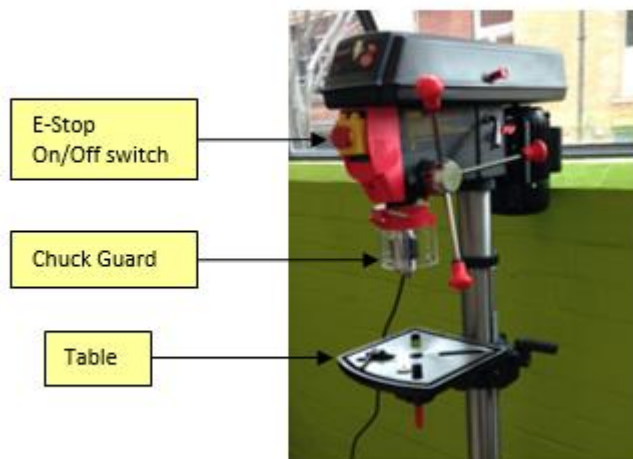


3.1 - Pedestal Drill Introduction

Introduction

Sometimes also known as a drill press, or bench drill, these machines are a fixed style of drill that may be mounted either on a stand or bolted to the floor or workbench. They are found in almost all workshops and offer a number of significant advantages over portable drilling machines.



Generally speaking a pedestal drill is mounted on a base plate and a column so that it is free standing. The column is normally such a length that if the machine is standing either on a bench or on the floor, the machine head and spindle are at head height.

A Pedestal drill consists of a base, column, table, spindle and drill head, usually driven by an electric motor.

The head has a set of three handles radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column.

The table can be adjusted vertically and is generally moved by a rack and pinion; however, some older models rely on the operator to lift and clamp the table into position. The table may also be offset from the spindle's axis and in some cases rotated to a position perpendicular to the column.

A range of speeds is available from stepped cone "V" pulleys at the top of the machine or by using a gearbox on larger machines.

Pedestal drills have a number of advantages over portable hand-held drills:

- Less effort is required to apply the drill to the work piece. The action of the lever handle gives the operator the advantage of having considerable force available.
- The table allows a vise or clamp to be used to position and restrain work, making the operation much more secure.
- The fixed setup of the machine allows holes to be drilled accurately and consistently.
- Pedestal drills are equipped with more powerful motors which enables larger drill pieces to be used and also speeds up drilling with smaller pieces. It also permits higher drilling speeds.



SPINDLE SPEEDS IN R.P.M.				RECOMMENDED SPEED FOR DRILL SIZE & MATERIAL			
1/8"	1/4"	3/8"	1/2"	1/8"	1/4"	3/8"	1/2"
1500	750	500	375	1500	750	500	375
1200	600	400	300	1200	600	400	300
1000	500	333	250	1000	500	333	250
900	450	300	225	900	450	300	225
800	400	267	200	800	400	267	200
750	375	250	188	750	375	250	188
700	350	233	176	700	350	233	176
650	325	214	163	650	325	214	163
600	300	200	150	600	300	200	150
550	275	182	139	550	275	182	139
500	250	167	125	500	250	167	125
450	225	150	113	450	225	150	113
400	200	133	100	400	200	133	100
350	175	118	89	350	175	118	89
300	150	100	75	300	150	100	75
250	125	83	63	250	125	83	63
200	100	67	50	200	100	67	50
150	75	50	38	150	75	50	38
120	60	40	30	120	60	40	30
100	50	33	25	100	50	33	25
90	45	30	22	90	45	30	22
80	40	27	20	80	40	27	20
75	37	25	18	75	37	25	18
70	35	23	17	70	35	23	17
65	32	21	16	65	32	21	16
60	30	20	15	60	30	20	15
55	27	18	14	55	27	18	14
50	25	17	13	50	25	17	13
45	22	15	12	45	22	15	12
40	20	14	11	40	20	14	11
35	17	12	10	35	17	12	10
30	15	11	9	30	15	11	9
25	12	9	7	25	12	9	7
20	10	7	5	20	10	7	5
15	7	5	4	15	7	5	4
12	6	4	3	12	6	4	3
10	5	3	2	10	5	3	2
9	4	3	2	9	4	3	2
8	4	3	2	8	4	3	2
7	3	2	1	7	3	2	1
6	3	2	1	6	3	2	1
5	2	1	1	5	2	1	1
4	2	1	1	4	2	1	1
3	1	1	1	3	1	1	1
2	1	1	1	2	1	1	1
1	1	1	1	1	1	1	1

[WARNING] FOR YOUR OWN SAFETY:

- Always wear safety glasses and earplugs.
- Do not wear gloves, jewelry or loose clothing. Tie back long hair.
- Securely clamp work to table. If it is too short to contact the clamps, clamp in supporting position.
- Securely lock head and support to column, arm to support and table to arm before operating the drill.
- Use only recommended accessories.

3.2 - Hazards

Hazards

- a. Laceration Injury – If the operators hands or fingers come into contact with the spinning drill piece a serious cut requiring first aid will result. NEVER overreach! Never reach around or under the working head, or grab the chuck to stop a drill press.
- b. Impact Injury – It is possible for the spinning drill piece to become excessively tight in the work piece, resulting in the uncontrolled and rapidly spinning workpiece. This can strike the operators body quite forcefully or may even become dislodged and fly across the workshop, striking somebody and causing injury. This can be avoided if the work piece is held securely in the vise, clamp or other appropriate fixture.
- c. Eye Injury – The operator must always use eye protection. Particles or objects can be thrown into the operators eyes from the rapid spinning of the drill bit.
- d. Splinters – The operator will need to clear shavings and sawdust from the work piece from time to time. A brush and pan should be used to do this to avoid getting splinters from hidden sharp pieces of wood and metal fragments if metal is being drilled.
- e. Operator Entanglement – Clothing, hair, jewellery and any other objects which could become entangled in the drill must always be restrained, tied back or removed.
- f. Drill Press Accessories – Be extremely careful when using accessories such as fly cutters or wooden toy wheel cutters. Some of these attachments have a large operational sweep and there is increased risk of entanglement injury or laceration.

Never hold the work piece by hand.

Secure the workpiece with a vice, clamp or another appropriate fixture.

If it is long enough it could be braced against the table column and held down to the table using clamps or fixtures to prevent it spinning.



3.3 - Using a Pedestal Drill

Before drilling:

- Be sure the chuck is tightly secured to the spindle.
- Tighten the bit securely in the chuck.
- Remove the chuck key and lower chuck guard in place before starting the drill.
- Carefully set the drill press speed for both the type of material and bit size you are using.

