

National Certificate in Building, Construction, and Allied Trades Skills (BCATS)

Use hardware and fastenings for a BCATS project

Unit Standard – 25919

Level 1, Credit 2

Name: _____





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What you need to do

By the end of this module, you should be able to:

- to identify, select, describe and use the hardware and fastenings
- complete work operations

How you will be assessed

You will be assessed by a combination of practical and written work.

You need to show your teacher/tutor that you can:

- identify and describe different types of hardware and fastenings
- establish hardware and fastening requirements from job specifications
- select the appropriate hardware and fastenings
- install hardware and fastenings
- complete all operations safely
- clean and store tools, plant and equipment correctly

Your teacher/tutor will also give you a worksheet that you need to complete, which your teacher/tutor will mark.

Glossary of terms

Term	Meaning
Adhesive	Any substance capable of holding materials together by surface attachment
Castor	A small wheel which can rotate through 360 deg attached to the underside of furniture, wheel chairs, shopping trolleys and other objects to make them easier to move.
Clearance hole	A hole drilled slightly larger than the shank of a screw, bolt or nail.
Coach screw	A heavy-duty wood screw with a square or hexagonal head.
Compatibility	The ability of two or more materials to perform together without any ill effects.
Corrosion	The disintegration or wearing away of a metal product usually as a result of a chemical reaction
Countersink	To enlarge the top of a screw hole to allow the head of the screw sit flush or below the surface of a material.
Durability	The ability of a material to withstand the effects of decay over a period of time.
Galvanising	A zinc coating applied to the surface of iron and steel products to protect against corrosion
Job specifications	A detailed and exact statement of particulars identifying materials, dimensions and instructions for a project to be built, installed or manufactured.
Nail	The family of timber fasteners made from extruded wire
Nail plate	A pressed metal plate with protruding prongs used to strengthen timber joints.
Pot life	The amount of time an adhesive remains suitable for its intended use.
Screw	A tapered or cylindrical fixing pin with a slotted head and a raised spiral surface which bites into the surrounding timber as it is driven in.
Specifications	A detailed written set of requirements which identify the extent, standard and quality of work to be carried out.
Stainless steel	A corrosion resistant steel alloy containing a high percentage of chromium
Working Drawings	The set of precise scale drawings with dimensions, details and notes which provide sufficient information to allow a project to be constructed accurately.

Introduction

Pieces of metal have been used to fasten lengths of timber together for many thousands of years. Modern hardware and fasteners have been carefully designed to meet a wide range of situations and purposes. They must be carefully selected and used to ensure that maximum durability of all components can be achieved.

The correct selection of a particular piece of hardware or fastening will normally depend on a range of factors including:

- durability
- corrosion
- compatibility

Durability is the ability of a material to withstand the effects of decay over a period of time. A durable product or material is one which does not quickly wear out, and is able provide a service over a relatively long period of time.

Corrosion can be caused a number of environmental factors combined with the incorrect choice of a proprietary product. The primary cause of metal failure affecting hardware and fastenings is corrosion, resulting in loss of strength and eventual failure of the product.

Compatibility is a measure of how stable a material is when it is long term contact with another material or substance. If they do not change then they are considered compatible. If the materials change or deteriorate over time then they are considered incompatible.



Durability:

The Building Code requires fastenings to meet a minimum standard when subjected to varying environmental conditions. When timber is wet or damp, and especially if the timber has been treated to H3 and above, a serious corrosion problem can occur.

For most outdoor situations, galvanising is a suitable means of protection.

Where treated timber and galvanised fastenings are used together in outdoor situations such as a pergola, deck or garden furniture and are subject to wet conditions, a second level of protection such as an application of paint or a coating system for the fastenings is recommended, to reduce or eliminate corrosion.

Surf beach spray zone: *The surf beach spray zone is defined as being the coastal area within 500m of the sea or 100m tidal estuaries and sheltered inlets. Other corrosion zones in New Zealand reflect the severity of exposure to wind-driven sea salt and also include areas subject to the corrosive effects of geothermal gases. In these areas, stainless steel fastenings are recommended.*

Types of fastenings which we will now examine include:

- nails;
- hinges
- handles, locks and latches; and
- screws;
- adhesive;
- timber connectors;
- bolts;
- wheels/castors

Nails

Nails are the most commonly used method of connecting timber in wood frame construction.

