

Refrigeration & Air Conditioning Technology
SIXTH EDITION

Section 2
Safety, Tools and Equipment,
Shop Practices

Unit 5
Tools and Equipment

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Unit Objectives

After studying this chapter, you should be able to:

- Describe hand tools used by the air-conditioning, heating, and refrigeration technician.
- Describe equipment used to install and service air conditioning, heating, and refrigeration systems.

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General Hand Tools (1 of 6)

•Screwdrivers

- Straight-slot screwdrivers turn screws with straight slots.
- Phillips head screwdrivers turn screws with slots resembling a cross.

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General Hand Tools (2 of 6)

- Wrenches
 - Common types of wrenches include the open end wrench, the box wrench, and the combination wrench.



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General Hand Tools (3 of 6)

Other wrenches include pipe wrenches and adjustable wrenches.





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General Hand Tools (4 of 6)

- Hex keys
 - Used to turn screws and set screws that have female hex heads
 - Also referred to as Allen wrenches

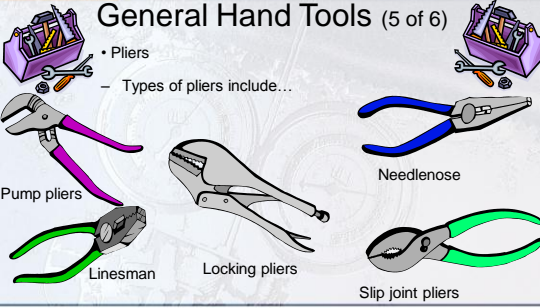



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General Hand Tools (5 of 6)

- Pliers
- Types of pliers include...




Pump pliers
Linesman
Locking pliers
Needlenose
Slip joint pliers

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General Hand Tools (6 of 6)

- Hammers
- Commonly used hammers include...



Ball peen
Carpenter's claw
Rubber mallet

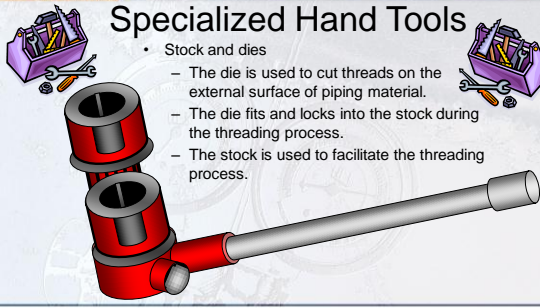
Always be careful when using hammers!

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Specialized Hand Tools

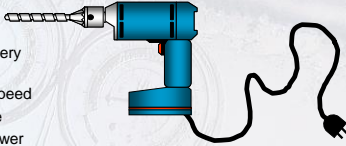
- Stock and dies
- The die is used to cut threads on the external surface of piping material.
- The die fits and locks into the stock during the threading process.
- The stock is used to facilitate the threading process.



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Electric Drills

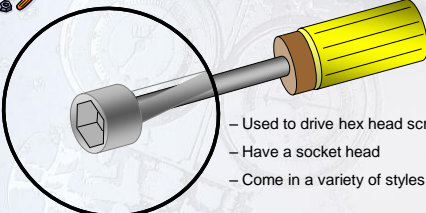


- Can be corded or battery operated
- Some drills variable speed
- Some types reversible
- Always disconnect power cord (corded drills) when changing the drill bit.

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Specialized Tools (1 of 4)




- Nut drivers
 - Used to drive hex head screws
 - Have a socket head
 - Come in a variety of styles

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Specialized Tools (2 of 4)



- Refrigeration service wrench
 - Ratcheting wrench used to turn square stems on fuel tanks, service valves, and other system components
 - Can be used on four different stem sizes

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 **Specialized Tools (3 of 4)** 

- Crimping tool
 - Cuts Wire
 - Strips wire
 - Crimps solderless connectors onto wires
 - Cuts small bolts




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 **Specialized Tools** 

- Inspection mirror
 - Telescopic mirror used to inspect solder joints for leaks



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 **Tubing Tools (1 of 4)** 


- Tubing cutter
 - Available in different sizes and styles
 - Used to cut copper and aluminum tubing and piping materials



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Tubing Tools (2 of 4)




- The flaring block and yoke are used to create flares in soft drawn tubing.