RECOMMENDED SPEED FOR DRILL SIZE & MATERIAL						SPINDLE SPEEDS IN R.P.M.			
SPEED RANGE (RPM)	WOOD		ALUM ZINC BRASS		IRON STEEL		180	250	300
	in	mm	in	mm	in	mm			
2740	3/8	9.5	7/32	5.6	1/8	3.2			
1410-2270	5/8	16.0	11/32	8.75	1/4	6.4	480	580	970
970-1280	7/8	22.0	15/32	12.0	11/32	8.75			
480-580	1-1/4	31.75	11/16	17.5	1/2	12.5	1280		
250-400	1-7/8	41.4	3/4	19.0	5/8	16.0			
180	2	50.8	7/8	22.0	4/5	20.0	1410	1540	2270
									2740

- Ensure table is set to required height and both table adjustment and table clamps are fastened.



- Set depth stopper if drilling holes to required depth and to prevent drill bit damaging table.
- Remove material or debris from the area that might be ignited by hot swarf.

During Drilling:

- **NEVER** overreach! Never reach around or under the working head, or grab the chuck to stop a drill press. This can result in hand injury or other serious injury should your clothing warp around the spinning drill.
- Don't force drilling. The tool will do the job better and safer at the rate for which it was intended.
- As you get close to breaking through the bottom of the workpiece, reduce pressure and allow the bit to pass through the hole easily.

After Drilling

- Don't touch the drill bit or chips/swarf. The drill bit and swarf are hot immediately after drilling.
- Store drill bits with care. Do not drop them or subject them to excessive heat, cold or humidity.
- Always clean up around the pedestal drill

This piece of equipment is designed to rapidly remove wood or metal from stock by rotating at high speed an abrasive belt or disc. Care should be taken to avoid contact to either abrasive belt or disc with any part of your body.

1.Contact with the belt and disc rotating at high speed can cause serious abrasions requiring medical attention.

2.Eye and hearing injury may occur without the appropriate PPE. Eye wear and hearing protection must be worn when using this equipment.

3 The wearing of gloves are a hazard when using this equipment,

4.Worn or torn belt or disc are a hazard when using this equipment. Always Inspect Belts and disc before use.

5. The wearing of a dust mask is recommended when using this piece of equipment.

1. Keep the surrounding area of the machine well maintained and free of loose materials, such as chips and cut-offs.
2. Always hold the workpiece firmly when sanding.
3. Use clamps or a vise to hold work when practical.
4. Never sand more than one workpiece at a time. Do not stack more than one workpiece on the machine base at a time.
5. 5. Do not sand with the workpiece unsupported. Do not sand pieces of material that are too small to be safely supported.
6. Avoid awkward operations and hand positions where a sudden slip could cause your hand to move into the sanding belt or disc.
7. Avoid kickback by sanding in accordance with directional arrows.
8. Never stand or have any part of your body in line with the path of the workpiece.
9. Machine should never be connected to power supply when you are assembling parts, making adjustments, or when not in use.
10. Never leave tool running unattended.

Belt/Disc Sander safety rules



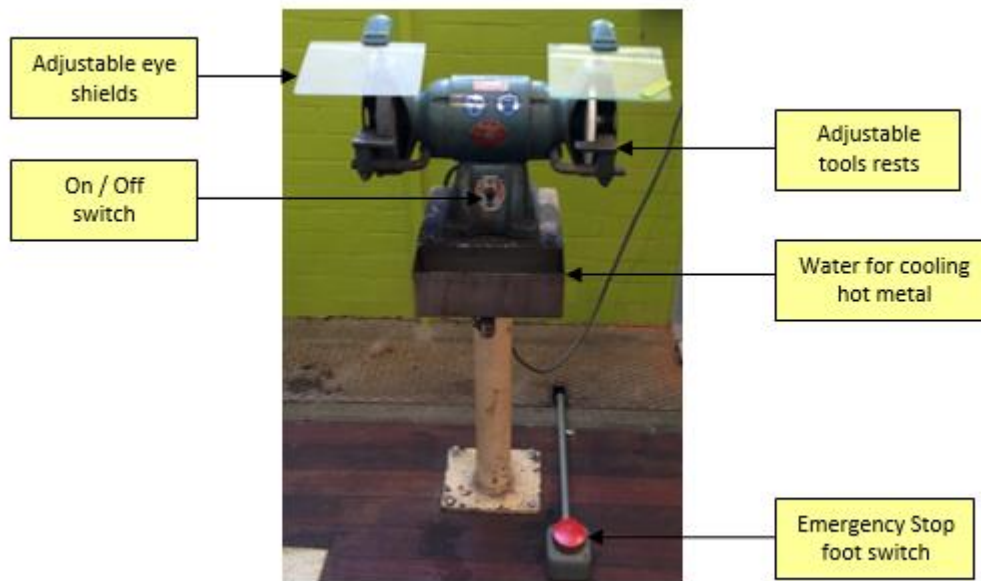


1. 1. Keep the surrounding area of the machine well maintained and free of loose materials, such as chips and cut-offs.
2. 2. Always hold the workpiece firmly when sanding.
3. 3. Use clamps or a vise to hold work when practical.
4. 4. Never sand more than one workpiece at a time. Do not stack more than one workpiece on the machine base at a time.
5. 5. Do not sand with the workpiece unsupported. Do not sand pieces of material that are too small to be safely supported.
6. 6. Avoid awkward operations and hand positions where a sudden slip could cause your hand to move into the sanding belt or disc.
7. 7. Avoid kickback by sanding in accordance with directional arrows.
8. 8. Never stand or have any part of your body in line with the path of the workpiece.
9. 9. Machine should never be connected to power supply when you are assembling parts, making adjustments, or when not in use.
10. 10. Never leave tool running unattended.
11. 11. Eye and hearing protection must be worn when using this equipment.
12. 12. Gloves should not be worn when using this equipment.
13. 13. the wearing of a dust mask is recommended when using this equipment on Wood MDF or other materials which may produce airborne particles.

Intrduction

The bench grinder is used for grinding the edges of flat metals, removing burrs from the ends of tubing or rod, and minor shaping of some metal tools. It is not suitable for grinding heavy sheet metal parts. Good work practices will ensure that bench grinders do not expose workers to hazards.

Bench grinders are one of the most commonly used tools in metal fabrication. Generally they are safe and reliable if care is taken with the grinding wheels. Bench grinder wheels can shatter into **dangerous** projectiles through lack of regular inspection and maintenance or improper use.

