19) Which tool is used to cut external threads on pipe fittings?
    a) Pipe die
    b) Hacksaw
    c) Snips
    d) Hand threader

3. Power tools and accessories

Overview

Purpose

To enable the gas technician/fitter to choose the correct power tool for the job.

Objectives

At the end of this Chapter you will be able to:

- describe requirements for selecting and using power tools and accessories; and
- identify power tools and accessories.

Terminology

Term	Abbreviation (symbol)	Definition
Alternating current	Ac or AC	An electric current that reverses its direction many times a second at regular intervals, typically used in power supplies.
Direct current	Dc or DC	An electric current flowing in one direction only.
Hydraulic power		When a liquid is used to generate power.
Pneumatic power		When compressed air (or other gas) is used to generate power
Powder-actuated tool		Nail gun used in construction and manufacturing to join materials to hard substrates such as steel and concrete
Revolutions per minute	rpm	Measure of the frequency of rotation, specifically the number of rotations around a fixed axis in one minute

Requirements for selecting and using power tools and accessories

Portable power tools provide the gas technician/fitter with speed and efficiency beyond that found with hand tools. However, their benefits are directly related to how you operate and maintain them.

The factors that you must consider when selecting power tools are:

- the type of work and the power tools available;
- the size of machine you need for the job;
- availability of appropriate power sources within the range of the machine's electrical connections; and
- safety.

Safety and security

Caution!

Always operate power tools according to manufacturers' directions.

Observe all necessary safety precautions (such as Workers' Compensation Board regulations).

Always wear appropriate safety clothing and equipment as you work.

Be extra careful when working in close quarters or up a ladder.

In Chapter *4. Hand Tools* > the *Using Tools Safely* section provides details for more specific tool precautions and safety procedures.

Electric power tools

Most electric power tools are available as a cordless design in the smaller size range. Larger tools and equipment operate at 110 volts (110 V) or at 240 V. Some of the safety issues when using electric tools are:

Do...	Do not/never...
• Either equip electrical power tools with a three-pronged grounding plug inserted into a properly grounded receptacle or double insulate them with a polarized plug and certified by CSA. This protects the user against shock if the insulation should fail or a short circuit happens. • Clean the tools with an air hose to keep the motor and vents free from foreign matter to avoid overheating.	• Stand on wet surfaces while operating electric tools. • Touch water or metal piping when operating electric tools. • Overload the tool by forcing its operation with too large a work piece or when it is stuck. • Use too long extension cords. Manufacturers specify the range of power tools. Keep within this range to avoid too great a voltage drop across the lines. • Crimp the cord because continual flexing may break the wire or cause it to overheat. • Operate power tools in a gaseous or explosive atmosphere.

Powder-actuated tools

Gas technicians/fitters use several powder-actuated tools to insert fasteners into concrete and steel.

Caution!

Do not use this equipment unless you are qualified and authorized to use the tool. You must hold a separate operator's card for each manufacturer's tools.

Each company that manufactures powder-actuated tools has designed a short course of instruction in the use of its tools. Only that course qualifies students for those tools. Workers Compensation Board regulations override any other instructions or precautions.

The following typical safety precautions for using a powder-actuated tool are based on the recommendations of one manufacturer.

Before you start:

Do...	Do not/never...
• Read the instructions and be sure that you understand them before you use the tool. • Operate the tool only if your supervisor authorizes you and if you are qualified with an operator's card. • Use only fasteners and powder loads manufactured for the tool you are using. • Always wear all required PPE and safety goggles rated for the task. • Store powder loads in a special container. Do not mix them with other objects or put them in your pockets. • Always check the material you are fastening into. Do not guess when the material is concealed.	• Use the tool in an explosive atmosphere. • Leave a tool untended where someone else might use it. Keep it locked up when you are not using it. • Attempt to fasten into glass block, tile, hardened steel, solid rock, slate, terra cotta, granite, glazed brick, cast iron, brick, hollow concrete block, marble, or unsound or cracked concrete.

As you work:

Do…	Do not/never…

• Stand behind the tool when firing it.
• Keep the tool at right angles to the work surface.
• Provide a backstop when firing into thin materials.
• Make sure you fasten into at least the minimum required thickness of material:
  • 2-1/2 in (65 mm) of concrete
  • 1/4 in (5 mm) of steel
• Fasten at least 2 in (50 mm) from a weld or vertical mortar joint.
• Fasten at least 3 in (75 mm) from the edge of concrete.
• Fasten at least 1/2 in (12 mm) from the edge of steel.
• Fasten at least 3 in (75 mm) from where a former fastener failed.
• Use a special adapter supplied by the tool manufacturer when driving a fastener into a hole.
• When you have finished, keep the unloaded tool and its cartridges in a dry locked container.
	• Place your hands in front of the barrel.
	• Use more powder load than you need.
	• Point the tool at a person (including yourself). Keep other workers out of the line of fire.