Before the flare

After the flare

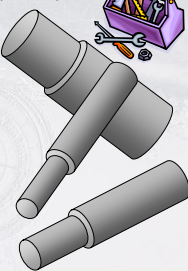
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Tubing Tools (3 of 4)



- Swaging tools
 - Used to expand the end of a tube so that two sections of the same size tubing can be joined
 - Used in conjunction with a flaring block



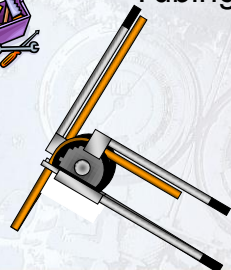
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Tubing Tools

- Tubing benders
 - Can be spring type or lever type
 - Used to bend soft copper or aluminum tubing



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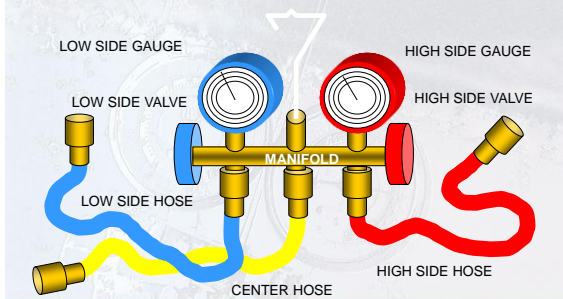
Specialized Service Tools (1 of 5)

- The gage manifold
 - One of the HVAC/R technician's most important pieces of equipment
 - Can read pressures on both the high- and low-pressure sides of the system
 - Can read pressures below atmospheric on the low-pressure side of the system
 - Can be of the two-valve or four-valve variety

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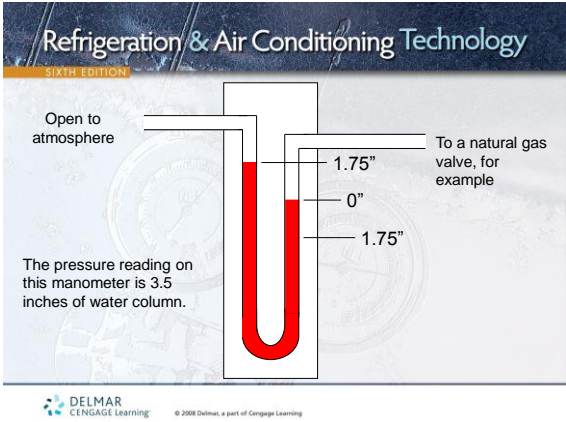
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Specialized Service Tools (2 of 5)

- The U-tube manometer
 - Can be the mercury or water variety
 - Can measure low pressures in inches of water column or millimeters of mercury
 - The liquid level rises on one side and falls on the other.
 - The difference between the two liquid levels is the pressure reading.

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Specialized Service Tools (3 of 5)

- Electronic vacuum gage
 - Measures the vacuum in a refrigeration system during the evacuation process
 - Can measure a vacuum down to 50 microns or 0.050 mm Hg
 - 1,000 microns = 1 mm Hg
 - As a vacuum is pulled on a system the micron level will drop.

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Specialized Service Tools (4 of 5)

- Electronic vacuum gage

Power indicator

Very poor vacuum

Fair vacuum

Good vacuum

Hose from vacuum pump

Cap

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Specialized Service Tools (5 of 5)

- Vacuum pump
 - Designed to remove air and non-condensable gases from an air-conditioning or refrigeration system

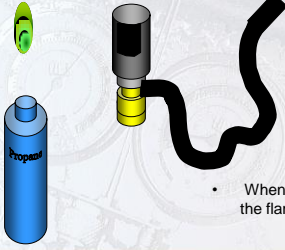


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Refrigerant Leak Detectors (1 of 2)

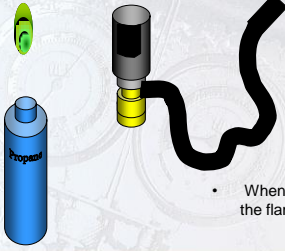
- Halide leak detector
 - It is used with acetylene, propane, or MAPP gas.
 - When ignited, the flame heats a copper disc.
 - Combustion air is drawn through a tube.
 - The open end of the tube is passed over fitting or piping.
 - When a leak is detected, the flame will change color (from blue to green).



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Refrigerant Leak Detectors (2 of 2)



- When a leak is detected, the flame color changes.

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Other Refrigerant Leak Detectors


- Electronic leak detectors
 - Contain refrigerant-sensitive elements
 - Reacts to leaks with rapid beeping
- Ultraviolet leak detectors
 - UV additive introduced to the system
 - Pipes will glow at the point of the leak
- Ultrasonic leak detectors
 - Detect the sound of escaping refrigerant

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The Clamp-on Ammeter (1 of 2)

- It is used to measure current flow in an electric circuit.
- The jaws of the meter are clamped around one conductor of the circuit.
- The meter can also be used to measure voltage and resistance.

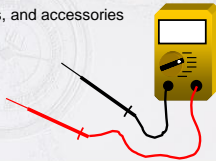


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Volt-ohm-milliammeter (VOM)

- Often referred to as a multimeter
- Measures volts, ohms, and amps
- Can be analog or digital styles
- Come with a number of features, options, and accessories



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Unit Summary

- Air conditioning, heating, and refrigeration technicians should be familiar with available hand tools and equipment.
- Always use tools and equipment properly.
- Only use tools for the jobs for which they were intended.
- Improper tool usage can result in personal injury.