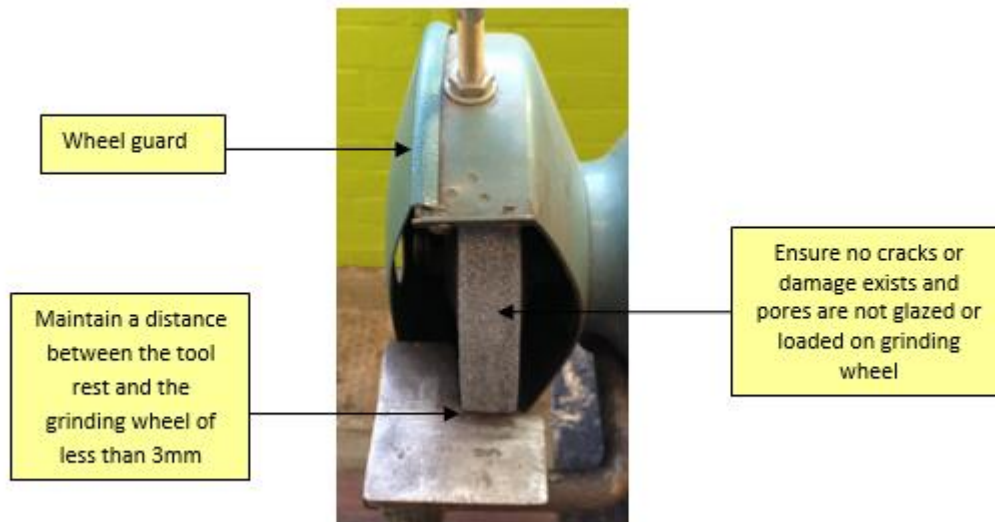


Safety aspects to watch include:

- Wear PPE required when operating bench grinder including safety glasses, hearing protection, closed toed solid footwear and dust mask if grinding materials that produce fumes.
- Long hair, jewellery and loose clothing (especially sleeves) to be secured to prevent entanglement.
- Avoid using grinding wheels designed for steel on materials that will clog the pores between the abrasive particles - for example plastic or aluminium.
- Unless the wheel is "dressed", when pores become blocked or it loses its cutting surface, the operator will have to press harder to achieve the same cutting effect, exerting forces that may cause the wheel to shatter.
- Pressing hard on a dulled wheel surface can produce excessive heat which will cause the bonding material to glaze.
- Never remove guards from a bench grinder. They offer protection in the event of wheel failure, and protect hands and fingers from injury.
- Don't operate the grinder with the wheel guard off.
- Don't use the grinding wheels for cutting purposes.
- Do not overload the grinder.

Before grinding

- Test e-stop before using grinder to ensure it works.
- Check condition of grinding wheel and ask a staff member (technician) to replace cracked or damaged wheels immediately.
- Ensure wheel guards, adjustable shields and tool rests are properly adjusted and in place.



- Adjust distance between wheel and tool rest to maintain 3mm or less separation as the diameter of the wheel decreases with use.
- Ensure grinding wheels rotate freely before switching on power.
- Stand beside the bench grinder when switching on the power, do not stand in front of the grinder.

Truing and dressing the grinding wheel



Grinding wheels, like other cutting tools, require frequent reconditioning of cutting surfaces to perform efficiently. Dressing is the term used to describe the process of cleaning the periphery of grinding wheels. This cleaning breaks away dull abrasive grains and smooths the surface so that there are no grooves. Truing is the term used to describe the removal of material from the cutting face of the wheel so that the resultant surface runs absolutely true to some other surface such as the grinding wheel shaft.

The wheel dresser is used for dressing grinding wheels on bench and grinders. To dress a wheel with this tool, start the grinder and let it come up to speed. Set the wheel dresser on the rest as and bring it in firm contact with the wheel. Move the wheel dresser back and forth across the face of the wheel until the surface is clean and approximately square with the sides of the wheel.

If grinding wheels get out of balance because of out-of-roundness, dressing the wheel will usually remedy the condition. A grinding wheel can get out of balance by being left sitting with part of the wheel immersed in the coolant; if this happens, the wheel should be removed and dried out by baking. If the wheel gets out of balance axially, it probably will not affect the efficiency of the wheel. This unbalance may be remedied simply by removing the wheel and cleaning the shaft spindle and spindle hole in the wheel and the flanges.

Operation

- Use the appropriate grinding wheel for the job: The "SOFT" wheel for hard metals. The "HARD" wheel for soft metals.
- Once the grinder is up to speed, move to the front of the wheel, hold the part firmly onto the tool rest, and move it slowly and gently forward until it comes into contact with the wheel. The grinding wheel removes the metal it contacts. Occasionally dip the part into the water to keep it cool.
- Do not grind wood, plastic, soft alloys (e.g. lead), or similar materials as this would clog the grinding wheels.
- Apply gradually increasing pressure to the part to be ground, which must not be brought into sudden contact with the grinding wheel.
- Do Not Gouge Wheel By Grinding In One Spot
- Some tools (e.g. wood chisels) must not be ground "blue".

Angle Grinder

Hand held angle grinders are one of the most commonly found power tools in the metal fabrication industry.

They have the capacity to be fitted with a variety of cutting attachments which allow the machine to be used for grinding, cutting, sanding and wire brushing operations.

Miller and cutting blades are used extensively in the Aluminium fabrication industry for cutting alloy sections and plate.



These blades when used in conjunction with an angle grinder can be extremely dangerous if they are used incorrectly.

Angle grinders are so named because the disc revolves at right angles to the rotation of the motor. These tools are measured by the maximum diameter of the disc that can be fitted and are available in a variety of sizes, ranging from 100 mm to 225 mm.

Grinding

When fitted with the correct abrasive wheel the angle grinder is a versatile tool which is frequently used in the metal industry.

Common uses include; removal of tacks, gouging welds, producing weld preparations, cleaning and straightening rough cut edges and the rapid removal of excess metal.

Make sure the wheel you chose is suitable for the type of material to be worked, whether it be steel or aluminium or other material. All wheels should have information about the type of material for which they are suitable written on them, as well as an indication of the safe

working speed.



This is stated as maximum revolutions per minute or as a maximum peripheral speed in metres per second.

Visual inspection of the wheel for damage or flaws should be carried out before operating an angle grinder. The bonding fibres should not show any signs of having given away.

Warped or distorted wheels should not be used since this may cause excessive vibration at high speed, side pressure or unequal heating and possibly result in a dangerous wheel breakage.

6.3 - Using a Cut Off Wheel

The cut off disc fitted to an angle grinder is similar in appearance and composition to a grinding disc only thinner, usually 3 mm.

It is designed to be used on the edge to make a narrow straight cut through the material.