Power tools and accessories

Electric power tools are either battery-powered (cordless) or plugged into an electrical receptacle (corded).

Some tools derive power from other sources of energy, such as gasoline engines and pneumatic (air) pressure.

Whatever the source of energy used to run the tool, the safety precautions are basically the same. The gas technician/fitter must follow the manufacturer's safety requirements for each tool, the employer's policy, and the supervisor's instructions.

Cordless tools

Most tools that gas technicians/fitters use are available in a cordless option for most applications. Cordless tools have many advantages and some disadvantages. The most obvious advantage is that the lack of an electrical cord frees up the tool for wider use and for applications where electric tools with a higher voltage are not suitable and where a risk of electrical shock exists. One disadvantage of a cordless tool is the need to charge the battery. You need to treat the battery chargers like any other 115- or 230-volt device, respecting all safety requirements and electrical codes.

The batteries for cordless tools have many different designs, applications, and special safety considerations. Follow all the manufacturer's instructions for charging, handling, and disposing of batteries for cordless tools.

The most common cordless tool is the cordless drill shown in Figure 3-1.

Figure 3-1
Cordless drill and charger
Image courtesy of DeWalt

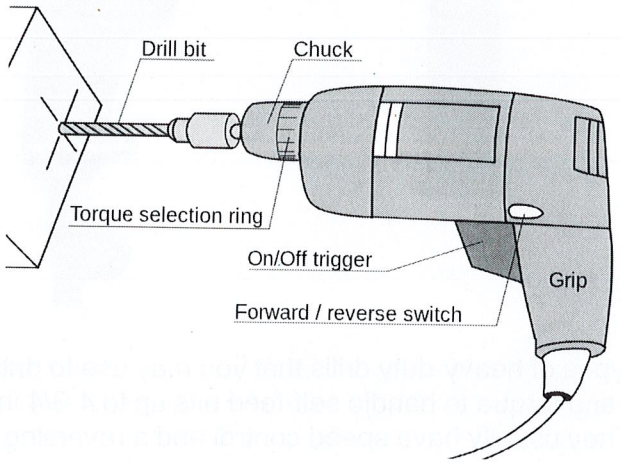
The gas technician/fitter uses many types of electric drills. Some drills work on 110 V or 115 V alternating current (ac) and some are powered by rechargeable batteries that typically run on 18-20 V direct current (dc). The three most common types of portable electric power drills used in the piping trades are the 1/2 in (12 mm) portable drill, the 3/8 in (9 mm) portable drill, and the hammer drill. The sizes refer to the maximum size of drill shank that can fit into the chuck.

Electric drills

Standard utility drills

Figure 3-2 shows the familiar standard drill used for light work. Its chuck capacity ranges from 1/4 in to 3/8 in (6 mm to 9 mm) drill size. Some models have a reversing switch and speed control

Figure 3-2
Standard utility electric drill
Image Source: Wikipedia, Mikael Häggström from original by Kosiarz-PL



Heavy-duty electric drills

Figure 3-3 shows a typical heavy-duty electric drill. The drills have chuck capacities ranging from 1/2 in to 3/4 in (12 mm to 19 mm). They usually have a reversing switch and a heavy-duty chuck.

You must exercise extra caution to avoid injury when operating these high torque drills due to the rotation. Protect your hands and wrist when operating this drill.

