

Hand Tools

How to use all of the different hand tools in the shop.

- T-Handles and Wrenches
- Ratchets and Sockets
- Pliers and Vice Grips
- Deburring Tools
- Clamps

T-Handles and Wrenches

T-handles and wrenches are common hand tools used in FRC for installing and removing fasteners. Choosing the right tool improves speed, safety, and prevents damage to hardware.

T-Handles

T-handles are used with hex (Allen) fasteners and provide better torque control than standard L-shaped hex keys.

Advantages:

- Higher torque capability
- Faster repeated fastening
- Better grip and control
- Reduced hand fatigue during long assembly sessions

Best use in FRC:

- Drivetrain assembly
 - Mechanisms with many hex fasteners
 - Repetitive tightening tasks
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Wrenches

Wrenches are used on external hex fasteners such as nuts and bolt heads.

Common types in FRC:

- Combination wrenches (open + box end)
- Ratcheting wrenches (faster operation in tight spaces)

Advantages:

- Strong torque application
- Works with nuts and bolt heads
- Useful in tight or awkward spaces

Proper Use

- Ensure full contact with the fastener before applying force
- Keep tools aligned to avoid rounding edges
- Use steady pressure instead of sudden force
- Match tool size exactly to fastener size

Common Mistakes

- Using incorrect wrench size (causes stripping/rounding)
- Applying force at an angle
- Using pliers instead of proper wrenches
- Not fully seating the tool before turning

Key Idea

T-handles are best for fast, controlled tightening of hex fasteners, while wrenches are essential for nuts and bolts. Using the correct tool protects hardware and improves build quality.

Ratchets and Sockets

Ratchets and sockets are common hand tools in FRC used for quickly tightening or loosening nuts and bolt heads. They are especially useful in tight spaces where a wrench cannot fully rotate.

Ratchet

A ratchet is a handle tool that allows continuous tightening or loosening without removing the tool from the fastener.

Advantages:

- Fast operation
 - Works well in confined spaces
 - Direction can be switched easily (tighten/loosen)
 - Reduces time during assembly and repairs
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Sockets

Sockets attach to the ratchet and fit over the fastener.

Types used in FRC:

- Standard sockets (for nuts and bolt heads)
- Deep sockets (for longer bolts or protruding threads)

Key rule:

- Always match socket size exactly to the fastener to avoid rounding
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Proper Use

- Fully seat the socket on the nut or bolt head
- Keep the ratchet aligned straight with the fastener
- Apply steady force instead of jerking motions
- Switch direction carefully to avoid over-tightening

Common Mistakes

- Using the wrong socket size
- Not fully seating the socket before turning
- Using excessive force at an angle (causes rounding)
- Forgetting to switch ratchet direction

Key Idea

Ratchets and sockets make fastener work faster and more efficient, but only when the correct size is used and the tool is properly aligned with the hardware.

Pliers and Vice Grips

Pliers and vice grips are gripping tools used in FRC for holding, bending, and temporarily securing parts. They are not primary fastening tools, but they are useful for support tasks during assembly.

Pliers

Pliers are hand tools used to grip, bend, or hold small parts.

Common uses in FRC:

- Holding nuts in tight spaces
- Bending wire or light metal
- Removing or adjusting small components

Types:

- Needle-nose pliers (precision work in tight areas)
 - Standard pliers (general gripping and bending)
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Vice Grips (Locking Pliers)

Vice grips are adjustable pliers that lock into place with high gripping force.

Advantages:

- Strong, adjustable grip
- Can hold parts without continuous hand pressure
- Useful for temporary clamping

Common uses in FRC:

- Holding bolts or nuts in place
 - Temporary clamping of parts during assembly
 - Removing stripped or stuck fasteners
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Proper Use

- Adjust grip before locking vice grips into place
 - Avoid over-tightening, which can damage parts
 - Use only when a proper tool (wrench or socket) is not practical
 - Release locking mechanism carefully to avoid sudden movement
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Common Mistakes

- Using vice grips as a permanent fastening solution
 - Over-tightening and damaging hardware
 - Slipping off due to poor adjustment
 - Using pliers instead of the correct size wrench or socket
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Key Idea

Pliers and vice grips are support tools in FRC. They are best used for holding and adjusting parts, not for replacing proper fastener tools like wrenches or sockets.

Deburring Tools

Deburring tools are used in FRC fabrication to remove sharp edges (burrs) created after cutting, drilling, or machining metal parts. Proper deburring improves safety, fit, and part durability.

What Is a Burr?

A burr is a sharp or rough edge left behind after:

- Drilling holes
- Cutting aluminum extrusion or plate
- Machining or grinding

Burrs can cause:

- Cuts and injuries
 - Poor part fitment
 - Difficulty inserting bolts or rivets
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Deburring Tools

Hand Deburrer

- Small rotary tool with a cutting blade
- Used to chamfer hole edges
- Fast and easy for repeated use

Deburring Bit (in drill)

- Installed directly into a drill
- Quickly cleans hole edges
- Common in high-volume fabrication

File or Sanding Tool

- Used for larger edges or cut surfaces
 - Removes sharp corners and smooths surfaces
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Proper Use

- Lightly remove only the sharp edge (do not remove excess material)
 - Deburr both sides of drilled holes when possible
 - Smooth cut ends of extrusion after cutting
 - Check parts by touch carefully after finishing
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Common Mistakes

- Over-deburring (making holes oversized)
 - Skipping internal hole edges
 - Leaving sharp edges on cut extrusion
 - Using excessive force that damages the part
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Key Idea

Deburring is a small step that has a big impact. Removing sharp edges improves safety, ensures proper fastener fit, and increases overall build quality in FRC robots.

Clamps

Clamps are holding tools used in FRC fabrication to secure parts together during assembly, drilling, or gluing. They act as temporary “extra hands” to keep parts aligned and stable.

Why Clamps Are Used

Clamps help:

- Hold parts in position during drilling
 - Keep assemblies aligned while fastening
 - Prevent movement during marking or layout
 - Improve accuracy and repeatability
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Common Types of Clamps in FRC

C-Clamps

- Strong, rigid holding force
- Best for heavy-duty metal-to-metal holding
- Slower to adjust but very secure

Quick-Release (Trigger) Clamps

- Fast to apply and remove
- Good for repetitive assembly work
- Moderate holding strength

Bar Clamps

- Used for larger assemblies or long parts
 - Provide even pressure across surfaces
 - Useful for aligning long extrusion pieces
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Proper Use

- Ensure clamp pressure is applied evenly

- Place clamps near the work area without blocking drill paths
 - Check alignment before fully tightening
 - Use protective padding if needed to avoid marking parts
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Common Mistakes

- Over-tightening and bending parts
 - Clamping without checking alignment first
 - Blocking access to drill or tool paths
 - Using the wrong clamp type for the job
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Key Idea

Clamps improve accuracy and safety by holding parts in place during fabrication. Proper clamp selection and placement are essential for consistent, high-quality FRC builds.