National Certificate in Carpentry

Demonstrate Knowledge of Portable Power Tools Used on Construction Sites

Unit Standard – 13000

Level 3, Credit 4

BCITO
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13000 – Demonstrate knowledge of portable power tools used on construction sites

What you must do to achieve this unit

- Correctly describe the use of portable power tools in terms of manufacturer's instructions.
- Correctly describe the setting up of portable power tools in accordance with manufacturer's instructions.
- Correctly describe care and maintenance of portable power tools in accordance with manufacturer's recommendations.
- Correctly describe the health and safety requirements of portable power tools. Includes: identification of hazards and controls; testing and tagging; certificates of competency; prevention from injury; prevention of damage to materials and machinery; electrical protection.

Note: *The level of detail asked for in the worksheets shows the depth of knowledge you should have about all the portable power tools covered.*

Contents

Published by: **Building and Construction Industry Training Organisation**
Level 6, 234 Wakefield Street
PO Box 2615
Wellington

Introduction

Portable power tools have become the basic production equipment of the modern construction industry. Portable power tools may be powered in different ways; either by battery, plug-in, compressed gas or air or powder activated. A wide range of portable power tools is available, and each different tool requires knowledge of its correct and safe use.

Apprentice/trainee operators must have adequate supervision from a suitably trained person until an acceptable standard of safe operation has been achieved in the following areas:

- the intended use of the tool;
- the capabilities and limitations of the tool;
- safe operating procedures for the tool; and
- maintenance requirements for the tool.

Reference required
The following book is referenced throughout this module. When referred to, it will need to be read as supplementary information.

Guidelines for the Safe Use of Portable Mechanical Powered Nailers and Staplers.
Available from the Occupational Safety and Health Service or their website – **www.osh.dol.govt.nz/order/catalogue/194.shtml**

Training Records

Operator Training

It is important that apprentices/trainees fully understand the operation of any portable power tool that they are required to use. Apprentice/trainee operators must receive adequate supervision until they are competent at using the complete range of portable power tools required to achieve Unit Standard 13039 (Use and maintain portable power tools for construction work on site).

An effective and ongoing training programme will need to be developed for each individual trainee. Evidence of training should be documented (for example, employer records).

It will also be necessary for trainees to document in their Record of Work the details of the training undertaken.

General Health and Safety

When using portable power tools, basic safety precautions should always be followed to reduce the risk of:

- personal injury to the operator or other workers;
- electric shock;
- fire;
- material damage; or
- damage to the power tool.

Preventing Personal Injury

Always use the appropriate Personal Protective Equipment (PPE):

- safety glasses, goggles or face shield;
- hearing protection with a suitable rating for the level of exposure to noise;
- respirator and/or dust masks; and
- rubber-soled safety shoes or boots.

Always follow these guidelines:

- Wear firm-fitting clothing. (Loose clothing can be easily caught in rotating tools.)
- Tie back long hair or retain it under a close-fitting cap.
- Keep work areas clean and free from off-cuts and other debris.
- Exclude all visitors from the immediate work area. On no account should casual site visitors have access to power tools or other machinery.
- When not required for use, power tools should be stored away securely.

Preventing Electric Shock

When using any electrical machinery, there are some basic safety precautions that must always be observed in order to reduce the risk of electric shock:

- Always use the appropriate electrical safety device, ie. isolating transformer or a Residual Current Device (RCD).
- Use only the appropriate three core extension leads designed specifically for outdoor industrial use, complete with weatherproof plugs and sockets.
- Do not use power tools in wet or damp conditions. Do not expose power tools to rain.
- Disconnect leads from the power source before changing blades and accessories or performing any maintenance operations.
- Before connecting any tool to the power source, check that the tool is compatible with the voltage supply. (Any power source with a greater voltage than that specified for the tool can result in serious injury or death to the operator.)
- Do not carry or lift a power tool by the cord. Always disconnect the cord from the power source using the plug. Do not pull on the cord.
- Keep the cord away from heat, oil and sharp objects.
- When operating a portable power tool, avoid body contact with earthed or grounded objects such as pipes, radiators, appliances etc.

Extension Leads, Plugs and Sockets

Most portable electrical tools will require an extension lead to deliver the power from the source to the tool. Extension leads are easily damaged, so it is important that the following precautions are observed in order to get the best performance from the tool:

- Use only properly made up three core extension leads. (Never use two core flex.)
- If the outer casing or the wires of a lead are damaged in any way, the lead should not be used and sent for repair.
- Weatherproof and shatterproof plug and socket connections are designed to keep moisture out of the join and lock the leads together, preventing potentially dangerous separation of the contacts.
- Keep operating extension leads as short as possible. Leads will lose a small amount of voltage for every metre of length.
- Provide protection for leads which cross traffic access by laying timber on either side of the lead.
- Do not overload electrical power outlets or use damaged outlets.
- Faulty equipment must never be used. Faulty equipment is to be identified and reported to your employer so it can be repaired.
- Completely unwind leads off reels or coils.

Portable Power Tool Hazards and Controls

The use of any portable power tool has its own hazards, and every hazard has a control. As users of portable power tools we need to be aware of the hazards and use the appropriate controls. This example may help to make the process clearer.

Before I use the circular saw, I think about the hazards and make sure I control each. The process is:

1. I think about what might happen.
2. I take action to ensure that it doesn't happen (or if it does happen, I make sure no one will get hurt).

What might happen?	**What do I need to do?**
Hazards	**Controls**
Damage to hearing from noise	Wear ear muffs
Damage to eyes from flying chips and dust	Wear goggles, check that guard is in place and operating properly
Machine kicking back, flicking backwards	Only cut a straight line (no curves), use firm forward pressure
Electric shock	Do not use power tools in wet or damp conditions Use RCD when using power tool

Common sense tells you what might go wrong, and common sense also tells you what to do to protect yourself and others. If in doubt, ask a more experienced workmate.

Testing and Tagging of Power Tools

In New Zealand, all portable appliances need to be tested and tagged regularly to comply with AS/NZS 3760 and for your workplace to be deemed safe. In the construction industry this testing needs to be carried out **every 3 months** by a suitably qualified person. The testing and tagging procedure is a control used to ensure appliances are of working order and do not have any dangerous (possibly hidden) electrical faults.

Certificates of Competency

For the powder-actuated fastening tool a certificate of competency is required to use the tool. More detail on this can be found in the powder-actuated fastening tool section.

Maintenance of Portable Power Tools

Regular basic maintenance of power tools and equipment is necessary to ensure:

- best performance;
- safe operation; and
- long, trouble-free service.

Note: *Isolate all portable power tools from the power source before carrying out any maintenance work.*

Basic maintenance tasks that can be carried out by the operator include:

- keeping the outside of the power tool clean to stop the build-up of dust and timber resins;
- checking that ventilation slots do not become clogged. (This can cause the tool to overheat and could even burn out the motor.);
- checking the carbon brushes frequently;
- lubricating the power tool if this is required by the manufacturer. (Most modern power tools are lubricated for their working life when manufactured.);
- always following the manufacturer's instructions when changing blades or knives;
- inspecting the power tool regularly and, if it is damaged, having it repaired by an authorised agent or electrician; and
- reading the manufacturer's instructions before carrying out any maintenance.

Note: *Signs that blades or cutting edges are blunt and need changing or sharpening are smoke being produced while used, blackened finish to cuts and lines on the finished face.*

Worksheet 1

Apprentice Name**:**

1. List four (4) precautions which could be taken to prevent electric shock on a building site.

2. Where would evidence of operator training be recorded?

3. List four (4) safety requirements when using extension leads.

4. What is the first step to be taken before carrying out any maintenance on a power tool?

WORKSHEET 1	Assessor Initials:	Date:

Portable Circular Saws

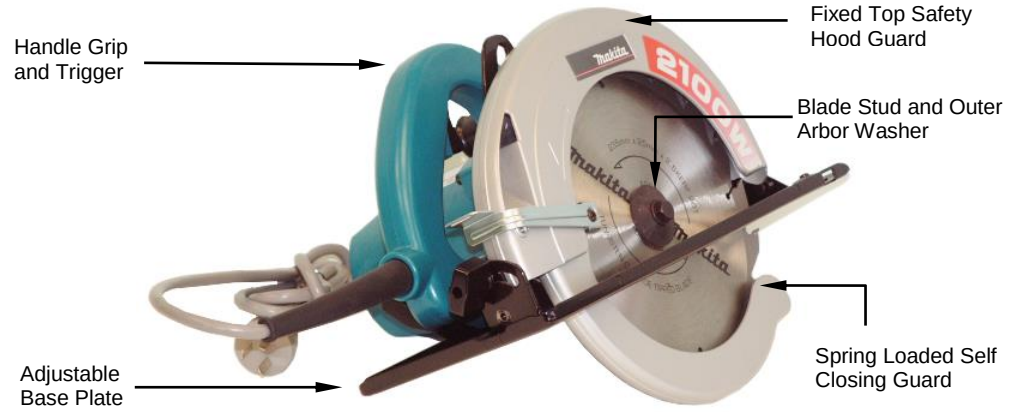
Portable circular saws are used extensively throughout the construction industry. They are available in a range of sizes and can be used to cut a wide variety of materials including:

- timber;
- plywood;
- manufactured boards (eg. particle board and customwood);
- fibre cement products;
- mild steel;
- aluminium; and
- plastic.