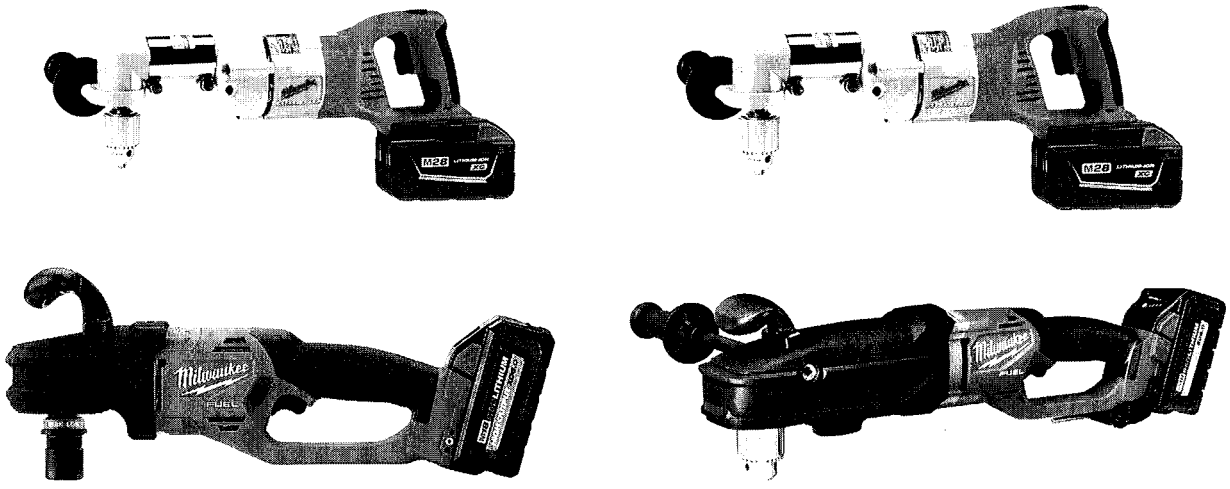
Figure 3-3
Heavy-duty electric drill

There are also compact types of heavy-duty drills that you may use to drill through studs and joists. These have power and torque to handle self-feed bits up to 4-3/4 in (120 mm) for wood and 1/2 in (12 mm) for steel. They usually have speed control and a reversing switch.

Right-angle drive electric drills

Figure 3-4 shows a right angle drive electric drill that helps drill through joists or studding, or in tight corners. Some have speed control and a reversing switch.

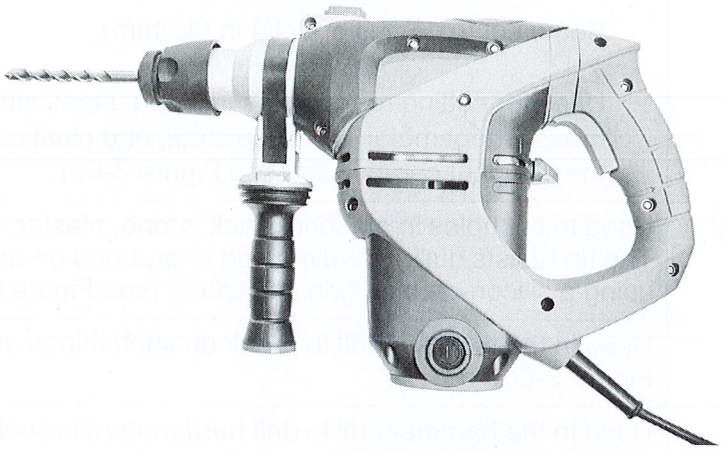
Figure 3-4
Right angle drive electric drill
Image courtesy of Milwaukee



Rotary hammer electric drills

Gas technicians/fitters use rotary hammer drills (Figure 3-5) for fast drilling in concrete. Manufacturers claim it can drill 5.5 in (140 mm) per minute in construction-grade concrete with a 1/2 in (12 mm) bit. These drills use carbide-tip bits.

Figure 3-5
Rotary hammer drill



The hammer drill produces both a drilling action and a hammering action while drilling is taking place. The combined actions produce faster, more accurate work.

The following are two common sizes of hammer drills for drilling holes in concrete that does not have reinforcing bars:

Dill size	Hole size
3/8 in (9 mm) drill	Up to 9/16 in (14 mm)
1/2 in (50 mm) rotary hammer If you used a "core" drill bit, you can drill a 2 in (50 mm) hole.	Up to 1 1/8 in (28 mm)

Many different hammer drills exist and there are three different energy sources that drive them—electric, pneumatic, or hydraulic drives—depending on the application.

Drill accessories

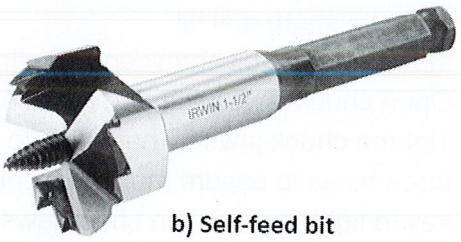
The following is a list of some of the types of drill bits that gas technicians/fitters use:

Drill bit	Description
Standard carbon drill bit	The most common of all drill bits. Can be used to drill through steel (see Figure 3-6a).
Self-feed bits	Used for cutting holes in wood for pipe sizes NPS 1/2 to 4. Some have replaceable feed-screw pilots (see Figure 3-6b).

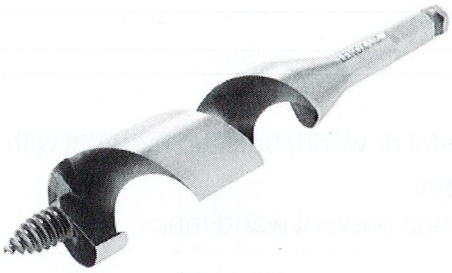
Drill bit	Description
Auger bits	Available to drill holes for pipe sizes NPS 3/8 to 1 (see Figure 3-6c).
Flat boring bits	Have diameters from 1/4 in to 1-1/2 in. Used in small, pistol-grip electric drills (see Figure 3-6d).
High-speed hole cutters	Have many purposes : Some cut to depths of 1-3/4 in (45 mm). Used for cutting round holes in wood, steel, aluminum, copper, brass, sheet metal, stainless steel, and plastics. With carbide tips, they can cut ceramic tile (see Figure 3-6e).
Carbide-tip masonry bits	Used to cut holes in masonry brick, stone, plaster, slate, or concrete. The tip resists dulling and may be sharpened on a bench grinder using a silicon-carbide grinding wheel (see Figure 3-6f).
Chisels	Used in the hammer drill to break up such things as concrete tile (see Figure 3-6g).
Cruciform drill bits	Used in the hammer drill to drill hard materials such as marble and granite (see Figure 3-6h).