The selection of the type of nail to be used for a particular purpose will depend on a number of important factors including:

- the type of material to be fixed
- the location where it performs its service life
- the durability requirements
- the geographic corrosion zone
- the compatibility between the nail and the material to be fixed

Most nails are manufactured from extruded wire and are available in a wide range of lengths, thicknesses and finishes. They are usually named for the shape of their head and/or their use.

Finishes

Nails are manufactured to meet the requirements of many different fixing situations. In order to meet the various demands there are a wide range of different finishes available. These include:

- bright steel
- hot dipped galvanised
- cadmium plated
- copper
- brass
- aluminium
- stainless steel
- powder coated

Holding power

When a nail is driven into a piece of timber across the direction of the grain, the pressure from the wood fibres pressing against the nail will hold it firmly in position preventing it from moving.

However when a nail is driven into the end grain of a piece of timber, the holding power of the nail will be greatly reduced.

There are a number of other factors that can affect the holding power of a nail including:

- the type and age of the timber being used
- the correct choice of nail
- the method used to position and drive the nail (nails slightly angled to the surface of the timber will increase its holding power)

While the shank of most nails is round and smooth, some nails are manufactured with threaded or twisted shanks and also with annular grooves to increase their holding power.

Types of nails

The type of nail you select will depend entirely on the job, the type of timber and the finish required.

Jolt head

Jolt head nails are commonly used because the cylindrical head can be punched below the surface of the timber. This leaves a small hole which can be easily filled with putty and coloured if necessary to blend with the surrounding surface of the wood. Uses:

- cabinet assembly
- framing

Flat head

The flat head nail has a larger surface area on the head where a greater holding power is required and the head does not need to be punched below the surface of the timber. The flat head makes them easier to drive but not so easy to punch below the surface of the timber. They are more suitable for use in places where the nail head will not be visible and are most commonly used for:

- fixing brackets and plates
- interior and exterior cladding
- softwood framing

Panel pins/finishing brads

These are small, thin nails which are available in a range of sizes from 12mm to 50mm and have a small conical head. When punched below the surface of the timber, it leaves only a small hole to be filled in to blend with the timber. These nails are used for:

- light cabinet assembly
- interior finishing work such as architraves, skirting and scotia

Roofing nails

These are nails used to fix roofing materials to the roof framing. They are available in a range of different types and are generally named for the type of head used to prevent water penetration into a building.

Lead head nail a bright steel flat head nail with a large conical lead head.

Spring head a galvanised nail with a round oval shaped head.

Proprietary fixing a nail usually with a dome shaped head and a spiral shank and a foam or rubber sealing washer to prevent the entry of water into the roof area.

Hints for nailing

- To avoid splitting the timber when nailing into hard timber or near the edge of a piece of wood, drill a hole slightly smaller than the diameter of the nail shank.
- To achieve a stronger joint, drive the nails at an angle to the surface of the timber
- Use a series of small strikes rather than one or two heavy ones
- To avoid unsightly hammer marks on your finished work, leave the nail head slightly above the surface of the timber and then use a nail punch to drive the nail home
- When driving nails, holding the base of a handle will provide you with more control over a hammer than holding it high up near the head

Ordering nails

Nails are usually sold by weight and an order will need to state the following:

- The length of the nail
- Diameter or thickness gauge
- Type of nail required for the job – jolt head, flat head etc.
- Finish required – bright steel, galvanised, cadmium plated etc.
- Quantity required usually expressed in kilograms or by the packet or box

 **Screws**

Screws and bolts are a type of fasteners which use a helical thread for fixing timber and metal components together.

Wood screws

The thread of a wood screw cuts into the fibres of the timber providing greater holding power than a nail.

Screws are available in a wide range of types and sizes. Each type is designed specifically for a particular purpose or for use with a particular material.





