

# Surtech



## Easy Guide Ancillaries for Belt Grinders and Polishing Machines



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## INTRODUCTION

This section contains details of equipment that is either essential or optional for our grinding, deburring and polishing machines.

The ancillary equipment facilitates or improves the operation of our machines.

Many of the items are difficult to source but SURTECH can supply most from stock and all within a short delivery period.

## SHAFTS & SPINDLES FOR BENCH AND PEDESTAL MACHINES AND POWER TOOLS

### Tapered spindles



The most common shaft for a polishing machine is the tapered spindle shown above.

It has a threaded internal bore to match the external thread of the motor shaft.

There are many different thread sizes, spindle diameters and lengths to suit the many machines models.

We can make tapered spindles to fit your machine and to suit your requirements



This short tapered spindle is used on flexible shaft machines and on portable polishing machines.



A small diameter tapered spindle to fit a machine with either a collet or chuck. For use with small diameter mops.



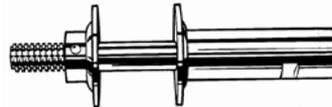
A special design tapered spindle with a slotted plastic insert to work with all wheels with a 25mm bore.

Push the plastic insert into the 25mm bore of the wheel and then screw on to the tapered spindle until the tip of the spindle exits.

The taper will expand the plastic insert and secure the wheel.

For use on machines with a collet or chuck.

### Parallel spindles

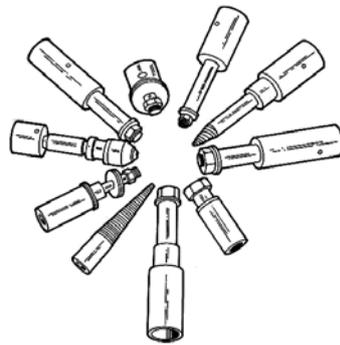


Parallel spindle for bench and pedestal polishing machines

The parallel spindle has an internal threaded bore which fits the external threaded bore of the motor shaft.

For use with finishing wheels, buffs and contact wheels. Wheels and buffs are held in place by a clamping plate on each side forced together by tightening the nut on the end of the spindle.

Fit spacers if necessary.



Parallel and tapered spindles for bench machines. With internal threaded bore.

There are nearly as many different spindles as there are abrasive wheels and brushes and machines. We have about a dozen standard designs in stock and we can make any size spindle to order.



Parallel spindles for use with portable power tools.

With internal threaded bores. Vast range to suit all machines and all consumables.

Many standard sizes in stock. Others made to order.



Two sizes of keywayed parallel spindles for use with abrasive wheels 100mm dia x 50mm or 100mm wide.

With internal threaded bores.



Parallel spindle with side plates. For use on machines with a collet or chuck.

## MANDRELS

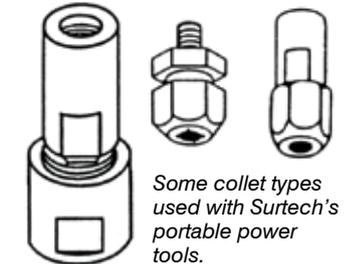


Mandrels for use on tube notchers. Available in various designs, widths and diameters. With bearings on each end.

There are no standard sizes for these mandrels. They are made up to individual requirements.

We can make any notcher mandrel to order.

## COLLETS FOR PORTABLE ABRASIVE POWER TOOLS



Some collet types used with Surtech's portable power tools.

Collets come in hundreds of designs, sizes and for our industry with metric inserts from 3mm to 12mm or imperial size inserts from 1/8" to 1/2".

Collets are used with shaft mounted abrasive tools and shaft mounted polishing tools as well as rotary files, burrs and mounted points.

Collets are almost exclusively used with portable power tools.



An extension collet to extend the reach of the abrasive tool. Extensions of 50mm and 75mm are available.

Extension collets must be run no faster than approx. 6000rpm otherwise there is the danger of whiplash or even breaking.

## CHUCKS



A special design shaft with threaded internal bore on one end and chuck on the other end.

For use on a dedicated multipurpose, variable speed bench grinder/polisher



A bench grinder/polisher with a chuck fitted.

## TOOL HOLDERS FOR MINI ABRASIVE DISCS

from approx. 25mm to approx. 75mm dia.



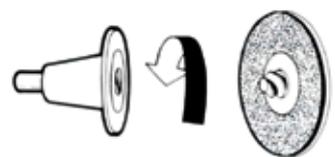
Back up pads for cloth and nylon abrasive discs.

With M14 internal threaded bore to fit straight on to the M14 threaded shaft of the machine.

Pads shown in the above photo are for "twist on" discs.



Shaft mounted back up pads. For "twist on" discs.



Principle of twist on method, the most popular system of fixing discs to back up pads



The "click on" method of fixing discs to back up pads

Because there are several competing methods of fixing discs to back up pads (We have only shown two above) and there are several ways of mounting the back up pads on to the machine we have ended up with dozens of pad designs and sizes.

