The 'hole truth and nothing but...'

When last did you change the speed on your pillar/pedestal drill? Have you settled for some mid-range speed in the hope that the drill copes with all drilling requirements? Have we lost the art of matching the correct drill speed to the drill diameter?

Modern pedestal drills typically have 12 speeds ranging from about 180 rpm to 2740 rpm, this adequately covers the correct speeds for drilling ferrous, non ferrous metals, acrylics, hard and softwoods. But what is the correct speed for drilling materials found in school workshops taking into consideration the material, the drill type and drill diameter?

Setting up drilling areas

You should ask yourself the following:

- Is there an easy reference 'drill diameter, material and drill speed chart' available at each pedestal drill in our department?
- Has each chart speed displayed been personalised to suit the nearest drill speed available from your drill?
- Would a graphical illustration of the pulleys and belts position aid quick speed changing?

Twist Drills

Table 1 shows typical correct speeds (in rpm) for drilling steel and aluminium in relation to the diameter of the twist drill.

Twist drill diameter (mm)	drilling speed (rpm)	
	steel	aluminium
3	1820	2580
4	1350	2580
5	1290	2580
6	970	2580
7	830	2580
8	830	2580
9	500	1820
10	500	1820
11	500	1820
12	420	1820
13	420	1350
14	420	1350
15	320	1290
16	320	1290

***Table 1** - Correct twist drilling speeds (rpm) for steel and aluminium, the two most commonly used metals in technology departments in schools.*

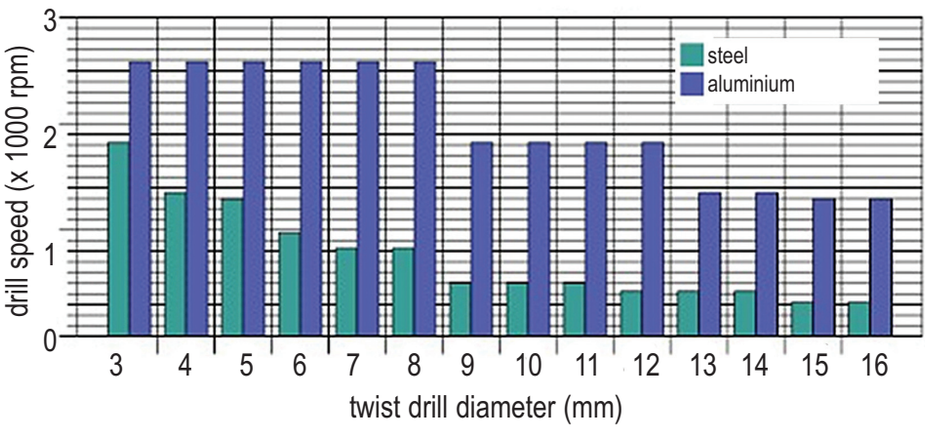

***Figure 1** - Graph results from Table 1.*

Depending on the source of information you may see some variation in the speeds from those stated here. Generally, when the drill diameter increases, the drill speed decreases. Table 1 shows that a particular speed is suitable for a range of diameter of drill.
Most twist drills/bits are manufactured from either High Speed Steel (HSS) or from Carbon Steel. HSS type should be used for drilling metals as they are able to withstand higher working temperatures. Carbon steel twist drills should never be used for drilling metals as they are more brittle, tend to be less flexible compared with HSS drills and they are not able to withstand the higher temperatures involved in drilling metals.

Today, it is common to see twist drills with a gold colour coating, this is titanium nitride (TiN). This coating has two functions, firstly to improve the drill's hardness and secondly to provide a self-lubricating property when drilling metals.

You can see that the drilling speed of aluminium for a 3 mm twist drill is about 1.4 times faster than that required for steel. For a 16 mm diameter drill, the relationship of the correct drilling speed for aluminium is over 4 times faster than for drilling steel. Steel and aluminium are the two most commonly used metals in school technology departments. The speed range for twist drills (3 to 16 mm dia.) from 320 to 2580 rpm is typically found in our 12 speed pedestal drills. Each drilling speed should be utilised when deemed necessary.

Drilling timber

Care must be taken when using twist drills with hardwoods and woods which are 'green' They tend to clog quickly, particularly if deep holes are required and must be withdrawn regularly and the waste removed.

Hole Saws

When drilling metals, lubrication is essential. The pilot drill should never extend past the teeth of the saw any more than the drilled material thickness. The pilot hole should be drilled at around 970 rpm.

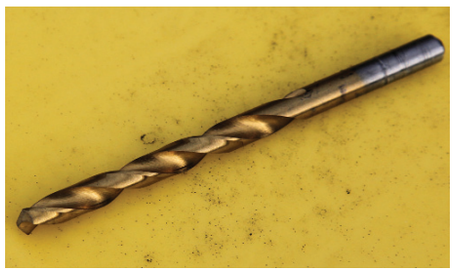

***Figure 2** - Twist drill.*

***Figure 3** - Hole saw.*

Figure 4 *- Forstner bit.*

Figure 5 *- Flat bit.*

Figure 6 *- Countersink bit.*

The range of drilling speeds varies from 85 rpm to 530 rpm for steel and 125 to 900 rpm for aluminium.

Notice that the speed for drilling aluminium with a hole saw is faster than that required for steel by a factor in the range 1.4 – 1.7, depending upon the diameter.

Further drilling of the main hole, after the pilot hole has been drilled, should be in keeping with the speeds shown in Table 4.

Conclusion

Drilling too fast can cause overheating, while drilling too slow may cause poor quality holes. When drilling in the end grain of timber, reduce speed. In order to operate safely, produce the best quality of work and efficiently use drills, check the tables and change the speed!

Twist drill diameter (mm)	Softwood (rpm)	Hardwood (rpm)
2 – 5	3000	3000
6 - 10	3000	1500
11 - 16	1500	750
17 - 25	750	500

Table 2 *- Drilling speeds using a twist drill for drilling timber.*

Twist drill diameter (mm)	Drill speed (rpm)
2 – 5	2500
6 - 10	2000
11 - 16	1500
17 - 25	not recommended

Table 3 *- Drilling speeds using a twist drill for drilling acrylic.*

Hole saw diameter (mm)	Drilling speed (rpm)	
	steel	aluminium
16	530	900
20	460	690
25	350	525
30	285	425
35	250	375
40	220	330
50	170	255
75	115	165
100	85	125
175	115	165

Table 4 *- Drilling speeds using a hole saw for steel and aluminium.*

Drilling timber with other bits

Forstner Bit (mm)	Figure 4	
6 – 10	2400	700
11 -16	2400	500
17 - 25	1500	500
26 - 32	1000	250
33 - 50	500	250
Flat Bit (mm)	Figure 5	
6 - 12	2000	1500
15 -25	1750	1500
26 - 38	1500	1000
Countersink	Figure 6	
2 – flute	1400	1400
5 - flute	1000	750

Table 5 *- Drilling speeds for timber using various types of bit.*

Drilling acrylic with other bits

Forstner Bit (mm)	
6 – 10	not recommended
12 – 32	250 rpm
35 – 50	not recommended
Hole Saw (mm)	
25 - 62	not recommended
Flat Bit (mm)	not recommended
Countersink (mm)	
2 – flute	not recommended
5 – flute	not recommended

Table 6 *- Drilling speeds for acrylic using various types of bit.*

Useful Websites

www.ultimatehandyman.co.uk/DIY_Metalworking/drilling_metal_technique.htm
www.diydata.com/tool/drillbits/drillbits.php
www.raygirling.com/dpspeed.htm