Wood screws are generally named for the shape of the head or the method used for driving the screw.

Each screw head is specially shaped to allow a screwdriver or bit to grip the screw slot firmly when it is either being driven in or withdrawn.

Screws rely on their threads to provide resistance to withdrawal and can usually be removed and reinserted without reducing its effectiveness.

There are many different types of screws available and it is important that the right type of screw is selected for a project. It is also important that the screwdriver used fits the slot of the screw correctly.

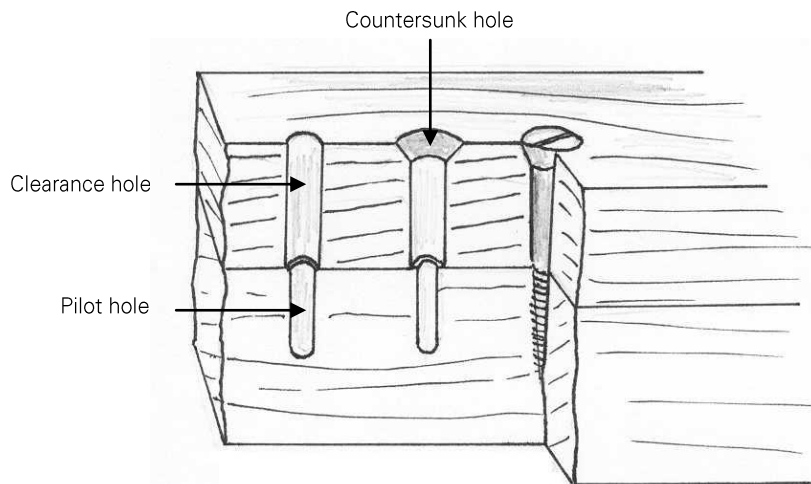
Four main types in common use are:

	Slotted	Standard or flat for driving single slotted screws. Tip width range from 4.2mm to 12.5mm.
	Phillips	Designed specifically for use with a Phillips head screw, which has two recessed slots at right angles to each other. Sizes range from 0 point (small) to 4 point (large).
	Pozidriv	Similar to the Phillips style, the screw can be identified by additional lines on the face. Sizes range from 1 point (small) to 4 point (large).
	Square drive	Square tip, commonly used in industrial applications. Sizes range from 1 point (small) to 3 point (large).

Driving wood screws

For best results when using screws to assemble a timber project, the following process should be followed:

1. Drill a pilot hole into both pieces of timber. Ensure that it is smaller than the outside diameter of the threaded portion of the shank; this allows the screw thread to bite into the wood fibres.
2. Next drill a clearance hole in the piece of timber where the head of the screw will sit. This should be slightly larger than the unthreaded portion of the shank and allow the screw to turn freely in the hole.
3. If a countersunk screw is to be used, then select the appropriate countersink bit and carefully remove the wood from the top of the clearance hole. The top of the screw head should finish flush with or slightly below the surface of the timber.



Helpful hints when using screws

- To make the screw easier to drive, lubricate the threaded portion using wax, grease or even soap.
- Always select the most appropriate screwdriver tip to match the size and type of the screw head. If the tip is too small it will likely damage the head of the screw and too large will leave marks on the surrounding timber.
- Remember that a screw is not only designed to be driven into timber but also may be required at some future date to be removed. Care taken when assembling a project may save a lot of frustration later.

Ordering Screws

When ordering screws the following information needs to be provided:

- The shape of the head
- The slot type
- The screw length
- Thickness or gauge
- The type of finish on the screw
- The quantity required

Bolts

Bolts are threaded fasteners designed to be inserted in pre-drilled holes in order to hold a range of materials together.

They provide a strong joint using a clamping action to hold the two surfaces together and can be tightened or released by turning either a square or hexagonal nut fitted over a round or square washer.

Bolts, nuts and washers are frequently used in the assembly of outdoor furniture and construction equipment where joint strength is required.

