Lesson #4: Drill Safety Exam and History of Drills

Objectives

Students will be able to…

- Identify the portable drill's major components and safety operation.

Common Core Standards

LS 11-12.6
RSIT 11-12.2
RLST 11-12.2
Health and Safety 6.0, 6.2, 6.3, 6.5, 6.6
Technical Knowledge and Skills 10.0, 10.1, 10.2
Demonstration and Application 11.1
Cabinetmaking and Wood Products Pathway A4.1, 4.3, & A4.4
Residential and Commercial Construction Pathway D2.1, D3.1, D3.2, D3.3

Materials

Portable Drill Safety Exam
Brief History of Drills Notes

Lesson Sequence

- Review the major components of a portable drill and the safety of it. (10 minutes)
- Pass out the ***Portable Drill Safety Exam***. Students must pass this exam before being able to participate in a project in the job. (20-25 minutes)
- Read through the ***Brief History of Drills Notes***. Highlight important information as you read through. Have students write down three things they learned as an exit ticket before leaving (15-20 minutes)

Assessment
Students must pass the portable drill safety exam prior to being able to participate in a project in the shop. Use exit ticket data to display student knowledge of the history of drills.

Accommodations / Modifications
Test May Be Read Aloud One on One Support Extra Time If Needed

Portable Drill Safety Exam

Directions: Fill in the blank spaces with the word(s) from the word bank.

Cooling vents	Tightened	Woodchips	Capability	Tightening location
Trigger switch	Jump	MPH	Faster	Drill bit
Power cord	Clamp	Defect	Flammable	Lefthanded
Hot	Dull	Balance	Pilot hole	Wedge
Lubricant	Slower	Angle	Center	Front
Portal sockets	RPM	Righthanded	Chuck key	

1. The portable drill's power cord must be unplugged before changing the _____.
2. Make sure when tightening the drill bit in the portable drill to always use _____.
3. Always pick up the portable drill up by the handle and never by the _____.
4. When drilling into a metal container make sure nothing in the container is _____.
5. In order to be a safe user of the portable drill, you must know the equipment's _____.
6. When tightening the drill bit in the portable drill, always make sure to use all three _____.
7. Controlling the speed of the portable drill is accomplished with the use of the _____.
8. A drill bit with a small diameter will require an rpm speed that is _____.
9. A drill bit with a larger diameter will require an rpm speed that is _____.

10. In order to avoid having a part spin when drilling it is recommended that you use a _____.

11. Before using the portable drill, inspect the power cord for any _____.

12. Drill bits are manufactured so that the direction of rotation when cutting is _____.

13. Avoid touching the drill bit during use due to the fact it may get_____.

14. It is a safe practice when drilling, to never reach and keep good _____.

15. To relieve pressure when drilling into a hard wood, you should create a _____.

16. When drilling deep holes into wood, you must withdraw the drill bit frequently to clear _____.

17. When drilling into a masonry or metal surface, you may need to apply a suitable _____.

18. To avoid overheating when using the portable drill, don't cover the _____.

19. To avoid braking drill bits that are long and have a small diameter, you must keep the drill at the proper _____.

Portable Drill Safety Exam – *Answer Key*

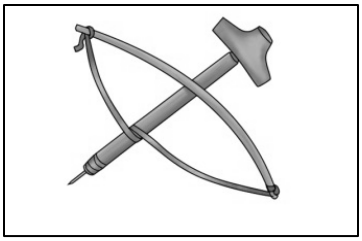
1. The portable drill's power cord must be unplugged before changing the **drill bit**.
2. Make sure when tightening the drill bit in the portable drill to always use a **chuck key**.
3. Always pick up the portable drill up by the handle and never by the **power cord**.
4. When drilling into a metal container make sure nothing in the container is **flammable**.
5. In order to be a safe user of the portable drill, you must know the equipment's **capability**.
6. When tightening the drill bit in the portable drill, always make sure to use all three-tightening **location**.
7. Controlling the speed of the portable drill is accomplished with the use of the **trigger switch**.
8. A drill bit with a small diameter will require an rpm speed that is **slower**.
9. A drill bit with a larger diameter will require an rpm speed that is **faster**.
10. In order to avoid having a part spin when drilling it is recommended that you use a **clamp**.
11. Before using the portable drill, inspect the power cord for any **defects**.
12. Drill bits are manufactured so that the direction of rotation when cutting is **righthanded**.
13. Avoid touching the drill bit during use due to the fact it may get **hot**.
14. It is a safe practice when drilling, to never reach and keep good **balance**.
15. To relieve pressure when drilling into a hard wood, you should create a **pilot hole**.
16. When drilling deep holes into wood, you must withdraw the drill bit frequently to clear **wood chips**.
17. When drilling into a masonry or metal surface, you may need to apply a suitable **lubricant**.
18. To avoid overheating when using the portable drill, don't cover the **cooling vents**.
19. To avoid braking drill bits that are long and have a small diameter, you must keep the drill at the proper **angle**.

Brief History of Drills Notes

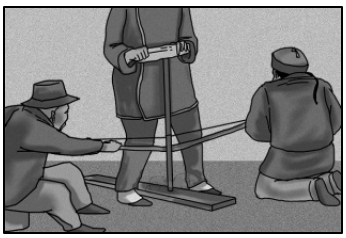
Historically, drilling holes has always required considerable time and effort.

The first human tool for drilling was the awl. The awl was simply a sharp stone that was attached to a stick, then pressed against the work piece and rotated by hand. Sand and other abrasive materials were often used to make the awl more effective at drilling.

