Tapping Threads

How to make the threads for bolts to tap into.

General Overview

A tapped hole is a drilled hole that has internal threads cut into it so a screw or bolt can be directly threaded into the material without using a nut.

How It Works

1. A hole is drilled to a specific size (called a tap drill size)
2. A tool called a **tap** is used to cut threads inside the hole
3. A screw or bolt can then be threaded directly into the material

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Why FRC Teams Use Tapped Holes

Tapped holes are useful because they:

- Eliminate the need for a nut on the back side
- Save space in tight assemblies
- Reduce part count
- Allow clean, compact mounting points

Common Applications

- Mounting sensors
- Attaching small brackets
- Light structural connections
- Situations where access to the back side is impossible

Limitations

- Threads can strip if over-tightened
- Not as strong as bolt-and-nut connections in high-load areas
- Requires correct drill size and careful tapping

Best Practice

- Always use the correct tap drill size
- Start tapping slowly and keep it straight
- Use cutting fluid when possible
- Avoid over-tightening screws in aluminum

Key Idea

A tapped hole allows a screw to thread directly into a material, making it useful for compact and lightweight FRC designs, but it must be used carefully to avoid stripping threads.

Tap Drill Hole Sizes

Page — Tap Drill Hole Sizes (10-32 and 1/4-20)

Before tapping a hole, the correct **drill bit diameter** must be used. The tap drill is slightly smaller than the final thread size so the tap can cut threads into the material properly.

10-32 Tap Holes

For a **10-32 thread**, the correct tap drill size is:

- **#21 drill bit (0.159")**

This size provides:

- Enough material for strong threads
- Proper engagement for aluminum tapping
- Reduced risk of stripping when used correctly

1/4-20 Tap Holes

For a **1/4-20 thread**, the correct tap drill size is:

- **#7 drill bit (0.201")**

This size provides:

- Strong, coarse threads suitable for higher loads
- Better durability in structural applications
- Lower chance of thread failure compared to tighter fits

Why Correct Hole Size Matters

Using the wrong tap drill size can cause:

- Weak or stripped threads
- Difficulty starting the tap
- Broken taps inside the material
- Poor fastener holding strength

Best Practice

- Always verify drill size before tapping
- Use a center punch before drilling
- Drill perpendicular to the surface
- Use cutting fluid when tapping aluminum

Key Idea

Tap drill size determines thread strength and reliability. In FRC, **#21 for 10-32** and **#7 for 1/4-20** are standard sizes that ensure strong, consistent threaded holes.

Using a Hand Tap

A hand tap is a tool used to cut internal threads into a drilled hole so that a screw or bolt can be directly fastened into material such as aluminum.

Before Tapping

- Drill the correct tap drill size hole (example: #21 for 10-32, #7 for 1/4-20)
- Deburr the hole to remove sharp edges
- Secure the part so it cannot move
- Select the correct tap size

How to Use a Hand Tap

1. Insert the tap into a tap handle
2. Align the tap perpendicular to the hole
3. Apply gentle downward pressure and begin turning clockwise
4. After 1–2 turns, continue turning slowly with steady pressure
5. Every few turns, reverse slightly to break chips
6. Continue until the desired thread depth is reached

Key Technique

- Keep the tap straight at all times
- Do not force the tap if it becomes difficult to turn
- Use cutting fluid when possible to reduce friction and improve thread quality

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Common Mistakes

- Starting the tap at an angle
- Forcing the tap (can break it easily)
- Not backing out to clear chips
- Using the wrong tap drill size

Key Idea

A hand tap must be started carefully and kept straight. Most tap failures come from misalignment or forcing the tool instead of allowing it to cut gradually.

Cutting Fluid

Cutting fluid is a lubricant used during drilling and tapping to reduce friction and heat.

Why It’s Used

- Reduces heat buildup
- Lowers friction on tools
- Helps produce cleaner threads
- Extends drill and tap life

When to Use It

- Tapping aluminum (10-32, 1/4-20)
- Drilling larger or deep holes
- When tools start to feel hot or resist cutting

How to Use It

- Apply a small amount to the hole or tool
- Reapply if needed during cutting
- Keep it light—don’t overuse

Key Idea

Cutting fluid makes drilling and tapping easier and safer by reducing heat and friction, especially in aluminum.

Preventing Broken Taps (Conclusion)

Preventing broken taps comes down to control, preparation, and patience.

Key Habits

- Drill the correct tap drill size before starting
- Keep the tap perfectly straight
- Use cutting fluid to reduce friction
- Turn slowly and apply light, steady pressure
- Back the tap out often to clear chips

What to Avoid

- Forcing the tap when resistance increases
- Starting at an angle
- Skipping chip clearing
- Rushing the process

Final Idea

Most tap failures are caused by technique, not the material. Careful alignment, steady motion, and chip control make tapping reliable and safe in FRC fabrication.