The most common types of bolts are manufactured from the following materials:

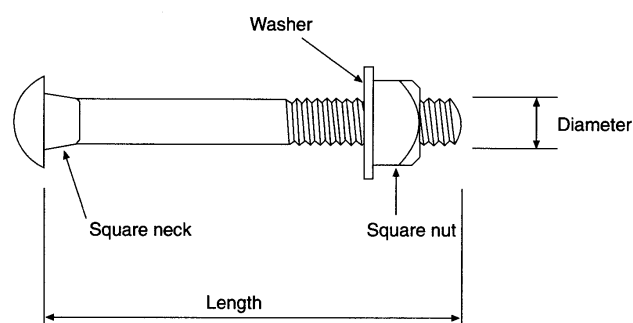
- Mild steel
- High strength steel
- Stainless steel

Additional protection for some of these materials can be provided by hot dipped galvanising or zinc plating.

Coach (carriage) bolts

Coach bolts have a domed head with a square section directly below the head and a round shank threaded at one end, allowing a nut and washer to be fastened to it. These bolts can be used to fasten both wood to wood and wood to metal.

The bolt is inserted into a pre-drilled hole slightly larger in diameter than the shank of the bolt. Place the washer and the nut on the threaded end and tighten with a spanner to pull the square section into the timber so that the underside of the domed head is hard against the surface of the timber.

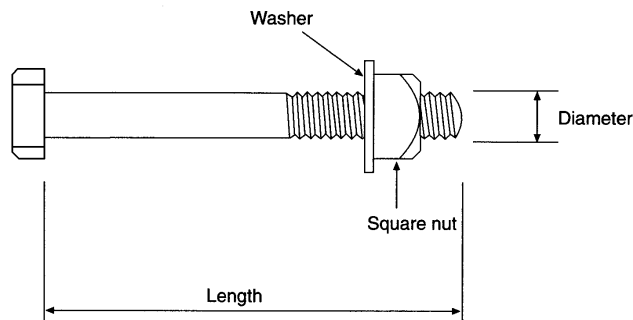


Engineers (machine) bolts

Engineers bolts have a round shank with a hexagonal head at one end and threaded at the other to allow a nut and washer assembly to be attached to it.

Engineers bolts are less common than coach bolts in woodwork. However, if necessary they can provide a sturdy fixing alternative for outdoor furniture such as barbeque tables.

A washer placed under the bolt head is often used to prevent damage to the surface of the timber as the nut on the opposite end is tightened.



Ordering Bolts

Bolts, nuts and washers are usually ordered by number, together with the following information:

Bolts

- Type Engineers bolt, coach bolt, coach screw.
- Length in millimetres.
- Diameter of the shank in millimetres.
- Finish mild steel, galvanised, stainless steel.

Washers

- Type square or round.
- Size in millimetres.
- Finish compatible with bolt.

Nuts

- Type square or hexagonal.
- Finish compatible with bolt.

Hinges

The icon consists of a solid black square with a white circle in the center, representing a hinge pin.

Hinges are available in a range of sizes, styles and finishes and are designed to suit different situations.

The type of hinge required will depend on the size and weight of the door or window to be fitted. These are normally specified in the job specifications.

Common types of hinges are described below.

Butt hinges

The butt hinge is the most common type of hinge and in its various forms is used for all kinds of doors and windows. It is available both with fixed and loose (removable) pins.

The **fixed pin butt hinge** is used for general furniture making, hanging windows, external doors and large doors. As the name suggests, the pin in the fixed pin hinge is fixed in position and cannot be easily removed.

The pin in a **loose pin hinge** can be easily pulled out allowing the door to be removed. These hinges are ideal for most normal household doors, allowing the door to be easily removed for maintenance without having to unscrew all of the hinges from either the door or the door jamb.

For security reasons this type of hinge should not be used on windows or external outward opening doors. Intruders are able to remove the pins and enter the building.

Usually most butt type hinges have to be recessed so that one leaf of the hinge is checked flush in the edge of the door or window and the other leaf checked into the jamb.

Butt hinges are available in steel and brass and in a range of sizes and finishes.

Gate hinges

Gate hinges come in a wide range of sizes and styles and designed to suit different situations.