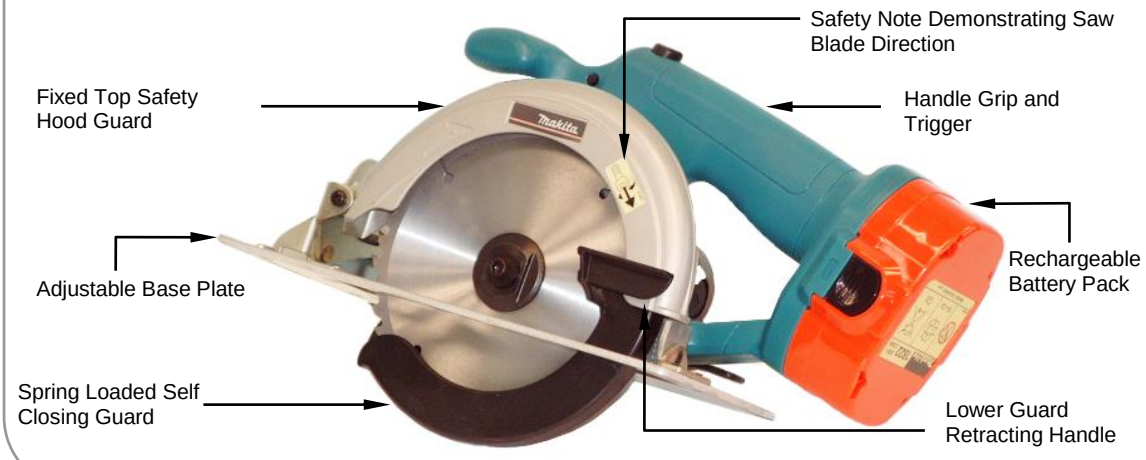
They are particularly useful for cutting materials that have already been fixed into position.

Portable circular saws are used primarily for cross cutting and ripping timber and are available in both 240 volt mains power and rechargeable battery power (cordless).

Portable Circular Saw (240 volt Mains Power)



Portable Circular Saw (Cordless)



Safety Features

All portable circular saws must have these in-built safety features:

- a fixed top safety hood guard, deep enough to cover both sides of the blade, to below the depth of the roots of the saw teeth, down to the base plate when the plate is set at right angles to the blade and in its highest cutting position; and
- a spring loaded, self-closing lower guard covering the lower portion of the blade, on both sides to below the roots of the teeth.

Portable Circular Saw Operation

The following basic principles apply to all operations with a portable circular saw:

- Check that the portable circular saw is suitable for the task to be done. Portable circular saws have two classifications – light and heavy duty. Heavy duty portable circular saws are more appropriate for the building site.
- Check that the base plate is always in firm contact with the material to be cut before starting the saw. As the blade cuts upwards, the cutting action will pull the material hard up against the bottom of the base plate.
- Do not attempt curved cuts. Twisting the blade in the saw kerf may result in a "kick back" (tool unexpectedly flicking backwards).
- Use firm forward pressure, without forcing the saw.
- The material to be cut must be held firmly in position, and the timber should be supported so that the waste is free to drop.
- Where chipping needs to be minimised, set the depth of the cut so that the teeth only protrude 5mm through the material.
- Allow blade to gain full speed before starting the cut.

Saw Blades for a Portable Circular Saw

- **Combination Saw Blades** – Most portable circular saws are supplied with a combination saw blade, which is suitable for most carpentry work. Other blades suitable for cutting timber include:
  - **Cross Cut Blade** – Gives smoother cutting across the grain.
  - **Ripping Blade** – Allows faster cutting along the grain.
  - **Tungsten Carbide Tipped Blade** – Can be used for longer periods before resharpening is required.

Other specialist saw blades available include:

- metal cutting blade for soft metals;
- wave saw blade for thin plastics;
- mitre saw blade for fine cuts in wood;
- diamond tipped blades; and
- fibre reinforced cut-off wheels:
  - for cutting masonry, ceramic tiles; and
  - for cutting light gauge ferrous and non-ferrous metals.

Changing Saw Blades on a Portable Circular Saw

Note: *While different makes and models may have different retaining methods, the procedures for changing saw blades on a portable circular saw are basically the same.*

- Isolate the portable circular saw from the power supply.
- Engage the arbor locking mechanism to hold the saw blade.
- Remove the blade retaining nut and washer. (Turn the spanner in an anticlockwise direction.)
- Retract the lower safety guard and remove the blade.
- Check that the retaining washers are clean.
- Replace the blade and firmly tighten the retaining nut.

Note: *Blunt blades or blades with chipped teeth should be reset, gulleted and sharpened by a saw doctor. Do not attempt to sharpen tungsten carbide tip saw blades. Send them to a saw doctor for specialised grinding.*

Portable Jig Saws

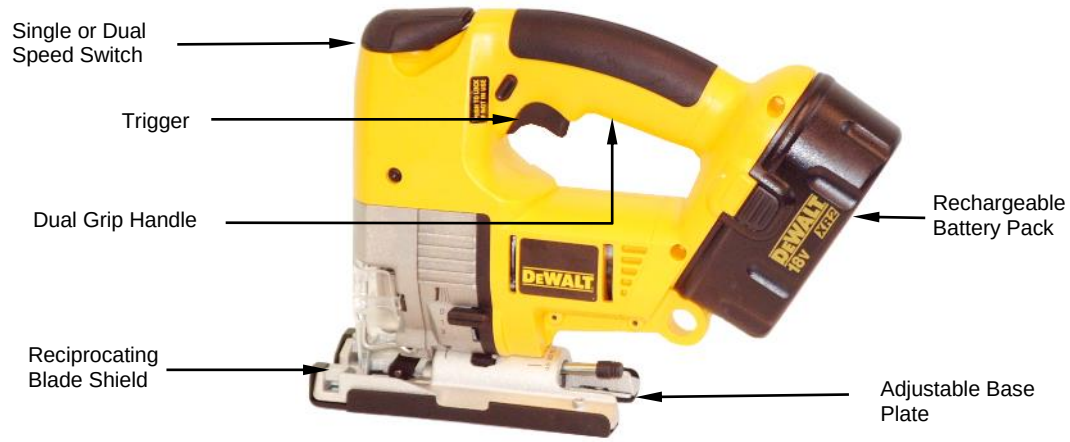
The portable jig saw is used mainly for internal cut-outs and for on-site curved work. Portable jig saws are available in a variety of sizes and models for cutting a range of materials varying from cardboard to steel plate.

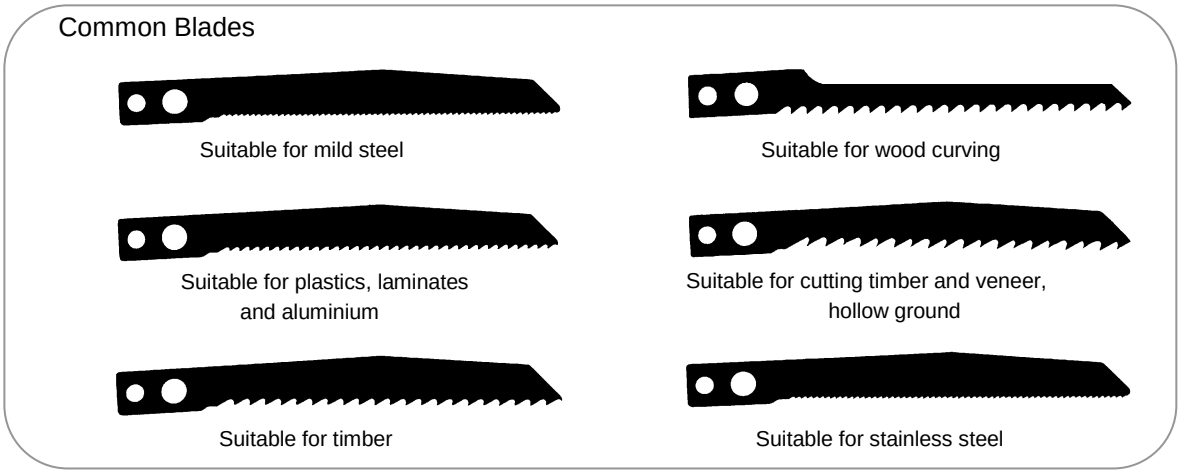
The most suitable portable jig saw for construction is a heavy duty model with dual or variable speeds that is able to cut a wide range of construction materials.