The cut off wheel should not be used for grinding as it is not designed for side forces and can flex and break easily. Care must be taken not to twist the disc in the cut.

Other methods of cutting materials should be used where possible in preference to using cut off discs as they do present a significant safety hazard.

Angle grinders used with cutting discs expose workers to a range of severe additional hazards.

Wherever a safer alternative cutting tool is available or can be obtained, an angle grinder should not be used as a cutting tool.

Sanding discs are mounted on a rubber or plastic backing plate attached to an angle grinder. Sanders are used to obtain a smooth surface preparation, the quality of the finish depends upon how coarse or fine the grit is on the disc. In the aluminium fabrication industry a common use for sanders is the removal of surface oxide from the material being welded.



Use grits which are appropriate to the job. For removing dags and large amounts of material use a coarse grit. For finishing work use a fine grit. The coarse grit sanding disc may leave deep gouges in the surface of the plate which could cause fracture when bending. The sander should always be used with two hands and the handle and guard should be fitted properly at all times. This machine should not be converted to left handed. This will lead to the blade rotating away from the body of the machine and it may become difficult to control.

When using a grinder on the edge of material it is best to keep the angle of approach as low as possible and ensure that the direction of cut is running off the edge not into the edge as there is a chance that the disc will tear and break apart during operation.

When using an angle grinder keep the angle of approach as low as possible and ensure direction of cut is running off the edge.

Wire brushing

There is a variety of wire brushing attachments available for use on angle grinding machines.



The wire wheels are usually cup shaped or flat and they are often used for cleaning surfaces of impurities such as paint, oxides etc. Safety precautions for the use of a wire wheel are similar to those required for safe use of sanding discs.

As fitting of the machine guarding is difficult or often inappropriate extra precaution must be taken to avoid injury, to the operator or others nearby, from the small strands of wire which often dislodge and fly from the wheel.

6.6 - HAZARDS

First Aid and workers compensation records indicate that a high percentage of accidents and injuries in the workshop occur while using grinders. Many of these injuries result in lost time/Workers Comp. In most cases the operator loses control of the machine whilst kneeling on the plate or work piece being ground or while holding on to the machine incorrectly.

Angle grinders are one of the most dangerous hand tools in the metals industry

Kickback, where the disc is thrust away from the object it is grinding, can result in severe cuts to hands, arms, head, torso and legs.

Causes of kickback can be pushing the grinder too hard, hitting an object while the disc is spinning or jamming the disc in a cut or groove.

Discs can shatter or explode, sending pieces flying across the workshop. A boilermaker was thrown backwards more than 2 metres when a disc exploded, seriously injuring his hand. Another welder was killed when attempting to use the wrong size cutting disc in an angle grinder, the disc shattered and pieces pierced his chest and abdomen, despite being evacuated by helicopter he died before he reached hospital.

Loss of control in using angle grinders has been found to be due to several causes:

Using the grinder one handed, often with the front handle removed..

Grinding along the edges of a plate or removing weld dags.

Using grinding or sanding discs that are worn or torn.

Inattention and complacency about the hazards associated with this powerful tool.

Like all power tools inexperience and overconfidence are significant factors in a lot of accidents.

Kneeling on the plate or work piece and attempting to grind it.

Incidents can be avoided by observing these rules

Do not use sanders one handed. Ensure front handle is in position.

Ensure discs are in good condition. Replace worn or damaged discs.

Use the correct technique for grinding edges of plate.

Direction of cut should run off the edges at all times.

Do not kneel or stand on the plate or work piece being ground. Squatting is the better option, or work at bench height with the work securely clamped.

Ensure guard is in place and in the correct position.
Do not use without guard.

Start and stop the machine while clear of the work.

The cutting edges work more efficiently and have less tendency to grab when rotating at full speed.

6.7 - Operating Grinding, Sanding and Wire Wheels

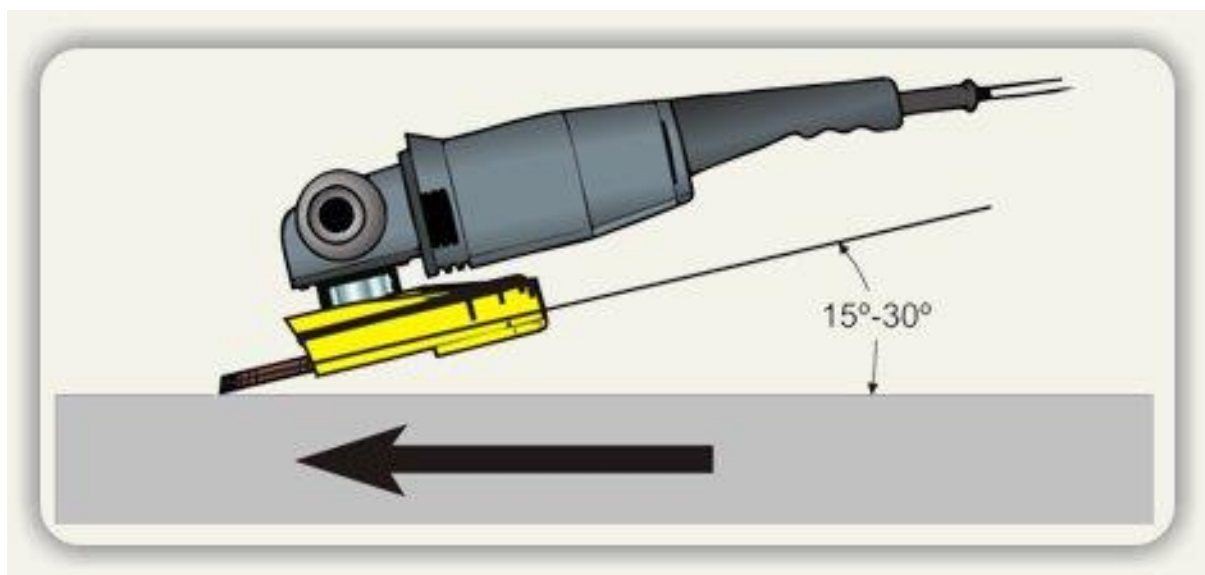
To use a Disc Sander, Grinder or Wire Wheel proceed as follows:

Grip the machine with both hands.

Adopt a well balanced stance and do not over-reach.

Start the machine and allow it to reach full speed before bringing it in contact with the material.

Bring the front section of the disc into contact with the work.



This technique makes control easier, as the disc pulls in one direction only.

Move the machine backward and forward along the length of the material, making each stroke a little further across the width of the required area.

Overlap each stroke slightly.