To ensure a gate or door works efficiently it requires the right type of hinge to support its weight and size. Tee or strap hinges are the most common type used for light to medium gates and doors. These hinges do not require to be recessed and are normally fixed directly to a gate or door. Decorative and heavy duty hinges are also available.

Furniture hinges

A hinge is a small but very important piece of furniture hardware and a necessity in every home. In addition to the butt hinge there is a large range of specialty type hinges specifically designed for a range of applications.

These include:

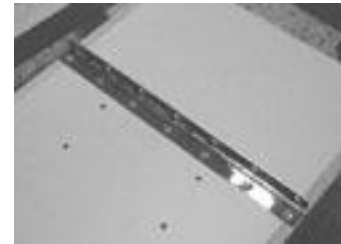
Concealed hinges

Concealed hinges are readily available from hardware stores and are easily fitted to cupboard doors. They come with fitting instructions including a template to locate drilling positions.



Piano hinge

These hinges are sold in long lengths and are available in a stainless steel, chrome or brass finish which can be cut to the required length. They can be either fixed directly on to the face of the timber or checked in.



Flap hinge

This is a butt hinge with oversized leaves making it a stronger fixing than the standard butt hinge.





Handles, locks and latches

There are many types and styles of handles including turned wood, plastic and stainless steel. It is important to carefully choose the type of handle to use on a project as your choice can either enhance or spoil the look of a project.

While selecting handles for a project is a matter of personal preference, it is also important to consider the type of long term use they will be subjected to and choose handles that will stand up to years of pushing and pulling.

Locks and latches

Locks and latches are security devices that can be fitted to a door, window or container to prevent unauthorized access.

There are many different locks available; the selection of one to be fitted will depend entirely on the function it is expected to perform and the method of construction used.

Door locks

Common types of door locks include:

- Lock sets** These locks have the locking mechanism within the handle or knob and are easy to fit and operate. They can be opened from the one side with a key and locked on the other side using a locking button in the handle. These locks are easily forced, so when fitted to exterior doors they should be used in combination with an additional security measure such as a rim dead lock
- Rim dead locks** Rim dead locks are fitted to the inside of exterior doors and are usually lockable from both sides. These locks provide an additional level of protection from intruders.
- Mortice locks** A mortice lock is one which requires the body of the lock to be fitted to the inside of a door or piece of furniture and is generally found in doors in older buildings.
It can be unlocked from both the inside and outside of the door by using a key to retract the bolt from a hole in the door frame.
- Dead lock** A deadlock may be either single cylinder or double cylinder. Turning the key or snib will move the bolt in and out of the lock.
A single cylinder deadlock can be opened with a key from the outside of the door and operated by a twist knob on the inside.
Double cylinder deadlocks need a key on both sides to open the door and does away with the twist knob. This prevents an intruder, after forced entry through a window, being able to unlock the door using the twist knob to remove valuable possessions.

- Latches** A latch is a type of fastener which is used to secure doors and gates either open or closed by engaging with another piece of hardware called a keeper or striker plate. A latch differs from a lock although often they are combined together as the same product.
Latches range from a simple cabin hook to complex electronic versions.
- Cabin hook** This is a hooked bar which is fastened permanently to a wall at one end by a ring or staple allowing the hook to engage with an eye fixed to a door or gate. Used to hold a door or gate open or shut.
- Snap latch** This is a simple latch system, fixed to a gate post, which captures and secures a bolt attached to a gate.
- Crossbar** A crossbar is possibly the earliest type of security system in use. It consists of a sturdy bar which slides across.

Window locks

Window locks make a window more difficult to open from the outside, and therefore provide a deterrent for intruders. The method of window construction and the material they are made from will determine the most appropriate type of window lock to be installed.

Furniture locks

Locks and catches, together with other hardware, are an important consideration for every furniture project. They must function smoothly and correctly and should match the furniture in style and weight.

- Cupboard lock** There are several types of cupboard locks available. The lock is screwed directly onto the inside face of the door and a hole drilled through from the front of the door provides access for the key.
- Barrel lock** This lock fits into a pre-drilled hole in the door and can be used for both doors and drawers.