Portable jig saws are available in both 240 volt mains power, and rechargeable battery power (cordless).

Portable Jig Saw (240 volt Mains Power)

Portable Jig Saw (Cordless)





Portable Jig Saw Cutting Action

Most portable jig saws have a reciprocating action (up and down) with the cutting being done on the up stroke. Some models may have an adjustable support, which reduces the unsupported length of the blade.

The thickness of material able to be cut by a portable jig saw will depend on the material being cut and the selection of the portable jig saw blade. It is important that the correct blade is used for the material to be cut. This will ensure that the cut will be to the required standard and that the portable jig saw and blade are not subject to any excessive loading.

Portable Jig Saw Operation

The following are the suggested operating procedures when operating the portable jig saw:

- Select the appropriate saw blade for the material to be cut. (A range of different blades is available for various materials.)
- Discard any worn or damaged blades.
- Place the base plate firmly on the work before switching on.
- Allow the blade to gain full speed before starting the cut.
- Do not force the blade while cutting. Use an even, firm pressure keeping the base plate in contact with the work.
- Allow the blade to come to a complete stop before removing it from the work.
- Drill holes to provide blade access for internal cuts.
- Do not exceed the capacity of the portable jig saw or its blade.
- For straight cutting, clamp a piece of timber to the work to act as a guide.
- Ensure the area below the line of cut is clear of any obstacles.

Portable Reciprocating (Sabre) Saws

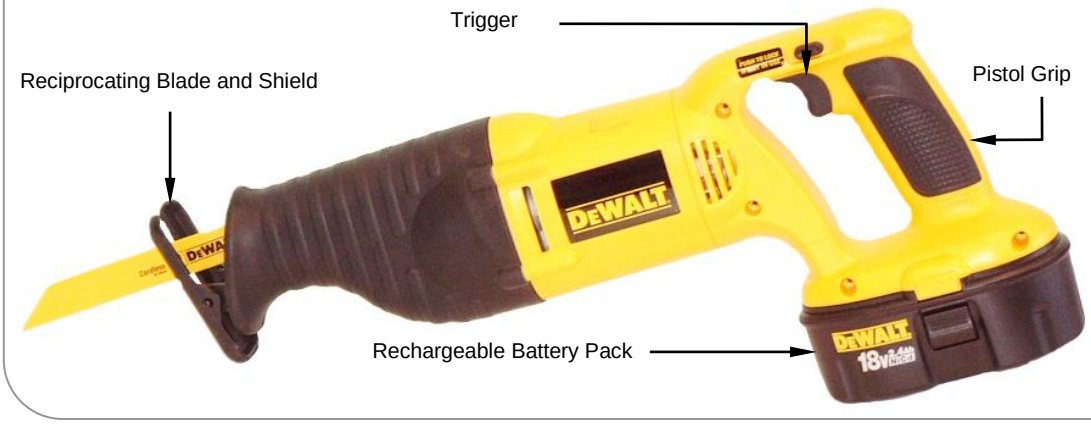
Portable reciprocating (sabre) saws are heavy duty hand-held saws, which can be used to cut a wide range of materials such as:

- metal (steel, aluminium and copper);
- timber;
- brick; and
- plastic.

Portable reciprocating saws are available in both 240 volt mains power and rechargeable battery power (cordless).

Portable Reciprocating Saw (240 volt Mains Power)

Portable Reciprocating Saw (Cordless)



Reciprocating saw blades are commonly available in sizes from 100 to 300mm, for cutting both wood and metal.

Portable Reciprocating Saw Operation

The operating and safety procedures for the portable reciprocating saw are identical to those for the jig saw.

Portable Electric Hand Planer

The portable hand planer is a lightweight planing machine, which can be used on a construction site for planing operations that would otherwise be done with a hand plane.

Some common uses of the portable hand planer include:

- planing rough sawn timber;
- small rebating and chamfering work; and
- reducing/straightening door edges to fit door jamb or frame.

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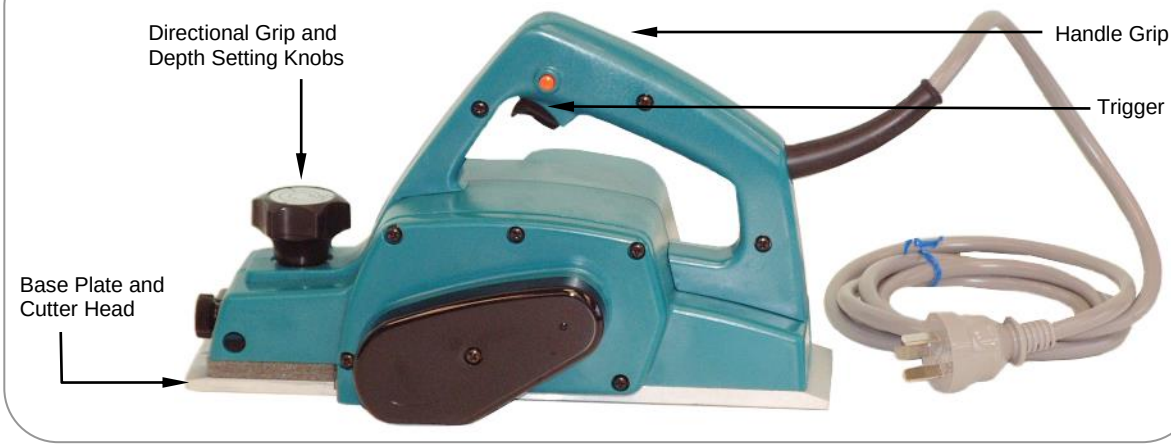
Portable electric hand planers are available in both 240 volt mains power and rechargeable battery power (cordless).

Portable Hand Planer (240 volt Mains Power)



Parts of a Portable Electric Hand Planer

- A fixed rear base. The cutting head is flush with this base.
- An adjustable front base which can be raised or lowered with the adjusting screw, providing the depth of the cut.
- A high-speed rotating cutter head usually with two blades.

Safety Precautions When Using a Portable Electric Hand Planer

Extreme care must be taken when using the portable electric hand planer, as the cutter head is continually exposed on the underside of the base plate.

- Always use with both hands on the handles provided.
- Switch on only when the front of the base plate rests firmly on the material.
- Wait until the cutter head stops revolving before placing the planer on the work bench. Place the machine on its side with the cutters clear of the bench and facing away from the operator.

Portable Electric Hand Planer Operation

For normal planing operations, the following procedures should be followed:

- Hold the material to be machined securely, as the material will be inclined to be pushed forward by the cutting action of the machine.
- Adjust the portable electric hand planer to the required depth. The rate of feed will depend on the depth of the cut. (A series of fine cuts is preferable to one coarse cut.)
- Place the front of the base plate on the work and apply pressure on the front handle.
- Switch the portable electric hand planer on and complete the cut. (Allow the cutting head to reach full speed before starting the cut.)
- Towards the end of the cut reduce the pressure on the front knob while maintaining the pressure on the rear.
- Switch off the machine and when the cutter head has stopped rotating, lay the planer on its side.

Cutter Replacement

Because of the wide range of portable electric hand planers available, it will be necessary to refer to the manufacturer's instructions when installing replacement blades. Blades are available as both standard or tungsten carbide tipped.

Isolate power at source before changing blades.