The first step forward in drilling was the strap drill, which had a leather cord wrapped around the shaft of a stick. By pulling the cord back and forth, the stone bit at the end of the stick could be rotated at a higher speed, making it more effective.



After the strap drill came the bow drill, which first appeared in Egypt over 6,000 years ago. The bow drill consisted of the two ends of leather from a strap drill attached to a bow. This made it easier to move back and forth, rotating the drill. The bow drill could be rotated faster than the strap drill, speeding up the drilling process.

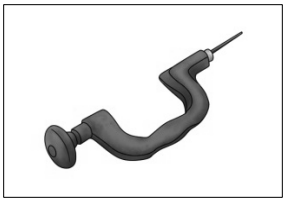


Bow drills were particularly popular in China, where they continued to be used until the beginning of the 20th century. Very large bow drills, which required several people to operate, were used for drilling larger holes.

Augers

During Roman times, the auger drill became popular. The auger was a metal corkscrew-like drill with two wooden handles at the top, giving it a 'T' shape. It was better suited to drilling wider holes than other drills that required several people to turn, so was used to drill very large diameter holes. Auger shaped drill bits are still used to this day in modern drills for drilling larger diameter holes into wood.

Hand Braces



The hand brace was the next big step forward in drilling. However, it did not appear until the early 1400s. The oldest remaining example of a brace came from an English ship that sunk in 1545.

Wood was used to construct the first braces which had the drill bit permanently attached. Up until the beginning of the 19th century, advances in brace design consisted of adding metal plates to reinforce and strengthen the wooden frame along with simple clamp-like chucks, which allowed different drill bits to be used.

At the end of the 19th century, good quality cheap steel allowed much stronger braces to be made. With the advances in manufacturing accuracy at the time, more complex parts could be made. This led to improved chuck designs and the invention of the ratchet mechanism that would be used on some braces and hand drills.

Hand Drills

The advances in materials and accuracy of manufacturing during the 19th century also led to the next invention in drill technology. The hand drill, which was first pictured in 1816, used a handle attached to a drive gear to turn a pinion, which spun the drill bit. Hand drills could achieve much higher turning speeds than other drills. This meant they were far better for drilling metal, which required a higher cutting speed.

Modern drills

The days of hand drills and braces were numbered though as the electric motor led to the invention of the electric drill in 1889 by Arthur James Arnot and William Blanch Brain of Melbourne, Australia. In 1917, Black & Decker patented the first pistol grip portable drill with a trigger switch. This marked the beginning of modern drilling.

Most Common Drill Bits

Twist Bit:

The first 'twist' drill bit was invented in 1861, by Steven A. Morse (not to be confused with Samuel Morse of Morse Code fame). This drill bit was originally formed by cutting two grooves on opposite sides of a steel bar and then twisting it. Today, twist bits are typically produced by grinding a steel bar while it is being rotated, creating the helical flutes. The twist bit is the most commonly used drill bit today, and is easily the most recognizable drill bit made. One of the reasons for this bit's popularity is because of its versatility. It's one of only a few of the many types of drill bits that can effectively/efficiently drill both soft and hard materials. Such materials include wood and metal.

The only thing you must be aware of when using a twist bit (depending on the hardness of the material you are going to drill) is the quality of the steel the bit is made of. For relatively soft materials such as wood, inexpensive carbon steel bits will work just fine. This is because very little heat is generated while drilling these materials. What heat is generated by the process can be handled by a bit made of carbon steel. However, if you need to drill something hard like plate steel, a carbon steel bit will not be able to cope with the heat of the process, and will dull quickly. To drill something this hard, you need a drill bit to be made out of higher grade steel. This steel is known as High Speed Steel (HSS), and it can withstand a great deal more heat than its carbon cousin.

An important point that you have, and will continue to hear throughout the BITA program, is that *heat is the destroyer of all things sharp*. For this reason, most carpenter's/trades people invest only in twist bits made from high-speed steel. This way they don't have to worry about what material they may have to drill on the jobsite; their bits will be up to the task.

Spade Bit:

The next most common bit that we use in the shop goes by several names, some of which are trade names to differentiate one manufacturer's bit from another, while others are jobsite slang. This bit is typically referred to as a spade bit, because of its resemblance to a flat shovel known as a spade. It is also referred to as a flat bit, a butterfly bit, or a speed bit, among others. Due to their shape, spade bits can only be used for drilling wood. Most spade bits are only useful for drilling extremely rough holes in framing members. Besides these limitations, these bits do have two attributes that make their lack of clean drilling relatively moot - size and speed. A spade bit will drill large holes much more quickly and much cheaper than a twist or other bit of comparative size. These bits are incredibly inexpensive compared to any other comparably sized drill bit.

Forstner Bit:

The final bit we are going to look at is known as the forstner. This bit is so-named for its inventor, an American gunsmith named Benjamin Forstner. Mr. Forstner received a patent for his drill bit in September of 1874 which he developed to drill extremely precise, extremely clean, flat-bottomed holes at any grain orientation (face edge or end) in any type of wood. This is exactly what it can do.

In its day, there were no other bits that could compare to the forstner's performance. Even now there are few, if any other drill bits that can match it. This is why the bit remains so popular among high-end wood workers and tradespersons almost 150 years after its invention. Like all things in life, these bits do have their disadvantages.

1. They can only be used to drill wood.
2. They drill rather slowly
3. They cannot be started at an angle, unless mounted in a drill press.

Forstner bits possess a diminutive pilot tip. Due to its small size, the pilot tip is of absolutely no use when trying to start a hole at any angle other than a few degrees above or below 90. However, if the bit is mounted in a drill press, this is not an issue.