Timber connectors

A timber connector is any device used to increase the strength and rigidity of joints between timbers and simplify timber construction. There is a wide range of different timber connecting products available for building applications and general industrial use.

Timber connectors are generally manufactured from light gauge steel and protected with a zinc coating. This level of protection is adequate for internal use only. Internal areas are defined as those within the building envelope that are kept permanently dry.

Where timber connectors are likely to be used outside the building and exposed to water or windblown salts (coastal corrosion zone), alternative methods of protection or stainless steel should be considered.

When selecting the product type and materials for timber connectors the durability requirements for a particular geographical location will need to be considered.

Some of the more common products available include:

- Nail plates
- Joist hangers
- Tie down connectors
- Post anchors

Adhesives

Adhesives are defined as substances capable of holding materials together by surface attachment and are primarily designed to bond materials together in a wide range of situations and conditions.

Almost any combination of different materials can be bonded together by using the correct choice of adhesive.

Adhesive bonding occurs with the conversion of a liquid or semi-solid into a solidified film in one of three ways through:

- solvent loss
- chemical reaction
- cooling of a hot-applied material

Types of adhesives

There are two main types of adhesives.

Natural Adhesives

- Animal glues
- Casein glue

Synthetic Adhesives

- Thermosetting glues
- Emulsion glues
- Contact glues

The most common adhesives are discussed below.

Polyvinyl acetate (PVA)

This is a white, synthetic emulsion, wood adhesive which sets through loss of water. It is a clean non-staining adhesive which comes ready to use. Because it is water based it will break down when exposed to moisture and humid conditions.

It is one of the most versatile and widely used of the synthetic adhesives. It is supplied in a liquid form where the bonding agent is dissolved in a water base. As the water evaporates the bonding between the surfaces takes place.

PVA is a thermoplastic adhesive which means that if it is subjected to excessive heat after it has set, the adhesive will soften resulting in loss of joint strength.

In addition to being unsuitable for use in wet and warm conditions, this adhesive will also lose its holding powers at temperature below 10 deg.

The **advantages** of polyvinyl acetate (PVA) glue:

- PVA is convenient and easy to use.
- It has a long shelf life.
- Does not blunt tools or stain timber.
- Has a reasonable setting time.

The **disadvantages** of polyvinyl acetate (PVA) glue:

- PVA will soften when heated after it has set.
- It will stretch or creep under stress.
- It cannot be used where the temperature is less than 10°C.
- It is not waterproof.

Contact adhesives

A contact adhesive is one which bonds to itself and therefore needs no cramping or pressing while it is setting. It is a rubber based liquid which is supplied in a can ready to use.

The adhesive is applied by evenly spreading it carefully over both surfaces to be joined. These are then left to dry (usually for 10 to 15 minutes depending on the weather conditions) and when the two surfaces are touch-dry they are carefully brought into contact with each other. As the bond is instant, the two surfaces must be accurately positioned before the contact is made.

The **advantages** of contact adhesive:

- Contact adhesive is supplied ready to use.
- It does not stain timber.
- No cramping or pressing is necessary.
- Reasonably waterproof.
- The bond is immediate.

The **disadvantages** of contact adhesive:

- As the bond is immediate, no adjustments can be made after contact.
- Not suitable where joints must slide together or where two pieces have to tighten against each other.
- Not recommended for exterior use.

Two-part adhesives

These adhesives are supplied in two separate containers and are commonly referred to as 'two-pot' products. These packs consist of:

- A resin, which may be supplied as either a liquid or in a powder form which is then mixed with water to form a thick syrupy mixture and
- A hardener, which is usually in a liquid form

The resin itself is not an adhesive on its own and must be mixed with the recommended hardener before use.

The chemical reaction which causes the resin to harden begins when the resin and the hardener are mixed together. The setting time for the adhesive mixture can be varied by the following conditions:

- The type of hardener used. These give a range of setting times from one hour to ten hours.
- The temperature of the environment and the materials where the adhesive is being applied.
- The application of heat. The more heat applied the less time taken for the adhesive to set.