Portable Electric Drills

The portable electric drill is the most versatile of all power tools and is available in a wide range of sizes, power ratings and accessories. Types of power drills available include:

- **Pistol Grip Drill** – Designed for one-handed operation. (Mainly used for small diameter drilling in wood and metal.)
- **Heavy Duty Drill** – Used mainly for larger holes. (Usually supplied with single or double side handles and breastplate.)
- **Impact Drill** – Used for drilling masonry. (Impact drills are more efficient at this task than other drills.) For drilling other materials, impact drills can be switched to a straight rotary action.
- **Hammer Drill** – In addition to the action of the impact drill, the hammer drill has a spring or a pneumatically driven floating hammer which adds a percussion force to the drill bit, independent of the force provided by the operator.
- **Specialised Drill** – Produced specifically for a sole purpose such as screw fixing proprietary products including roofing materials and exterior and interior wall claddings. (These tools do not have a drilling capacity. However, some are designed with an automatic screw feed which can speed up the fixing of a particular product.)

Portable Electric Drill (240 volt Mains Power)

Portable Electric Drill (Cordless)

Special Features and Accessories for Portable Electric Drills

Portable power drills may be:

- **Single Speed** – Mainly high speed for small diameter drilling.
- **Dual Speed** – Able to drill a variety of materials and drill sizes.
- **Variable Speeds** – These drills provide the operator with the ability to select the most appropriate speed to suit the material and drill size. Variable speed drills rely on the pressure the operator applies to the trigger.
- **Angled Head Drill** – Which can be used for drilling in confined spaces.
- **Reversible** – To enable the drill to be used to drive and remove screws etc.
- **Keyless Chuck** – To speed up bit changing and avoid key loss problems.
- **Variable Torque** – Many portable drills now feature variable torque settings which enable the drill to be used to drive screws and adjust nuts to a pre-set torque.

Safety Precautions When Using Portable Electric Drills

- The basic safety precautions outlined earlier in this module should be observed.
- Use side handles when the drill diameter is larger than 8mm.
- Avoid using a drill when working from a ladder as back torque from the drill may result in a fall.

Portable Electric Drill Operation

To operate the drill, use the following procedure:

- Select the appropriate drill bit.
  - Carbon steel twist bits for wood and soft steel.
  - High-speed steel twist bits for harder metals.
  - Wood auger bits for general carpentry work.
  - Flat bits can be used for soft timber and plastics.
  - Tungsten carbide tipped bits can be used for concrete, masonry, ceramic tiles and fibre cement products.
- Fit the drill bit.
  - Most drills are fitted with a three jaw self-centring key operated chuck. Fit the drill bit in place and hand tighten. Use the key to hold the drill firmly in place.
  - For drilling requiring a number of drill bit changes, a keyless chuck may be used. The knurled surfaces are gripped and tightened by hand.
- Select the correct speed.
  - For general carpentry work, the smaller the drill bit being used, the higher the speed required.
- Centre punch the starting point for hard materials.
- Secure the work piece. (Use a vice if possible.)
- Start the power tool and drill the hole.

Impact and Hammer Drills

The operating procedures for the impact and hammer drills are the same as for smaller rotary drills with the following additions:

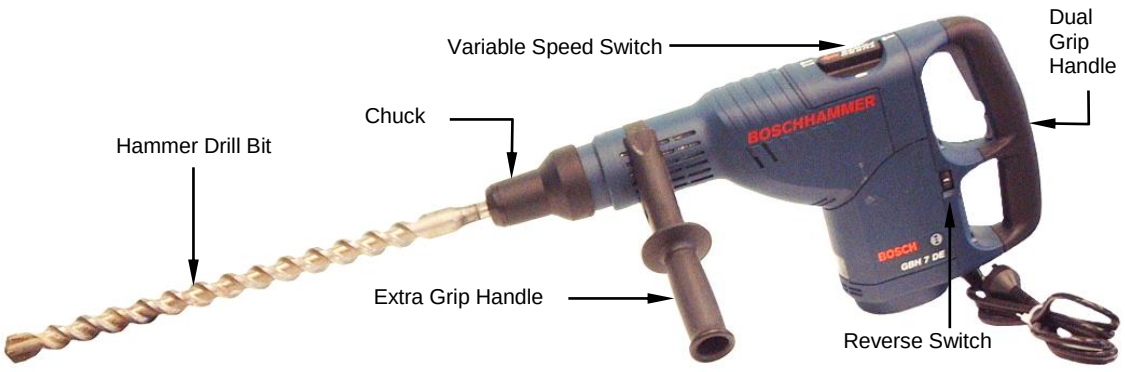
- After selecting the speed, set the impact mechanism. (Some drills may have a variable impact control knob while others may have a number of settings.)
- Set the depth gauge if fitted.
- Apply continuous heavy feed pressure.
- Disconnect the impact function when drilling ceramic tiles.
- Do not exceed the manufacturer's recommendations.

The advantages of a hammer drill compared with an impact drill are:

- faster drilling rate;
- less tiring on the operator; and
- easy to operate in a confined space.

The same basic operating procedure should be followed as for normal drilling operations, except that less feed pressure is required. A wide range of accessories is available depending on the make, model and size of the drill.

Portable Hammer Drill (Dual Handed)



Portable Hammer Drill (Pistol Grip)

Portable Electric Screwdrivers

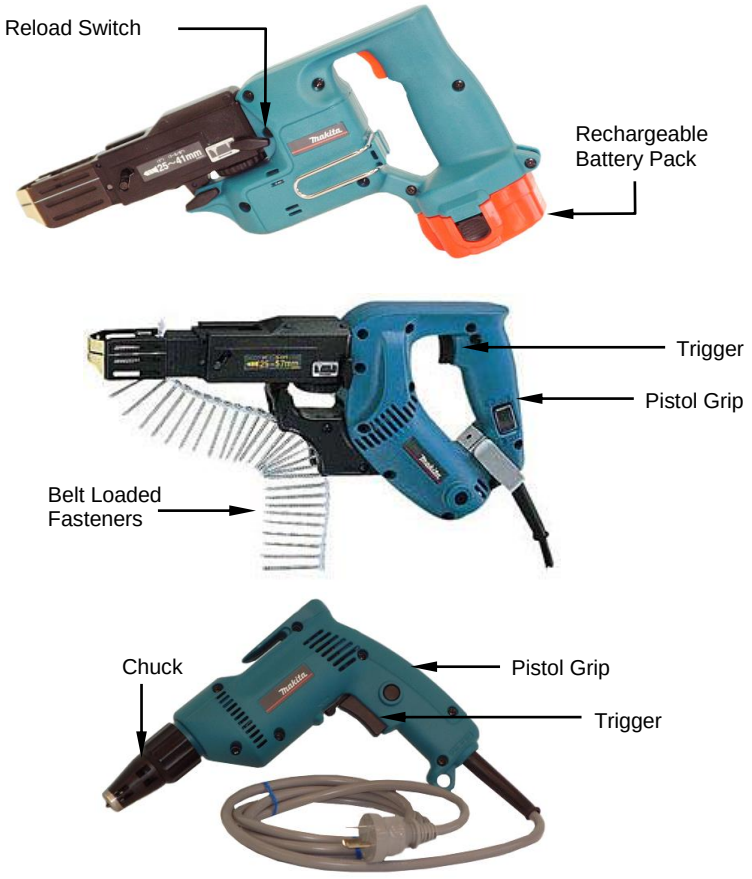
There are number of specialised tools developed to save time, effort and produce consistent results for driving screws. Screw fixings can be collated in strips and fed into the machine which automatically advances the strip after each screw is driven. By adjusting the settings, the depth of the screw head below the surface can be altered. These automatic screwdrivers are commonly used for fixing wallboards and sheet flooring.

Portable Electric Screwdriver Operation

Portable electric screwdrivers have similar controls to portable electric drills, except that all portable electric screwdrivers have a reverse switch – which most of the larger portable electric drills do not. Some makes of portable electric screwdrivers are single speed, while others have variable speed controls. When using a portable screwdriver:

- Select the correct speed for the job. (High speeds for self tapping operation, low speeds for normal operation.)
- Select the correct bit for the screws to be used. (Screw bits are available in a wide variety of sizes and shapes.) On most portable electric screwdrivers, the spindle assembly is magnetised, holding the bit, sleeve and screw in position.
- Hold the portable electric screwdriver at right angles to the screw head.

Portable Electric Screwdrivers



Worksheet 2

Apprentice Name:

1. What are the two (2) guards that are required on a portable circular saw?

2. List three (3) types of saw blades that are commonly used on a portable circular saw.

3. List three (3) items of Personal Protective Equipment (PPE) that would be necessary when using a portable circular saw to cut manufactured board.