Keep the grinder moving at all times.

Do not let it rest in one position.

Maintain an even light pressure.

Lift the tool clear of the work before switching it off.

Move the machine backward and forward along the length of the material, making each stroke a little further across the width of the required area.

Overlap each stroke slightly.

Keep the sander moving at all times.

Do not let it rest in one position.

Maintain an even light pressure.

Lift the tool clear of the work before switching it off.

Removing and replacing discs and accessories

When fitting any of the standard attachments to an angle grinder care must be taken to ensure that the attachment is suitable for use on that particular machine.



When grinding and sanding the discs are held in position by a broad, flat flange nut, which fits into a depression in the centre of the pad or disc.

Check that the hole in the centre of the disc is the same diameter as the raised section on the flange or flange nut, the hole size may vary and will lead to the wheel being off centre and the machine will run out of balance and may vibrate uncontrollably when in use.

Do not over tighten the retaining nut; it will tend to tighten itself when the machine is operated due to the rotation of the machine.



While removing and replacing discs, the spindle is held either by a locking button or by a flat spanner provided by the manufacturer.

In the case of grinding and cutting discs the flange nut is removed using the two pinned spanner provided.

Any other method of removing the nut will cause damage which will require the nut to be replaced.



In most cases when replacing sanding discs, once the spindle is locked, the backing disc can be rotated by hand to loosening the nut sufficiently to enable replacement without the use of a spanner.

Introduction



A Cold Saw is used in Design and Technology to:

- Crosscut metal tube, rod, bar and sections to length.
- Cut mitres and bevel cuts.

The saw arm can be swung from side to side to adjust the horizontal angle of the cut.

Cold Saws are multi-purpose circular saws that use a High Speed Steel (HSS) blade that cuts above the material. During the cross cutting operation the metal workpiece to be cut is firmly clamped underneath the blade in a machine vice.

The operator pulls down on a handle to move the blade, which is flooded with cutting fluid, through the workpiece being cut so that the material can be pushed away from the operator.

A Cold Saw's blade is fixed and does not walk or wander.

Cold sawing produces square or perpendicular cuts and minimal or no burns.

Because it is a cold cutting process, cold sawing does not work harden the workpiece, which can be a benefit for a workpiece that requires subsequent finishing with cutting tools.

Cold sawing is suitable for cutting smaller-diameter or thin-walled material that requires tight tolerances.

While some Cold Saws can handle round tube up to 85mm diameter and round solid up to 50mm diameter they are most effective at cutting stock with a maximum OD of 44mm.

7.2 - Hazards

Safety hazards of a cold circular saw

Point of operation

- Contact with the blade may occur
 - Lacerations or amputations from rotating blade

Nip points

- The rotation of the blade means that if something were to be caught then it would be 'wound' down onto the blade or guard very quickly
 - Under no circumstances should an operator bend down near this machine whilst it is operating
 - The operator must be aware of the position of their hands and fingers in relation to the blade at all times.

Flying debris

- Metal swarf can be thrown up into the operators face by the action of the blade.
 - A workpiece can be ejected from the machine after being caught by the blade
 - Broken blade can be ejected from the machine.
 - Certain coolants may cause an allergic reaction in people.

Incidents can be avoided by observing these rules

- This machine has the capacity to break blades when forced into the workpiece.
- Attention must be paid to unusual noises and visual indicators of improper operation.
- Blades must be kept sharp. A blunt blade requires more feeding pressure, which can be dangerous.
- Workpiece must be securely fastened in the work vice. When a mitre or angle cut is to be undertaken the machine is to be set up with the workpiece secured in the vice, which is firmly locked in position. Do not cut 'free hand'.
 - If your work piece is large or heavy, you must use an extended bench to support it.
- The removal of off cuts must only occur when the saw blade is in a safe rest position and has stopped rotating.
 - It is good practice to use a stick rather than hands to remove off cuts.
- Incidents can occur when operators cross their arms during cutting.
 - For example, they pull a workpiece along the backstop, from right to left, using the left hand instead of correctly pushing it along with the right.
 - Avoid reaching across the saw line.
 - Left-handed operators may require specific training.
- Make sure that the saw is fully retracted by positive pressure with the hand at the end of the cutting cycle.
- When loading moving or unloading workpiece ensure that hands do not get near the blade.

7.3 - Safe Operation of the Cold Saw

Safe Operation

1. Check condition of the blade.
2. Ensure all locks are tightened before operating.
3. Ensure workpiece is securely held in workpiece vice.
4. Do not start the machine with the workpiece against the blade.
5. Allow the machine to develop full speed before sawing.
6. Allow the blade to do the work without forcing the saw.
7. The maximum cut must not be exceeded.
8. Do not reach over the blade for any reason.
9. Return the cutting head completely to the top of the saw after each cut.
 - Release the operator switch.
 - Do not remove hand from the operating handle unless the cutting head is completely above the workpiece.
10. Avoid the accumulation of swarf, waste or stock on the machine table or on the floor.
11. Ensure that long and heavy pieces of metal are properly supported.
12. Bring the machine to a complete standstill and isolate the machine from power before cleaning or making adjustments.

Step 2 – Check the Machine

Set the safety guards on the machine before you run it. This will help to protect you from the moving parts of the machine. Check the blade to ensure it is in good condition.

If you spot any signs of damage, ask a staff member to replace it.

Step 3 – Run a Test

Turn on the switch so that you can confirm if the rotation of the saw blade is clockwise. Press the "Emergency Stop Button" to confirm if it works.

Step 4 – Secure the Work Piece

Firmly clamp the metal to be cut in the machine vice. This is located underneath the blade. Check to see that the work piece is not against the blade before you run the machine.

Step 5 – Cutting

Turn on the machine and allow it to attain full speed. To move the blade, you must steadily depress the handle on the machine. Do not force the blade to cut the work piece as the blade may break. When firmly secured in place and set properly, the blade should be able to cut through the metal with ease. Vibrations or unusual noises while the machine is operational indicate it is not being handled properly. Use a stick to remove off cuts to prevent serious cuts to your hands. Do not attempt to remove off cuts while the blade is in motion.

Tips

- Wear safety glasses to protect your eyes from flying chips of metal. You also need some form of protection for the ears due to the extremely high noise levels.
- Avoid loose clothing and jewelry when at work as this can easily get caught in the machine. It is best to contain your hair if it is long.
- A cold saw can produce extremely high noise levels.
- Keep your hands away from the saw blade at all times to prevent serious cuts or amputation.