Preparation: Before mixing any two-part adhesive, it is extremely important to read and understand the manufacturer's instructions on the container and, if necessary obtain a copy of the material safety data sheet for the product. Use the exact quantities recommended as increasing or decreasing the quantities can reduce the strength of the glue.

Safety when using adhesives

Many adhesives can cause severe skin irritation and some can affect the respiratory system. Fumes from solvent based adhesives can create a fire and toxicity hazard.

These risks can be minimised by using good ventilation, using the correct personal protective clothing and by immediately washing off any material spilt on the skin

Before use, always read the manufacturers' information or relevant safety data sheets regarding the safe use of a particular adhesive.

Summary

- The properties of the timber and wood based products and the environment in which they are to be used must be considered carefully when selecting an adhesive.
- The correct preparation of both the materials to be joined and the selected adhesive is very important.
- One of the most common reasons for joint failure with wood adhesives is people not following the adhesive manufacturer's instructions.
- Special care must be taken when using adhesives with flammable or toxic properties.

Wheels/castors

A castor is a type of small wheel which can be attached to the underside of a piece of furniture or other heavy object to make it easier to move.

They can be either mounted on a swivel or fixed to a plate, both of which allow a castor to rotate through 360 degrees.

Castors operate best on smooth and flat surfaces. They are designed in many different sizes, are available in a range of materials including, rubber, plastic, nylon, aluminium, or stainless steel, as well as being light, medium or heavy duty.

Selecting the correct type of castor to use will depend on the amount of use it will receive and the weight of the object to be supported.

Job specifications and working drawings

The key to producing a quality product or job is to ensure that all of the necessary documentation has been thoroughly prepared before a project is started.

Good documentation should:

- accurately represent the extent and content of the project by defining the scope and quality of the work to be done and the materials and products to be used
- provide all the necessary information for the project to be completed
- ensure there is consistency between the working drawings and specifications
- be presented neatly, concisely, legibly and in a logical sequence

Construction problems can largely be avoided with a good set of working drawings and specifications.

Following the working drawings and job specifications will ensure that the end product will meet the customer's or your personal requirements and that it is produced in accordance with good workplace practice.

Care of plant and equipment

Plant and equipment is expensive to purchase and also to replace. The better they are looked after, the better they will perform and the longer they will last. Before storing tools away after use, make sure that they are thoroughly cleaned and metal parts are wiped with an oily rag to prevent rust.

Use hooks and shelves to store plant and equipment and a tool box or cupboard for your personal tools. Store all equipment in a dry and secure place.

All tools perform better when they are sharp and in good condition. Blunt tools can be very dangerous when they are used. Learn the correct methods to sharpen and adjust hand tools such as planes and chisels.

Check all power tools after use and if any maintenance is required they should be sent to the appropriate dealer for repairs.

When using power tools always use a Residual Current Device (RCD) to prevent electric shock.

Safe working practices

Understanding safety and applying safe work practices when working in workshops or on construction sites is critical for ensuring that accidents are avoided.

By following some basic rules, such as wearing personal protective equipment (PPE) and applying common sense, you play an important part in ensuring that every workplace is a safer place to work in.

Hazards continually change because of what people do or do not do, and because the nature of the work may change. The Health and Safety at Work (HSW) Act sets out the minimum legal obligations for identifying and controlling hazards in workplaces (including schools),

Anyone in charge of a workplace must have an effective method in place for identifying hazards. Anyone who is going to be working in the workplace needs to be consulted, trained and involved in the process of identifying and controlling them.

Everyone should be provided with information about the hazard identification procedures, which may include:

- information about hazards that are known to be present in the workshop or on the project site (which could be in the form of a checklist); and
- the process you must follow to identify hazards.

There are several methods which can be used to identify potential hazards. The environment of each workplace will largely dictate the most appropriate method or combination of methods - However, it is important that a site specific safety plan (SSSP) clearly identifies the hazards, the risks assessment of them and the controls to be put in place at any particular site.

If you haven't already achieved the level 1 safety Unit Standard 24352 *Demonstrate knowledge of and apply safe work practices in the construction of a BCATS project* then it is recommended that you work towards completing it either before or at the same time as this one.