4. List three (3) safety precautions (**not** items of PPE) that should be observed when using a portable electric hand planer.

WORKSHEET 2	Assessor Initials:	Date:

Portable Electric Sanders

There are two types of portable electric sanders. They are:

- portable belt sanders; and
- portable orbital and reciprocating sanders.

Precautions and Good Working Practices

The sanding of some building materials can produce contaminated dust – which can have long-term health effects. These include the following materials:

- lead-based paint;
- treated timber;
- fibre cement products; and
- medium density fibre boards (MDF).

When working with these materials, care must be taken and all the following safe working practices must be observed:

- Wear the appropriate protective equipment including overalls, respirator and safety goggles for the task being performed.
- No eating, drinking or smoking should be done in the work area.
- Food, drink, etc. must not be left in the work area where the dust could settle on it.
- Keep all visitors and other workers away from the area.

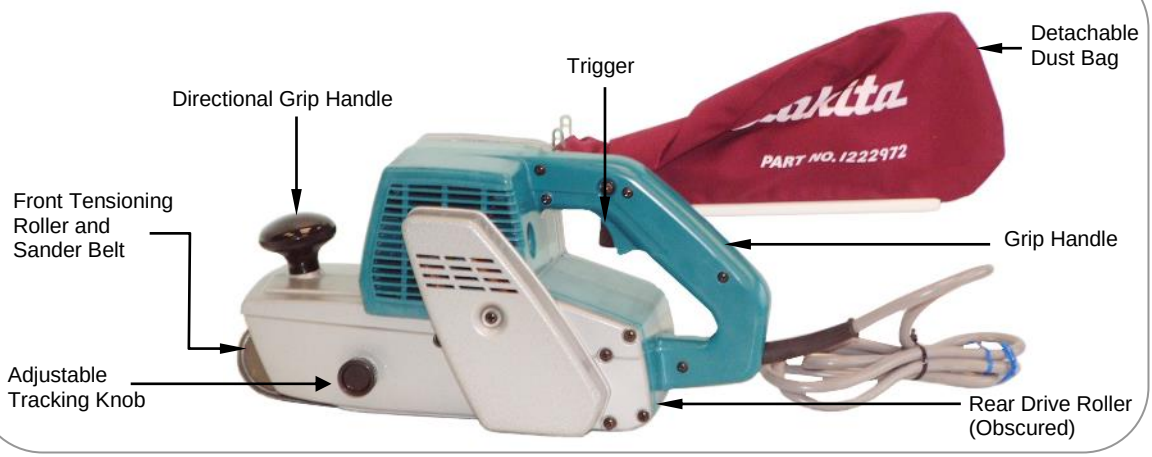
Portable Electric Belt Sanders

Belt sanders produce a smooth finish on timber surfaces by removing machine marks in preparation for finishing.

A portable electric belt sander is made up of the following parts:

- an abrasive belt or loop which runs continuously underneath the machine;
- two rollers:
  - a rear roller which drives the belt; and
  - a spring loaded front roller which allows the belt to be tensioned and also tracking adjustment; and
- a base plate providing a surface for the belt to pass over.

Portable Electric Belt Sander



Portable Electric Belt Sander Operation

- Check the tracking of the belt by holding the portable electric belt sander upside down on a firm surface.
- Check the position of the belt across the base plate.
- Run the portable electric belt sander in short bursts and adjust the tracking knob if necessary.
- The belt will be tracking correctly when it runs evenly and flush with the outside edge of the base plate.
- Place the rear of the timber to be sanded firmly against a fixed stop or hold it firmly with a cramp.
- Grip the portable electric belt sander firmly with both hands.
- Switch the portable electric belt sander on before making contact with the timber.

- Lower the portable electric belt sander onto the timber so that the base plate sits flat on the surface. Be ready to absorb the forward pull from the machine.
- Use sander in same direction as grain of timber; not across the grain.
- Guide the portable electric belt sander evenly over the surface of the timber. The weight of the machine is sufficient to provide efficient sanding. It is not necessary to apply additional weight.
- Lift the tool clear of the work before switching it off. Ensure that the belt has completely stopped before placing the tool down.

Portable Electric Belt Sander Maintenance

- Clean the belts regularly to allow them to work effectively.
- To change belts:
  - Isolate the power tool from the power source.
  - Release the tension on the belt. (Check manufacturer's instructions.)
  - Remove the old belt and fit the new belt. (Care must be taken to ensure that the directional arrows point in the same direction as the arrows marked on the tool.)
  - Align the belt with the sides of the base plate.
  - Tighten the belt using the tension mechanism, and adjust the tracking of the belt.

Portable Orbital and Reciprocating Sanders

Orbital and reciprocating sanders are similar in appearance, but have different sanding actions:

- The orbital sander rotates an abrasive disc in a circular motion at between 5,000 to 25,000 orbits per minute.
- The reciprocating sander moves the abrasive backwards and forwards in a straight line.

Both types are simple to use and provide little danger to the operator as the sanding stroke is reduced to approximately 3mm to 5mm in any direction.

Care must be taken to select the correct grade of abrasive, as the appropriate grade must be fitted to suit the standard of finish required.

Portable Electric Orbital and Reciprocating Sanders

Portable Electric Router

The portable electric router consists of a high-speed electric motor that drives a spindle with a chuck (collet) attached to one end. The revolutions per minute (rpm) of the motor vary for different machines, from 9,000 rpm to 30,000 rpm. The motor speed of a portable electric router is very high when compared with most other portable power tools.

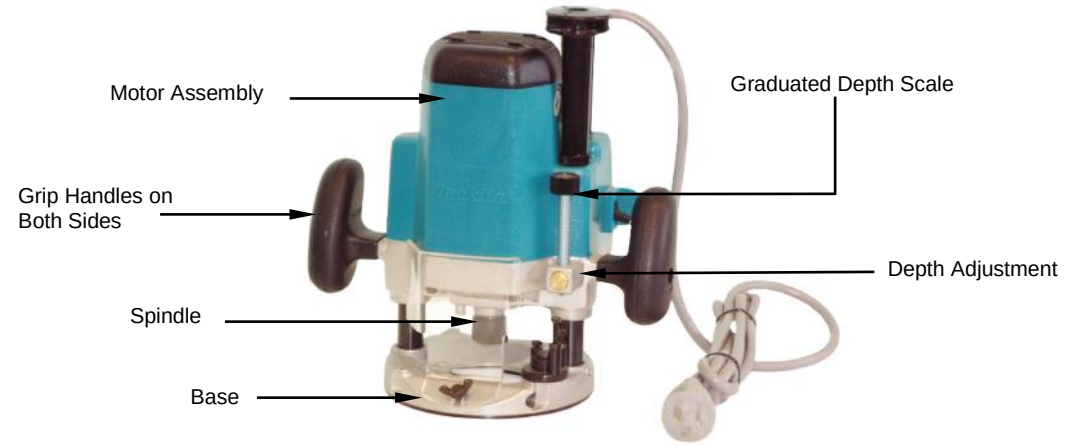
The portable electric router simplifies the task of making joints, cutting decorative edges, rebates and laminate trimming.

The versatility of the portable electric router is provided by the wide variety of bits and cutters designed for its use.

The operation of portable electric routers will vary considerably depending on the make and model. It is important to become familiar with the manufacturer's instructions.

Note: *As with any machine tool, all training should be supervised by a suitably qualified person and recorded in the trainee's Record of Work book. Routers can be very dangerous if not operated in a safe manner.*

Portable Electric Router



Types of portable electric Router Available

- Portable electric routers.
- Plunge routers.
- Laminate routers / trimmers.

The main difference between the various makes is mainly the design and power output. The greater the spindle speed the smoother will be the finish of the cut.