8.1 - Vertical Band Saw Introduction

Introduction



Introduction to BandSawA bandsaw is a Piece of Machinery which uses a blade consisting of a continuous band of metal with teeth along one edge to cut various workpieces. The band usually rides on two wheels rotating in the same plane, although have three or four wheels. Bandsawing produces uniform cutting action. Bandsaws are used for woodworking, metalworking, or for cutting a variety of other materials, and are particularly useful for cutting irregular or curved shapes, but can also be used to produce straight cuts. The minimum radius of a curve that can be cut on a particular saw is determined by the width of the band.

8.2 - Hazards

- lacerations and or amputations of fingers when working in close proximity to the blade
 - lacerations and or amputations of fingers when operators are distracted while cutting
 - lacerations while changing or fitting the bandsaw blade
- Manual Handling of stock while positioning and cutting of the Material.

8.3 - Safe Operation of the Vertical Band Saw

1. Remove jewellery, secure loose clothing, and confine long hair.
2. Always use personal protective equipment (PPE) proper eye protection.
3. All materials (workpiece) should be inspected for defects such as warps, knots and foreign objects.
4. Keep safety guards in place. Upper guide should clear stock by about 6 mm (1/4").
5. Make curved cuts gradually and use relief cuts for tight radius curves.
 6. Never back out of curved cuts while machine is still running as this will result in the blade coming off. (You must wait until blade comes to a complete stop).
7. Make all cuts on the *waste-side of the line*.
8. Always keep your hands on the sides of the blade while operating.... *never in front of blade!*
9. Maintain a well-balanced position and feed work into blade firmly, but without pushing too hard.
10. Never start the machine with workpiece touching blade, never reach under the table, and never perform layout or setup on the table.
11. Turn machine off and disconnect from power source before installing or removing accessories, when finished cutting, before adjusting or changing set-ups, or when making repairs.
12. If blade breaks during operation immediately stop the saw, leave the workpiece where it is, unplug the saw and report the incident to staff.

Introduction



9.2 - Hazards

Potential hazards

- Sharp edges and burrs
- Crush and pinch points
- Manual handling sheets

Pre-operational safety checks

- Ensure fixed guards are in place to prevent hands or other parts of the body from entering the trapping space.
- Guards or safety devices must never be removed or adjusted, except by an authorized person for maintenance purposes.
- Working parts should be well lubricated and free of rust and dirt.
- The area around the machine must be adequately lit and kept free of materials, which might cause slips or trips.
- Be aware of other personnel in the immediate vicinity and ensure the area is clear before using equipment.
- Familiarise yourself with and check all machine operations and controls.

- Ensure cutting table is clear of scrap and tools.
- Faulty equipment must not be used. Immediately report suspect machinery.

Operational safety checks

- Do not attempt to cut material beyond the capacity of the machine.
- Never attempt to cut rod, strap or wire with this machine.
- Use correct lifting procedures when handling large sheets of material.
- Take extreme care during the initial feeding of the workpiece into the machine.
- The workpiece should always be held sufficiently far back from the edge being fed into the guillotine.
- Ensure fingers and limbs are clear before actuating the guillotine.
- Hold material firmly to prevent inaccurate cutting due to creep.
- When cutting ensure feet are positioned to avoid contact with the foot operated lever.
- Ensure metal to be cut is appropriate size – small pieces are not to be cut on this machine!
- If metal is thick ask for assistance to apply pressure to foot operated lever.
- Always mark accurately where cut is to be made. Use this mark to line up metal accurately to the blade.
- Always keep fingers clear of blade at all times – if you have assistance ensure their fingers are also clear!

Operation

- Appropriate clothing, hair and foot wear is adhered to and appropriate PPE is worn.
- Wear protective gloves while carrying large sheets of copper.
- Have a second person help to carry and cut large material.

Start-up

- Measure and scribe lines to be cut.
- Slide metal between guillotine bed and blade.

In the case of large material:

- Person 1 stands in front of guillotine and person 2 behind guillotine, manoeuvring metal until scribed line is lined up with the blade.
- Both people hold external corners of the plate steady while person one steps on the pedal.

In the case of a small material:

- One person can slide plate between the bed of the guillotine and the blade, and align scribed line with the blade. Then holding front corners of the plate step on the pedal.

When you finish Clean area thoroughly and dispose of all debris/scrap appropriately.

10.1 - Introduction to the SawStop Wood table Saw



SawStop Wood Saw is a bench height table top wood saw used to cut (rip, with the grain and crosscut. across the grain) dressed uniformly shaped flat wood products.

Potential hazards

- Sharp edges and Splinters
- Crush and pinch points
- Manual handling sheets
- High speed saw blade

Pre-operational safety checks

- Ensure fixed guards are in place to prevent hands or other parts of the body from exposure to the cutting blade
- Emergency stop button operates
- Ensure machine is in good operational condition
- Guards or safety devices must never be removed or adjusted, except by an authorized person for maintenance purposes.
- The area around the machine must be adequately lit and kept free of materials, which might cause slips or trips.
- Be aware of other personnel in the immediate vicinity and ensure the area is clear before using equipment.

- Familiarise yourself with and check all machine operations and controls.
- Ensure cutting table is clear of scrap and tools.
- Faulty equipment must not be used. Immediately report suspect machinery.

0.3 - Safe operation of the SawStop Wood Table Saw

Safety

A table saw is a dangerous tool and there are hazards inherent with using this saw. Some of these hazards are discussed below. Use common sense when operating the saw and use the saw only as instructed. ***You are***

responsible for your own safety!

WARNINGS

1. Read and understand the instruction manual and all safety warnings before operating this saw. Failure to follow instructions or heed warnings may result in electric shock, fire, serious personal injury or property damage. Save these instructions and refer to them whenever necessary.
2. WARNING; This product contains one or more chemicals known to the state of California to cause cancer and birth defects or other reproductive harms. In addition, some types of dust created by sawing, power sanding, grinding, drilling, and other construction activities contain chemicals known to cause cancer, birth defects or other reproductive toxicity or harm. Some examples of these chemicals are lead from lead-based paints, crystalline silica from bricks, cement, and other masonry products, and arsenic and chromium from chemically treated lumber. In addition, wood dust has been listed as a known human carcinogen by the U.S. government. The risk from exposure to these chemicals and to dust varies depending on how often you do this type of work. To reduce your exposure, work in a well ventilated area and work with approved safety equipment including dust masks or respirators designed to filter out such dust and chemicals.
3. THIS SAW MUST BE CONNECTED TO A GROUNDED WIRING SYSTEM or to a system having an equipment-grounding conductor. In the event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. Improper connection of the equipment-grounding conductor

can result in a risk of electric shock and/or malfunction. Check with a qualified electrician or service personnel if the grounding instructions are not completely understood or if in doubt as to whether the tool is properly grounded.

