to avoid snapping the end off in the work.

REDUCED SHANK DRILLS



Many hand-drills have a 13mm capacity chuck, limiting the size of hole that can be drilled. One way around this is to use a reduced-shank drill bit, which has a smaller shank, usually 10mm or 12.5mm, allowing it to fit into a regular chuck. But problems may arise with slippage when using large diameter bits. Drilling speed will also need to be reduced as diameter increases.

BIMETALLIC HOLESAW



Bimetallic holesaws feature saw teeth made from HSS, which are welded to the steel body of the tool and are suitable for drilling metal, plastics and timber. Arbors are used to connect the hole saw to the drilling machine and are fitted with a pilot drill, which is used to centre the hole saw. Arbors for small hole saws screw into the body of the tool, while larger hole saws are attached using locking pins. Provided the correct drilling speed is used and swarf is kept clear from the cut, bimetallic holesaws can drill through quite thick sections of steel. Some clearance holes drilled around the circumference of the cut can help considerably with swarf clearance. See From the Workshop, FA267 April 2014 for more information.

EXTENDED LENGTH DRILLS



While HSS drills are available in long series for deeper holes, ultra-long drill bits are available for applications where extreme drilling depth is needed. These drills are not easy to use and must be handled very carefully. Drills have a tendency to wander and not drill straight and must be withdrawn to clear swarf often because clogging is a real issue. Use low feed pressure and lower drilling speeds. They are also ideal where drilling access is limited.

TAPERED SHANK DRILLS



Larger pedestal drills are usually fitted with a 16mm chuck, but the best way to drill large diameter holes is to use tapered shank drill bits, which fit directly into the drill press spindle with the chuck removed. The flat end of the shank engages in the top of the socket, positively securing the bit and preventing it from spinning in the taper socket. Note the shanks are a different size, and most are commonly Morse taper number two or three (Pictured are MT5, MT3 and MT2 top to bottom). An adapter sleeve is used to fit smaller shanks into larger sockets. Just make sure your drilling machine has a large enough internal socket before purchasing a set.

TUNGSTEN CARBIDE HOLESAW



Tungsten carbide tipped holesaws are a more robust form of holesaw, with TCT bonded into the shell instead of HSS teeth. While they remove a greater amount of material during operation, they also last longer. The TCT holesaws pictured are designed for use on metals only, but other versions (usually with fewer teeth) are designed to cut a range of materials including timber.

COUNTERSINK BITS



Countersink bits are available in cross hole, single flute and multiple flute (pictured) configurations, and are designed for de-burring drill holes or producing a precision countersink of 90 degrees or 82 degrees angles. Slower drill speeds produce improved finished results. Note the quick-change shank on the right bit above.

STEP DRILLS



A step drill has a tapered form, with a range of steps along the length of the bit. It is mainly used on sheet metal and other thin materials where a range of hole sizes can be drilled with a single bit, leaving a neat hole with little burr. The upper bit can drill sizes from 10-30mm, in 2mm increments. The lower bit has deeper steps for drilling holes in thicker material. Step drills work well on plastic and metal without a pilot hole, and the hole being drilled is deburred on one side by the next largest step. It is far easier to create a perfectly round hole in sheet metal with a step drill rather than a twist drill, which tends to leave a slightly triangular hole in thin materials.

ROTARY BROACH



Rotary broaches or annular cutters are used with magnetic base drilling machines (see From the Workshop, FA260 September 2013) and can easily cut about three times faster than a comparable drill bit because only the outside of the hole is removed, leaving behind a central plug of undrilled material. While they work in a similar fashion to a holesaw, they do not use a centre guide drill, but feature a locating pilot pin to centre the hole, which retracts as drilling progresses.

CARBIDE BURRS



While not strictly a drill bit, carbide burrs are a handy addition to your drill bit collection. They are ideal for reaming out holes, or 'adjusting' a hole drilled slightly in the wrong location, and can be used to turn a set of chain-drilled holes into a slot. They are easily used in a hand drill, but are best used in an air-powered die grinder with a far higher rotational speed.