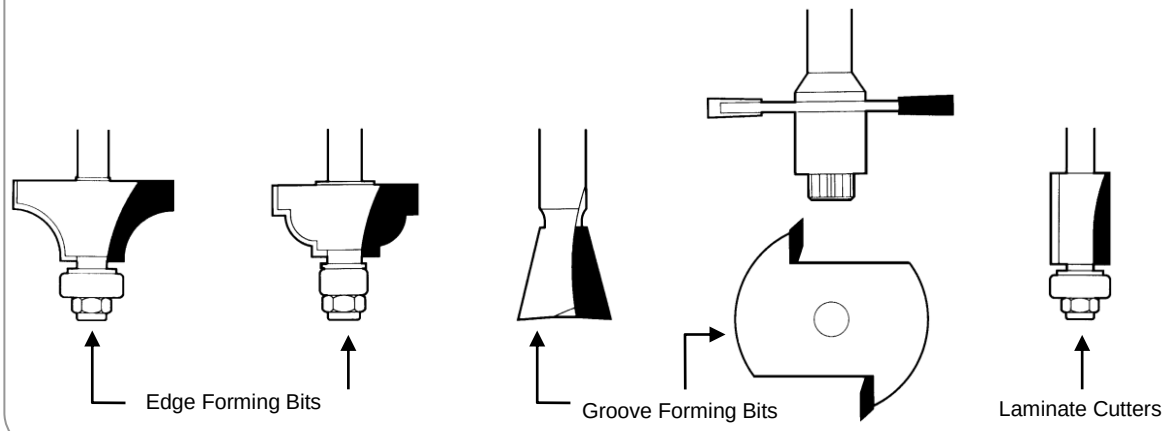
Portable Electric Router Bits and Cutters

Portable electric router bits and cutters are made of carbon tipped steel or high-speed tool steel. They are available in a wide variety of sizes and shapes.

Bits and cutters are held in place by a collet and a collet nut. The four main types of cutters are:

- groove forming bits;
- edge forming bits;
- laminate cutters; and
- slot cutters.

Examples of Portable Electric Router Bits



Safety Precautions When Using Portable Electric Routers

- Always disconnect the power supply plug at the source before changing cutters.
- Hold the portable electric router firmly when starting, to resist the initial torque.
- Always use sharp cutters or bits. This not only gives a good finish, but also protects the motor from overheating.
- Appropriate PPE must be worn including:
  - safety glasses or goggles;
  - a dust mask or respirator; and
  - suitable hearing protection.
- The portable electric router must be held firmly with both hands at all times.
- Always check that the cutter is clear of the work before starting the portable electric router.

Portable Disc Grinder

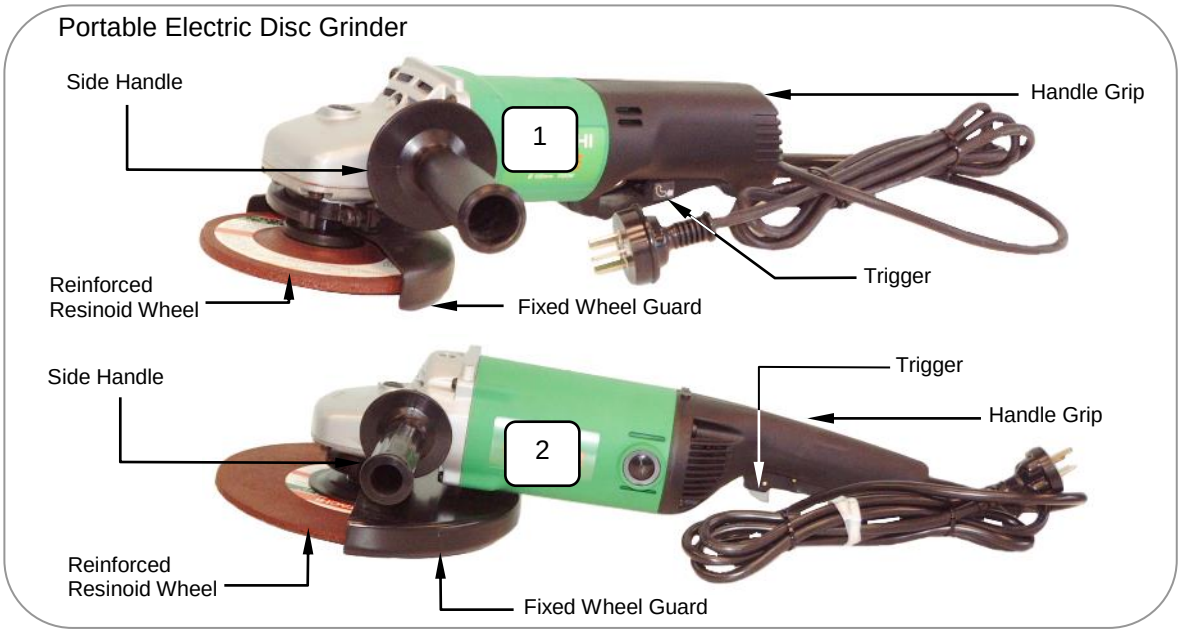
A portable disc grinder (or angle grinder) is a machine fitted with a reinforced vitrified or resinoid grinding wheel mounted on a drive shaft.

The basic function of the portable disc grinder is to "grind" material. They may be used to:

- cut steel pipe and metal sheet;
- grind metal joints and welds;
- cut masonry; or
- sand and polish.

Portable disc grinders come in two different sizes:

1. 100 to 125mm diameter grinder (shown below). (This small, all round angle grinder is the one most likely to be found on building sites.)
2. 190 to 230mm diameter grinder (shown below). (This is a larger version of the one above. It is designed for heavy duty grinding operations. These models may produce a gyroscopic effect and can be difficult to control.)



Speed in revolutions per minute (rpm) can vary with each machine. Before use, check that the machine speed is not greater than maximum rpm of the disc. It is important that the correct disc is fitted to avoid injury or damage.

Safety Precautions When Using a Portable Disc Grinder

Portable disc grinders create a large amount of dust, debris and noise. Eye, hearing and breathing protection are essential. Select PPE suitable for the task being done.

A large number of industrial accidents occur with these machines. Always ensure the guard is fitted. Grinding discs without guards can cut legs, arms and fingers. Grinding discs can also disintegrate if they are run at a speed greater than the rating on the disc.

Portable Disc Grinder Operation

- Always check that the machine is switched off before connecting it to the power supply.
- Check that the grinding disc is properly secured to the machine.
- Before starting the grinding operation, check that the material to be ground is firmly secured in a vice or to a bench.
- The operator must have a clear view of the material. They should also be standing in a comfortable, well-balanced position.
- Point the portable disc grinder down when starting. (Hold firmly to compensate for kickback.)
- Use a backward and forward motion across the surface of the material.
- When the grinding operation has been completed, switch the machine off. Wait until the wheel has stopped running and then place it down, with the grinding disc facing up.
- Never operate the machine above shoulder height.

Portable Bench Grinder

A portable bench grinder is usually double ended, ie. abrasive wheels are fitted directly to both ends of the spindle.

A coarse grit wheel for rough grinding is mounted on one end of the spindle and a fine grit wheel for finishing is mounted on the other.

A portable bench grinder is used primarily for sharpening cutting tools such as:

- hand tools – planes, chisels etc.;
- twist drills;
- hand-held construction equipment; and
- it can also be used for removing excess metal or material, and the rough shaping of parts.

Portable Electric Bench Grinder

Safety Precautions When Using a Portable Bench Grinder

Any grinding operation must be performed with a high regard to personal safety. Significant danger is created when heavy abrasive wheels are rotating at high speeds in close proximity to the operator.

Precautions to be taken when operating a portable bench grinder:

- The grinding wheels must be properly guarded. Always use guards and eye shield. The guard should expose just enough of the wheel to perform the grinding operation.
- Suitable PPE including eye, hearing and breathing protection should be worn.
- The adjustable work rests are positioned no more than 2mm away from the face of the wheel. Make any adjustment to the work rests when the wheel is stationary.
- Manufacturers of grinding wheels specify the maximum safe operating speed. Do not fit a wheel to a portable bench grinder which will increase the operating speed causing

the wheel to disintegrate. The maximum safe operating speed is indicated on the paper wheel washer.

- Adjustable eye shields should be kept clean and free of dust and debris.
- Check the abrasive wheels regularly for any damage. Types of damage could include:
  - broken or chipped edges;
  - cracks;
  - damaged spindle bushes; or
  - worn or damaged compressible paper washers.
- A damaged wheel must be replaced before operating the machine.
- Stand to one side of the grinder when starting.
- After fitting a replacement grinding wheel, run the grinder for one minute without applying any load to the wheel. Should a new wheel disintegrate it will happen during the first minute.
- Always read the manufacturer's operating instructions.
- Do not use side of wheel for grinding.

Hammer Drill/Breaker

This tool is used for breaking concrete and asphalt as well as rubble-laden ground, for demolishing concrete, masonry and similar building material, for ripping up roads and concrete, asphalt, tar as well as wood-block and stone paving, for cutting off clay, for breaking compacted ground and for ramming in posts and earth rods.