4. Pay particular attention to instructions on reducing the risk of kickback. Kickback occurs when a work piece contacts the downstream edge of the blade as it is being cut and is propelled back towards the user at a high velocity.
5. Keep guards in place and in working order. Use a blade guard and spreader for every operation for which it can be used, including all through-sawing. Use a push-stick when required.
6. Remove adjusting keys and wrenches from the saw before turning it on.
7. Keep the top of the saw clean and free from clutter. Cluttered areas invite accidents.
8. Do not use the saw in dangerous environments. For example, do not use the saw in damp or wet locations or expose it to rain; and keep the work area well lighted.
9. KEEP CHILDREN AWAY from the saw. All visitors should be kept at a safe distance from the work area. Make the workshop kid-proof with padlocks, master switches, or by removing starter keys.
10. Do not try to force the saw to do something it was not designed to do. For example, do not try to cut wood faster than the motor can handle, and use the right blade for the job. Use the right blade for the job.
11. Wear proper apparel when using the saw. Do not wear loose clothing, gloves, neckties, rings, bracelets, or other jewelry which may get caught in moving parts. Non-slip footwear is recommended. Wear a protective hair covering to contain long hair.
12. Always wear safety glasses when using the saw. Also use a face or dust mask if the cutting operation is dusty. Everyday eyeglasses are not safety glasses.
13. Keep hands out of the line of the saw blade. Never reach around or over the saw blade. Keep proper footing and balance at all times.
14. Maintain the saw as specified in this manual. Use only identical replacement parts when servicing the saw.
15. Turn the power disconnect switch to OFF before servicing the saw and when changing components or accessories such as blades, brake cartridges, and the like.
16. Use only recommended accessories with the saw. Consult this manual for recommended accessories. The use of improper accessories may cause risk of injury to persons.
17. Never stand on the saw. Serious injury could occur if the saw is tipped or if the cutting tool is unintentionally contacted.

18. Check to make sure the saw is in proper working order before using the saw. For example, check the alignment of moving parts, look to see whether moving parts are binding or rubbing, check to see whether parts are broken, make sure accessories are properly mounted in the saw, and check any other conditions that may affect the operation of the saw. A guard or other part that is damaged should be properly repaired or replaced.
19. Feed work into the blade or cutter against the direction of rotation of the blade or cutter only. Feeding the work in the direction of rotation may cause the work to be thrown by the blade and could result in serious personal injury.
20. Never leave the saw running unattended. Wait until the blade comes to a complete stop, and then turn both the Main Power switch and the Disconnect switch to OFF when you are finished using the saw.
21. You must install a rip fence before using this saw. Attempting to use the saw without a rip fence could result in a serious personal injury.
22. Always maintain firm control over the material being cut. Never cut any material freehand.
23. Never operate the saw with the access doors open. Do not attempt to bypass or defeat the access door interlock switches.
24. Secure your work. Use clamps or a vise to hold work when practical. It's safer than using your hand and it frees both hands to operate the saw.
25. Do not perform any operation freehand. Freehand means not using a fence (for rip cuts) or a miter gauge (for cross-cuts) to guide the work piece as it is being cut. Always maintain firm control over the material being cut.

!

WARNING

For your own safety,
read the instruction manual before operating this saw.

1. Wear eye protection.
2. Use the blade guard and spreader for every operation for which it can be used, including all sawing.
3. Keep hands out of the line of the saw blade.

when required.

reduce the risk of kickback.

any operation freehand.

around or over the saw blade.

fire the brake system.

position of the brake cartridge while the blade is spinning.

disable the brake system.

before changing the blade, changing the brake cartridge or servicing.

the motor directly to a power supply.

switch only when necessary.

to rain or use in damp locations.

4. Use a push-stick

5. Know how to

6. Do not perform

7. Never reach

8. Never try to test

9. Never adjust the

10. Do not try to

11. Unplug the saw

12. Do not connect

13. Use the bypass

14. Do not expose

10.4 -The SawStop Safety System

The SawStop Safety System

This table saw is equipped with the SawStop® safety system. This revolutionary technology was developed to reduce the potential for a serious injury in the event of accidental contact with the saw blade. SawStop® table saws are the first saws ever built to be smart enough to know the difference between you and the wood you are cutting.

The SawStop® safety system includes two components, an electronic detection unit and a fast-acting brake. The electronic detection unit detects when a person contacts the blade. A small electrical

signal is induced onto the blade by electrodes placed around the arbor. Although this low voltage, high frequency signal is too small to feel, it can be measured by the detection system. When human skin comes into contact with the blade (or arbor), a portion of the signal is absorbed by the body due to the inherent electrical capacitance of the human body. As a result, the signal on the blade gets smaller and the detection unit recognizes this as contact.

Wood and other non-conductive materials such as plastic, foam, cardboard, Corian®, melamine, etc., do not cause a drop in the signal because those materials do not absorb the signal on the blade. Conductive materials such as aluminum and other metals, carbon fiber materials, mirrored acrylic, carbon-filled materials, etc., will typically cause the brake to activate. If you need to cut these conductive materials, the safety system can be placed in "Bypass" mode to temporarily disable the brake. (See page 33 for instructions on how to use the saw in Bypass mode.)

The fast-acting brake includes a small fuse that holds a strong spring in compression. If the electronic detection unit detects contact while the blade is spinning (including during coast down), the fuse is burned by a surge of electric current. The spring then pushes an aluminum brake into the teeth of the spinning blade. The teeth cut into the brake, stopping the blade. The total time between the detection of contact and stopping the blade is just a few milliseconds. If the brake is activated while the blade is at or near full speed, the blade will also quickly retract below the table. The system will not activate the brake when the blade is stopped—even if you spin the blade by hand. This allows you to touch or change the blade when the motor is off just as with ordinary table saws. However, for safety, always switch the Main Power and Disconnect switches to OFF when changing the blade.

The SawStop® safety system is active whenever the Main Power is on. The

safety system continuously performs many different self-checks to ensure that the components of the system are operating properly. If any problems are detected, the safety system will disable the motor and display a system status code to identify the problem (see page 30 for a description of the system status codes and the corrective action). If the problem is detected while the motor is spinning, the motor will be shut off. The safety system will not allow the motor to be started, even in Bypass mode, as long as a problem is detected.

The electronic detection unit and fast-acting brake are contained in the “brake cartridge,” which is positioned under the table and just behind the blade (see Fig. 1). The brake cartridge must be correctly installed before the motor can be started (see page 41 for instructions on removing/installing the brake cartridge). In the event that the brake is activated, a new brake cartridge must be installed before the saw can be used again.

