Drilling

How to drill.

- Drill Bit Sizes
- Pilot Holes
- Drill Presses vs. Hand Drills
- Proper Feed Pressure and Speed

Drill Bit Sizes

Selecting the correct drill bit size is important for proper fastener fit, tapping, and hole accuracy in FRC fabrication.

Common FRC Drill Bit Sizes

Drill Bit	Common Use
#43 (0.089")	Tap drill for 4-40
#36 (0.106")	Tap drill for 6-32
#21 (0.159")	Tap drill for 10-32
#7 (0.201")	Tap drill for 1/4-20
1/8"	Rivets and small hardware
3/16"	Large rivets
13/64"	Clearance hole for 10-32
17/64"	Clearance hole for 1/4-20

Tap Drill vs. Clearance Drill

Tap Drill

A tap drill creates the correct size hole for cutting threads with a tap.

Example:

- A 10-32 screw uses a **#21 drill bit** before tapping.

Clearance Drill

A clearance hole allows a fastener to pass through freely.

Example:

- A 10-32 bolt typically uses a **13/64" clearance hole**.

Best Practices

- Verify the required drill size before drilling.
- Use a center punch to prevent drill wandering.
- Deburr holes after drilling.
- Label commonly used bits to prevent mistakes.

Common Mistakes

- Using a clearance hole when tapping is required.
- Selecting the wrong drill bit size.
- Drilling oversized holes.
- Forgetting to deburr the finished hole.

Key Idea

Using the correct drill bit size ensures proper fastener fit, accurate hole placement, and reliable assemblies on an FRC robot.

Pilot Holes

A pilot hole is a small hole drilled before the final hole size. Pilot holes improve accuracy and make larger holes easier to drill.

Why Use a Pilot Hole?

Pilot holes help:

- Keep the drill bit centered
- Reduce drill bit wandering
- Improve hole accuracy
- Reduce cutting force on larger drill bits
- Produce cleaner holes

When to Use Pilot Holes

Pilot holes are especially useful when:

- Drilling large holes
- Drilling thick material
- Working with precise hole locations
- Using step-up drill sizes

Small holes, such as rivet holes, often do not require a pilot hole.

Typical Process

1. Mark the hole location.
2. Center punch the hole.
3. Drill a small pilot hole (such as 1/8").
4. Drill the final hole size.

Best Practices

- Always center punch before drilling.

- Keep the drill perpendicular to the material.
- Use steady pressure and let the drill bit cut.
- Deburr the finished hole.

Key Idea

Pilot holes improve drilling accuracy and make larger holes easier to produce. Taking the extra step can prevent misplaced holes and improve part quality.

Drill Presses vs. Hand Drills

Both drill presses and hand drills are commonly used in FRC fabrication. Choosing the correct tool depends on the accuracy, size, and location of the hole.

Drill Press

A drill press holds the drill bit perpendicular to the material and provides precise control.

Advantages:

- Highly accurate hole placement
- Straight, perpendicular holes
- Better for large or repeated holes
- Safer for precision work

Best for:

- Drilling plates
- Tapping preparation holes
- Multiple identical parts
- High-accuracy hole locations

Hand Drill

A hand drill is portable and can be brought directly to the workpiece.

Advantages:

- Portable and versatile
- Fast setup
- Useful on large assemblies
- Can reach locations that do not fit on a drill press

Best for:

- Robot repairs
- Large assemblies

- Quick modifications
- Field or pit work

Safety

- Always secure the material before drilling.
- Wear safety glasses.
- Remove chips and debris frequently.
- Keep hands away from the drill bit.

Key Idea

Use a **drill press when accuracy is most important** and a **hand drill when portability and accessibility are needed**. The right tool depends on the job.

Proper Feed Pressure and Speed

Proper feed pressure and drill speed are important for producing clean holes, extending tool life, and improving safety.

Feed Pressure

Feed pressure is the amount of force applied while drilling.

- Apply steady, consistent pressure
- Let the drill bit do the cutting
- Do not force the drill through the material

Too much pressure can:

- Break drill bits
- Create oversized holes
- Cause the drill to grab the material

Too little pressure can:

- Generate excessive heat
- Dull the drill bit
- Produce poor surface finish

Drill Speed

Different materials and bit sizes require different speeds.

- **Small drill bits:** Higher speeds
- **Large drill bits:** Lower speeds
- **Aluminum:** Moderate to high speeds

If the drill bit becomes extremely hot or produces poor chips, adjust the speed or feed pressure.

Signs of Proper Drilling

- Continuous metal chips are produced
- The drill cuts smoothly
- Minimal vibration occurs
- The hole is clean and round

Common Mistakes

- Pushing too hard on the drill
- Running large bits at high speed
- Using excessive force when the bit becomes dull
- Continuing to drill if the material is vibrating or moving

Key Idea

Use steady pressure and the proper drill speed for the material and bit size. Let the drill bit cut the material rather than forcing it through.