CERAMIC DRILLS



If you want to drill through ceramics such as tiles, porcelain or even terracotta flower pots, these strange looking bits are the ones to use. Depending on the manufacturer, some will even drill through non-toughened glass. Generally, use a slow drilling speed, and take care not to use too much pressure. These bits are used on hard, brittle materials which may crack and shatter.

CERAMIC CIRCLE CUTTER



This circle cutter is designed specifically for cutting a range of different hole sizes in ceramics, but other versions are also available for sheet metal. The hole diameter is easily adjusted by loosening the set screw and shifting the cutting arm. Take care not to run the cutter at too high a speed, especially when set at a large diameter.

AUGER BIT



Traditionally, auger bits were used with a hand cranked brace for deep holes in timber. The bit has a lead screw which draws the auger into the work. Spurs on the side prevent splintering of the entry and exit holes. Modern auger bits are used with higher power drilling machines, but at low speeds, especially when drilling larger, long holes through timber such as for hanging farm gates. Bits have either a solid centre (above) or a hollow centre for greater cleaning ability in deep holes. As bits are used at higher levels of torque, a hex shank prevents slipping in the drill chuck.

FORSTNER BIT



Forstner bits work in a similar fashion to a hole saw, but produce a flat-bottomed hole in wood. They can be used to hollow out a section of timber for mortising hinges or concealed fixings, and holes can be easily overlapped for irregular shaped areas. Forstner bits are difficult to sharpen compared to other wood drilling tools. They are ideal for creating a bolt-head recess when joining timber structures with bolts or coach screws.

MULTI-PURPOSE DRILL BITS



There are a few different styles of multi-purpose drill bits featuring a tungsten carbide tip. These Bosch multi drills are a good example, and can handle concrete, masonry, wood, sheet metal, aluminium and ceramics, and can be operated with or without impact. They are handy when you need something to handle a range of jobs, but don't expect the drill to bore an accurate size hole.

DIAMOND-TIPPED CORE DRILL



If you need to drill larger diameter holes in ceramics, for example to fit a tap through the bathroom wall, a good option is a diamond-tipped core drill, which is basically a holesaw for ceramics. There are several styles of these core drills with coarse or fine embedded diamond grit, and depending on the manufacturer, some versions can drill glass.

BRAD POINT BIT



While standard twist drills are perfectly fine for drilling timber, if you do a fair bit of woodworking, you may want to invest in a set of brad point bits. These have a sharp point in the centre of the drill, and spurs on the edges of the bit to help with clean cutting. The centre point eliminates wandering and most holes can be drilled in accurate locations without the need for a centre punch mark. Normal twist drills require a centre punch mark for accuracy.

MASONRY DRILLS



Proper masonry bits are similar in appearance to the multi-purpose drills pictured to the left, but the tungsten carbide tip is designed primarily for masonry and concrete. Masonry bits will drill rapidly through these materials, but will make a real mess of ceramics and should not be used. They have a much blunter tip, and are generally used with impact. In soft materials, or when a more accurate hole is required, try drilling without the impact engaged. The hex shank on larger drill bits help prevent the bit slipping in the chuck.

GLASS DRILL



Dedicated glass drill bits have a fine layer of diamond grit attached to the cutting edge and the sides of the bit. The layer of grit is attached using either electrolysis for cheaper drills, or sintered on using high temperatures for the better quality bits. They require a flood of water during drilling for cooling and lubrication. For drilling on vertical surfaces, you can use a small stick-on plastic tank to hold the water, which is often supplied with the drill bit.

SPADE BITS



Spade bits are a flat, simple drill bit that work extremely well in timber. Spade bits cut fast and resist clogging, and are an inexpensive way to purchase drill bits for drilling larger holes. Modern spade bits have spurs on the edge of the blade, which form a reasonably neat cut on the edge of the hole and a neater entry and exit hole, but they are not generally thought of as a precision drill bit. With care you can re-grind a spade bit to suit a custom sized hole.