The SawStop Safety System

The SawStop® safety system does not interfere with your use of the table saw in any way. You can still make all the cuts that you can with ordinary saws including 0° to 45° bevels, non-through cuts, and dado cuts (with the optional dado brake cartridge—sold separately). Furthermore, no special blades or other accessories are required. Any standard 10 inch saw blade or 8 inch dado set is compatible with your SawStop® saw.

Although your SawStop® saw operates similar to ordinary table saws, there are a few important points to keep in mind as you use the saw.

1. Do not rely on the SawStop® safety system to protect against unsafe operation. Although the system is designed to react and stop the blade very quickly in the event of accidental contact, it cannot react until contact is detected. This means that you may receive at least a minor injury

even with the SawStop® safety system. Therefore, always use safe operating practices, and use the blade guard, push stick and other safety devices whenever possible. The SawStop® safety system, like the airbag in a car, should be considered as a last measure to minimize injury when all other safety practices and devices have failed to prevent an accident.

2. Do not operate the saw in Bypass mode unless you are cutting electrically conductive material.

When Bypass mode is engaged, the SawStop® safety system will not activate the brake if contact is detected and a serious injury could result if you contact the blade.

3. Do not use non-conductive blades, including abrasive blades, blades with plastic hubs, or blades that have non-conductive teeth. The safety system cannot induce the electrical signal onto a non-conductive blade, and blades with non-conductive teeth may prevent the system from detecting contact. Only standard steel blades with either steel or carbide teeth should be used.

4. Do not use saw blades or dado sets that have a lacquer or other coating on the teeth. These coatings are non-conductive and therefore can reduce the speed at which the system detects contact.

In other words, a coated tooth must cut slightly deeper into the skin for contact to be detected, resulting in a somewhat more serious injury. Used blades that originally had a lacquer coating are OK to use since the coating is worn away within a few uses. However, SawStop recommends that you examine each tooth on such blades to confirm that no lacquer remains. If you decide to use a new blade that has lacquer on the teeth, be especially carefully during the first several uses.

5. In the event of contact, the blade will be stopped in about 3–5 milliseconds (coarse toothed blades stop more quickly than fine-toothed blades such as plywood blades). Therefore, the seriousness of the injury incurred will depend on the speed at which a person's hand or other body part is moving in toward the blade. For example, if a person's hand is moving

toward the blade at 1 ft./sec., then the depth of the cut will be approximately 1/ 16 inch (1 ft./sec. * 0.005 sec. = 0.005 ft. or 1/ 16 inch). At faster speeds, the cut will be proportionally deeper. Therefore, it is possible to be very seriously injured even with the SawStop® safety system.

6. Never use a blade with damaged or missing teeth as this can result in a more serious injury or a false activation of the brake. Blades with variable spacing between teeth are compatible with the SawStop® safety system, however you must ensure the brake is positioned correctly by rotating the blade at least one full revolution to be certain that none of the teeth touch the brake (see page 18 for more information on setting the brake position).

7. Never attempt to use a blade other than a single 10 inch blade with the standard SawStop® brake cartridge. Never attempt to use a dado set or blade other than an 8 inch dado set with the SawStop® dado cartridge. The use of smaller diameter blades with a brake cartridge designed for larger blades could result in a serious injury because the brake cannot be positioned correctly to stop the smaller blades.

8. Do not use molding heads. The use of molding heads could result in a serious injury because neither the standard brake cartridge nor the dado brake cartridge is designed to stop a molding head.

9. Never install the blade backwards. The brake might not stop a blade that is installed backwards, therefore you may receive a serious injury.

10. Blades with depth-limiting shoulders may take longer to stop in the event of an accident than standard blades, and you could receive a more serious injury. Therefore, SawStop recommends using blades without depth- limiting shoulders.

11. Never install two or more 10 inch blades together. The safety system is not designed to stop

multiple stacked 10 inch blades and a serious injury may result.

12. Never stack dado blades thicker than 13/ 16 inch. The 8 inch dado brake cartridge is not designed to stop dado stacks thicker than 13/ 16 inch and a serious injury may result.

13. The motor cannot be started without a blade installed. Since the safety system disables the motor if the blade is spaced too far from the brake, a missing blade will be detected as a blade-to-brake spacing error and the motor will be disabled.

14. Do not use table inserts, guards, fences or other devices which have metal parts that may come into contact with the blade. Any metal part that contacts the blade may cause the brake to activate. All SawStop® accessories are specifically designed to prevent metal contact with the blade.

15. Do not disconnect or turn off electrical power to the saw before the blade has stopped spinning. If electrical power is interrupted while the blade is moving, the safety system will not be active and therefore the brake will not activate in the event of accidental contact. You may receive a serious injury if you contact the spinning blade while the electrical power is interrupted.

16. Do not replace the arbor belt with a non-SawStop® belt. The SawStop® arbor belt is designed to dissipate static electricity that may build up on the spinning blade which could cause a false activation of the brake.

17. Never reach under the blade while it is spinning. In the event the brake is activated, the retraction of the blade may cause a very serious injury if you contact the bottom of the blade.

18. Never touch the arbor, arbor pulley, arbor nut or arbor washer when the blade is spinning because you may receive a serious injury. These parts are all electrically

coupled to the blade and
the brake will activate if contact with these parts is detected.

19. Never attempt to disable the SawStop® safety system or modify the electrical wiring of the saw in any way. Any change or modification or disablement of the safety system or other wiring could result in a serious injury and will void all warranties.

20. Never attempt to repair, adjust, modify or otherwise service a brake cartridge. There are no user-servicable parts inside the brake cartridge. The brake cartridge is permanently sealed against dust and other contaminants— destruction, removal, or alteration of this seal voids all warranties.

21. Wet, pressure-treated wood may cause the brake to activate. The chemicals used to pressure treat wood often contain large amounts of copper, which is conductive. When pressure-treated wood is wet, the combination of copper and water substantially increase the conductivity of the wood. Therefore, allow wet pressure-treated wood to fully dry before cutting. Typically, the wood will be sufficiently dry if left unstacked in a dry location for 24 hours. If you must cut wet pressure-treated wood, you can make several cuts in the wettest piece(s) using Bypass Mode to test whether the wood is too wet. See pages 32 and 33 for instructions on testing the conductivity of a material using Bypass Mode. If the test indicates the brake will activate if the system is not in Bypass Mode, you must either allow the wood to dry or make the remaining cuts in Bypass Mode.