Safety Precautions When Using a Hammer Drill/Breaker

- When working with drilling and breaking hammers make sure that you have a firm stand, especially when working on ladders or scaffolding.
- Make sure the bit is securely in place before use.
- The operation of this machine may cause broken-off pieces to be flung away so no-one but the operator should come near the machine while it is in use.
- Vibration can cause the screws to come loose during operation. Check the tightness of screws before use.

Hammer Drill/Breaker Operation

The following are the suggested operating procedures when operating the portable hammer drill / breaker:

- Hold the tool firmly with both hands.
- Place the breaker on the material in question and switch on by pressing the switch lever. After a few seconds the electric breaker reaches its full percussion rate.
- Exploit the weight of the electric breaker when working. Applying great force against the surface being worked does not improve the performance of the tool.
- In order to avoid no-load strokes and to ensure easy handling, it is necessary to apply a certain amount of pressure on the handles.
- Position the chisel in such a way that the material to be worked can be split. This prevents the tool from jamming and the demolition performance is increased.

Compressed Air and Gas-powered Nail Guns

The use of mechanically powered nailers and staplers is now one of the most common labour saving devices on a construction site.

The range of fasteners fixed by these devices can vary from staples to 100mm nails. Compressed air nail guns are used for:

- sub-floor framing;
- flooring;
- wall and roof framing;
- claddings;
- finishing trim; and
- joinery assembly.

Compressed air and gas-powered nail guns are available in a variety of models and sizes, and features including nail depth adjustment, single or sequential firing options and automatic firing stop are available.

Portable Compressed Air Nail Guns

Portable Gas-powered Nail Guns

Safety Precautions When Using a Compressed Air or Gas-powered Nail Gun

The following safety rules should be followed when operating nail guns:

- Always assume that the tool is loaded with fasteners.
- Always check that safety mechanisms are working before use.
- Do not aim the tool at anyone. Always consider the firing zone.
- Always operate the tool with consideration for others.
- Take care when nailing near the edge of any material. Keep a lookout for any defects in timber, which may deflect the fasteners.
- Disconnect the compressed air nail gun when adjusting, cleaning or if leaving it unattended.
- Use only the power source (gas or compressed air) designed for that tool. (Never use bottled oxygen with compressed air tools as it can explode.)
- Use the appropriate safety equipment including eye and hearing protection sufficient to meet minimum NZ Standards when operating a compressed air nail gun.

Note: *Compressed air (like any power source) must be used with care.*

Every operator of compressed air equipment should be aware of the potential dangers which are present, in order to avoid accidents and injury.

Compressed Air and Gas-powered Nail Gun Operation

- Compressed air and gas-powered nail guns must be checked regularly before they are used. This check should include the energy supply and connections including compressors, air lines and hoses. Any defect in the machine should be repaired before its next use.
- For nail guns with gas cartridges as a power source, checks should be made for gas leaks.

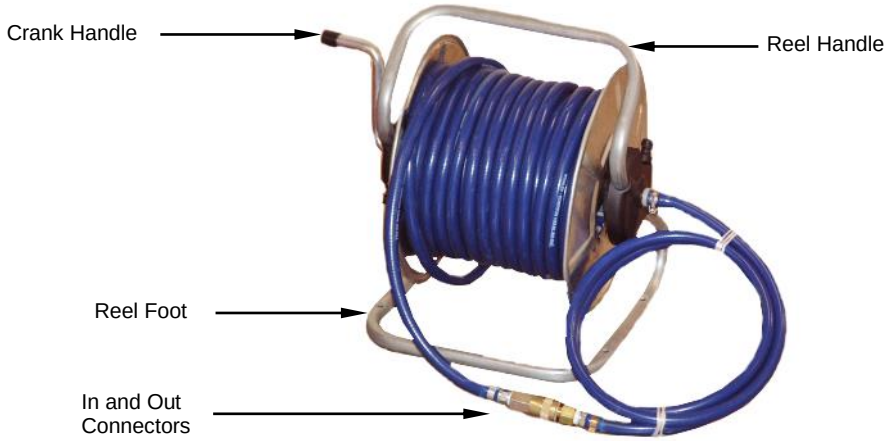
Compressors

When a compressor provides the power source, it is important to achieve the best performance for the tools by:

- locating the compressor in an area free from dust and dirt;
- keeping the air line as short as possible;
- operating the compressor out of direct sunlight to assist in cooling;
- keeping electrical extension leads as short as possible. (The appropriate electrical safety devices must also be used.);
- working within the capacity of the unit and not overloading it; and
- servicing regularly.

Portable Electric Compressor

Portable Compressor Hose and Reel



Filtering and Regulating Compressed Air

Air supplied by a compressor will contain water vapour and also dirt and dust. This can cause serious damage to tools and significantly reduce their operating life. The compressed air supplied is also at a much higher pressure than what is needed for the operation of the tool.

It is essential that both the impurities are removed and the pressure is controlled if air tools are to operate efficiently. This is done by installing an air filter between the compressor and the tool being operated.

Pressure regulators reduce the pressure from the compressor and maintain that pressure in the air line for the particular tool being used.

Note: *In all cases, the manufacturer's recommendations must be followed for the maintenance and servicing of the compressor and its accessories.*

Fasteners

Fasteners can be supplied in either strips or coils to fit the appropriate magazine in the nail gun. They are joined with a variety of materials, most of which are discharged into the timber with the fastener.

Reference

www.osh.dol.govt.nz/order/catalogue/194.shtml

Compressed Air and Gas-powered Nail Gun Operator Training

It is important that operators of compressed air and gas-powered nail guns are competent in the safe operation of this tool. Apprentices/trainees should receive adequate supervision until such time as they are deemed competent and evidence of such training should be recorded in the Record of Work.

Powder-actuated Fastening Tools

Powder-actuated fastening tools are widely used throughout the construction industry. This is a hand-held tool capable of driving a pin, stud, bolt or similar fastening into or through building materials such as concrete, brickwork and structural steel using an explosive cartridge.

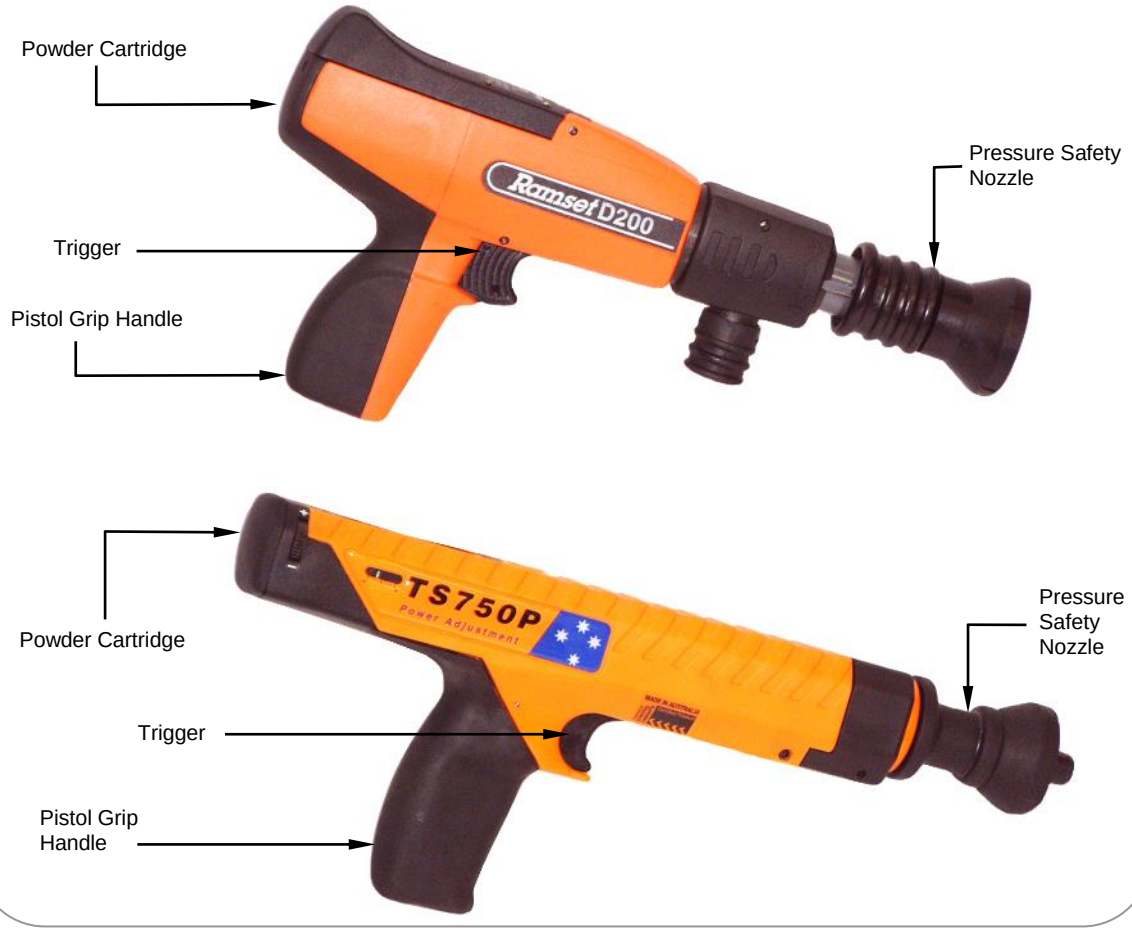
Reference

OSH Code of Practice – Powder-activated, hand-held fastening tools.
Also available from **www.osh.dol.govt.nz/order/catalogue/16.shtml**