Figure 3-6
Various drill bits
Images courtesy of DeWalt (dill bits except e)
Image courtesy of Milwaukee (drill bit e)

a) Standard bit

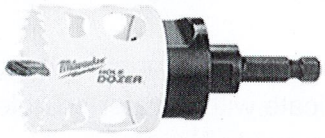


b) Self-feed bit



c) Auger bit

d) Flat boring bit

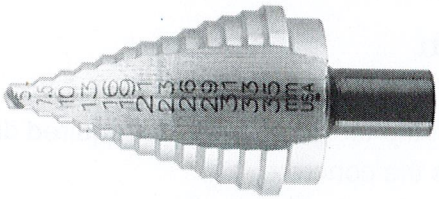


e) Hole saw bit

f) Masonry bit

g) Carbide-tipped masonry bit

h) Hammer drill chisel bit



i) Step bit

Drilling procedures

Inserting bits

1) Disconnect the power cord.
2) Select a sharp drill bit.
3) Make sure the bit shank and chuck jaws are clean. Dirt may cause improper bit alignment.
4) Open chuck jaws wide enough to allow bit to strike bottom of chuck.
5) Tighten chuck jaws by hand first to align the bit, then use the chuck key progressively in all three holes to assure maximum chucking pressure. Do not use means other than the chuck key to tighten or loosen chuck jaws that require a key.

Set-up

1) Clamp material securely. When drilling into light gauge metal or wood, back up material with a wooden block to prevent bending and grabbing of material.
2) Center-punch materials to be drilled to give the bit a start and prevent wandering.

Drill operation

1) If drill has a reversing motor, allow the motor to stop completely before using the reversing switch.
2) Install the auxiliary handle (if desired) into one of four positions on the drill for safer handling.
3) Lubricate the bit with cutting oil when drilling iron or steel. Lubricate with a water-soluble coolant (commonly soap and water) when drilling copper, brass, or aluminum.
4) Hold drill on the centre mark of the hole to be drilled. Maintain a stable operating position and press the on-off switch to start the motor.
5) Begin by applying steady pressure.
6) Stop from time to time to break up the chip.
7) When the drill is ready to break through the underside of material, decrease feed pressure so that the drill will not catch and break.

Hammer drill operation

1) Place the drill bit in the chuck and tighten the chuck.
2) Adjust the rod on the side of the tool to provide the required drilling depth. You reach this depth when the rod touches the concrete.
3) Make sure that the supply voltage is the same as the voltage shown on the nameplate of the machine.

General safety rules

Before you start:

Do...	Do not/never...
• Wear protective clothing, particularly goggles or safety glasses. Remove loose clothing and jewelry. Tie long hair back or contain it in a net. • Each type of power drill requires special attention. Read the instructions. • If you are unsure of how to adjust or use the machine, ask for help. • Ensure the work area is dry and well-lit. • Bystanders should be clear of work area. • Get help when lifting heavy vises or work pieces. • Fasten the cutting tools properly in the chuck.	• Because drilling can cause sparks, do not use drills where fumes or dust may cause combustion or explosions.

As you work:

Do...	Do not/never...
• Stop the feed from time to time when drilling to break up the chip so that it will not be a hazard and will be easier to handle. • Use a brush instead of your hands to clean chips off the machine. • Remove burrs from a drilled work piece as soon as possible, since any sharp edges or burrs can cause severe cuts. You can use a grinder or file for this purpose. • When you finish using a drill or other cutting tool, wipe it clean with a shop towel and store it properly. • When increasing the size of a hole with a larger drill, apply feed pressure slowly to prevent the drill bit from catching on work and breaking. • When drill is ready to break through underside of material, decrease feed pressure to prevent the drill from catching and breaking. • Disconnect tools from the electric power supply when not in use before servicing and when changing parts.	• Use an air jet for removing chips unless a controlled air nozzle is used. An uncontrolled air nozzle will cause the chips to fly at a high velocity, with possible injury to the operator or bystanders.

Maintenance:

Do...
• Lubricate gears and screws regularly according to manufacturer's recommendation.