Typical applications include:

- fixing timber and metal wall plates to concrete floors;
- fixing battens to concrete block walls;
- fixing suspended ceiling fittings to concrete structures;
- fixing partition tracking to floors and ceilings; and
- fixing conduits to steel and concrete.

Powder-actuated Fastening Tools



Powder-a**ctuated** Fastening Tools Certified Operators and Operator Training

A powder-actuated fastening tool is in the same category as an ordinary firearm and consequently must not be loaded or fired except by a person who is the holder of a certificate of competency issued by the manufacturer or their agent.

Any person training for such a certificate may operate the powder-actuated fastening tool, provided that it is under the direct personal supervision of the holder of the appropriate certificate.

Powder-actuated Fastening Tools Inbuilt Safety Features

Explosive powered tools have a number of safety features including:

- The tool will not operate unless the operator applies a minimum pressure.
- The breach cannot be opened when the tool is in the cocked position.
- They are equipped with a protective shield that extends in all directions at the end of the barrel. This shield may be adjusted if the surrounding material can arrest the projectile.
- They must not be capable of accidental discharge when the barrel deviates more than 6º from the perpendicular, from the surface of the work.
- Each tool has the following notice in a prominent position on the tool:
  "Do not remove the fastening tool from the work surface for at least 10 seconds if the charge fails to fire."

The above safety features are mandatory.

Powder-actuated Fastening Tools Explosive Charges

Explosive charges must be marked on the top or bottom, to indicate the relative strength:

- Charges must be kept in a secure, lockable metal container clearly marked “EXPLOSIVE CHARGES”.
- Charges must be compatible with the type of tool being used.

Powder-actuated Fastening Tools Operation

Loading, cleaning and general maintenance procedures will vary from brand to brand. Therefore it will be necessary to follow the manufacturer's instructions provided with the tool being used.

The following are same general rules which must be observed for the safe operation of the tool:

- Never fasten too close to the edge of any material.
- Check that the barrel is clear of any obstruction before loading.
- Do not use the tool where there is the possibility of inflammable gases.
- Use the weakest charge for the task.
- Do not fire into a structure or material of unknown construction. The pin could pass right through any weak section – such as a mortar joint. Place an observer well clear on the other side of the wall. Keep the area clear of other construction workers for a safe distance in all directions. The area on the opposite side to the firing location should be cordoned off to restrict entry while firing operations are taking place. Appropriate “Caution” signs must be displayed so as to be clearly visible to all people in the immediate area.
- Use the appropriate safety equipment including eye and hearing protection sufficient to meet minimum NZ Standards when operating a powder-actuated fastening tool.

Powder-actuated Fastening Tools Misfires

In the event of a misfire, the operator must comply with the following requirements:

- Observe the manufacturer's misfire precautions and procedures. Where the manufacturer has not provided specific instructions, the following steps should be taken:
  - Wait at least ten (10) seconds and carefully release the downward pressure.
  - Release the tool from the surface of the work maintaining the direction in which the tool was pointing.
  - Remove the charge and store safely for later disposal.

Note: *Any charges that have misfired should not be used again. Return them to the supplier. If a number of misfires occur from one batch of charges, return the whole batch to the supplier for destruction.*

Powder-actuated Fastening Tools Maintenance

The operating and maintenance procedures will vary from brand to brand. It is essential that the manufacturer’s instructions for maintenance and servicing procedures are observed. This will ensure that the tool is not only safe to use but will also significantly extend its economic life. The following points should be followed:

- Inspect the tool carefully before use.
- Regularly clean the tool.
- Have the tool certified by manufacturer’s representative every six months.

Worksheet 3

Apprentice Name:

1. What signs would indicate blades were blunt and needed changing/sharpening?

2. What type of sander would be selected to sand timber which is to be smooth finished?

3. Outline the steps involved in changing a portable circular saw blade.

4. What are three (3) common uses of a portable hand planer?

5. How is the depth of cut of a planer adjusted?

WORKSHEET 3	Assessor Initials:	Date:

Hiring Portable Power Tools

Building contractors may have the occasional need to hire portable power tools which may be too expensive or too specialised to purchase.

Hire centres can offer a wide range of equipment for use on building sites. However, there are a number of precautions that should be taken when hiring equipment, including:

- Plan the work and select the tool carefully.
- Allow plenty of time to complete the task. (When hiring by the hour or day there may be a temptation to hurry the job.)
- The operator may not be familiar with the tool, so it is important not to work alone in the case of an accident.
- Hire from a reputable hire centre.
- Do not accept a heavy or unwieldy machine that would be difficult to handle.
- Check that the machine is complete with all the necessary attachments and special tools for making adjustments to the machine.
- Visually check the machine to see if servicing has been completed since the previous hirer returned the tool.
- Ask for instructions, safety advice and, if necessary, ask for a demonstration.
- Check that all PPE is available.
- Remember that all the previous operating procedures, guidelines and safety precautions also apply to the use of hired equipment.

Wood Dust

Wood dust can provide a wide range of short- and long-term health problems for anyone who works with wood. This hazard can vary depending on the following factors:

- type of wood;
- chemicals contained in the timber;
- amount of exposure; and
- sensitivity of the individual.

The natural chemical composition of some timbers, together with treatment of preservatives, fungicides, insecticides, waxes, oils etc., can produce an adverse health reaction when machined or handled.

Wood dust (particularly the dust from treated timbers and manufactured boards) can, when heated during machining, alter the chemical nature of the dust.

PPE, ventilation and dust extraction are extremely important to avoid health complications that can arise through exposure to wood dusts.

The amount of exposure required to cause some of the more serious effects is not known. It should therefore be considered that there is no safe exposure level for the inhalation of wood dust.

Worksheet 4

Apprentice Name:

1. What four (4) power sources are used to drive portable woodworking and fixing tools?

2. Which portable fastening tools require the operator to be certificated to use them?

3. Identify six (6) safe practices which should be carried out by the operator of a portable power tool.

4. List eight (8) operating procedures required when using a jig or reciprocating saw.

5. Name two (2) types of router bits and draw an example of each.

Bit 1	Bit 2

6. List five (5) safety precautions that should be followed while using a compressed air or gas-powered nail gun.

7. List three (3) items which need to be checked prior to using a compressed air or gas-powered nail gun.

WORKSHEET 4	Assessor Initials:	Date:

Assessor's comments

Sign off check

The apprentice has successfully completed all the worksheets and answered all the questions correctly.

Checklist:

❑ Worksheet 1 ❑ Worksheet 2 ❑ Worksheet 3 ❑ Worksheet 4

Where reassessment of certain questions has occurred, the correct answers were:

❑ Re-written by the apprentice

❑ Confirmed through oral questioning and noted next to the answer

The apprentice has correctly answered a selection of oral questions

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5

❑ 6 ❑ 7 ❑ 8

Other (specify):

In signing off this unit standard, the apprentice can:

- correctly describe the use of portable power tools in terms of manufacturer's instructions;
- correctly describe the setting up of portable power tools in accordance with manufacturer's instructions;
- correctly describe care and maintenance of portable power tools in accordance with manufacturer's recommendations; and
- correctly describe the health and safety requirements of portable power tools. Includes: identification of hazards and controls; testing and tagging; certificates of competency; prevention from injury; prevention of damage to materials and machinery; electrical protection.

UNIT STANDARD	**Assessor Signature:**	**Date:**
13000 COMPLETED	**Moderator Signature:**	**Date:**