These mini discs, from approx. 25mm dia to approx. 75mm dia are almost exclusively used on portable power tools.

You can either try to match the power tool to the disc or match the disc to the power tool.

We can supply any pad design and size and we can also supply power tools specially designed and with speed controls for use with mini discs.

## TOOL HOLDERS FOR MINI WHEELS



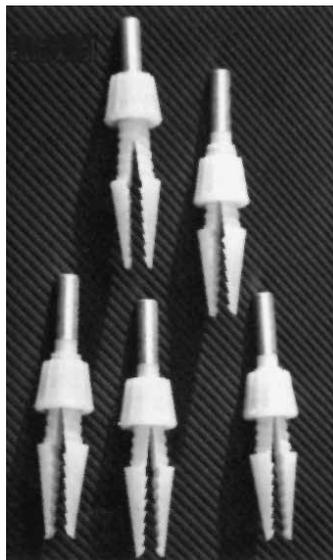
The tool holder system for wheels is very similar to that of the "twist on" disc but with an additional locating tab to make sure the wheel runs true.

## TOOL HOLDERS FOR ABRASIVE BRUSHES



Brushes come in many sizes and with different bores. There are tool holders for all models.

## TOOL HOLDERS FOR SPECIALITY ABRASIVES

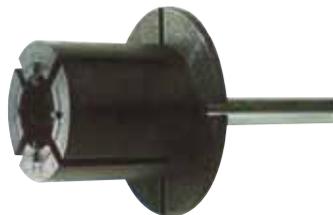


Crocodile holders to fit collets or chucks.



A crocodile holder mounted on a portable tool with collet and equipped with a piece of abrasive impregnated nylon.

## SHAFT MOUNTED EXPANDING TOOL HOLDER



These holders are designed for abrasive wheels.

The wheel must have the correct bore size for the diameter of the boss of the holder.

The boss expands with speed and holds the wheel safely in place.

## SHAFT FOR MOUNTING ABRASIVE CARTRIDGES



The dedicated tapered spindle for abrasive cartridge wheel has a threaded front end and a locating section to hold the abrasive cartridge safely in place.

For use with portable power tools fitted with collet or chuck.



An abrasive cartridge wheel mounted on a dedicated tapered spindle and fitted to a machine with chuck.

## HIGH SPEED SHAFTS



A unique shaft which can be run up to 14000 rpm on variable speed machines. Only 19mm dia and with a collet.



Our variable speed machine with the high speed shaft.



## IDLER WHEELS, DRIVE WHEELS AND CONTACT WHEELS

To get a belt to track accurately it is important that drive wheels, idler wheels and contact wheels are in the right condition and in the right position.

Contact wheels normally have a flat face with both edges slightly radiused to keep the belt tracking accurately.

The centrifugal force makes the edges expand more than the centre of the contact wheel and if the edges were not radiused the belt would run off centre either to the right or the left.

A sure sign of wrong alignment or wrong tracking setting shows up when the belt jumps suddenly from one position to another.

If the contact wheel edges have been lightly radiused and the belt still does not track properly you need to check if the idler wheel and the drive wheel are crowned. Once the crown is worn abrasive belt tracking will get increasingly difficult.



Idler wheels can be steel, aluminium or rubber coated steel or aluminium.

## CONTACT WHEELS

### INTRODUCTION

#### The importance of contact wheel selection

Next to the abrasive belt, correct choice of the Contact Wheel is the most important factor affecting performance of belt grinding, deburring and polishing operations.

SURTECH contact wheels are designed to maximise abrasive belt performance. Worn contact wheels and the use of the wrong contact wheel type reduce abrasive belt efficiency and affects abrasive belt tracking.

#### Finishing

A soft, 45 shore contact wheel, with 2: 1 land to groove ratios and rectangular tapered lands. For J and Flex weight abrasive belts in grits from 120 to 400. For fine finishing with little stock removal.

#### General Purpose Grinding And Finishing

A medium hard, 65 to 70 shore contact wheel, with 1: 2 land to groove ratios and rectangular square lands.

For all grades of abrasive belts and all operations requiring aggressive cutting action and an even finish.

#### High Stock Removal

A hard, 85 to 90 shore contact wheel, with buttressed lands. (1: 2 land to groove ratio).

For X and Y weight abrasive belts in course grits from 36 to 80. For high stock removal and maximum aggression.

For grinding to close tolerances.

This wheel must be run in one direction only - see drawing.



### Contact wheels - Some rules of thumb

A small diameter contact wheel removes more stock than a large diameter contact wheel. A large diameter contact wheel produces a finer finish than a small diameter contact wheel.

Small diameter contact wheels produce shorter scratch patterns than large diameter contact wheels.

Shorter scratch patterns are easier to buff than long ones.

The harder the contact wheel the higher the stock removal. Softer contact wheels produce finer finishes than harder contact wheels.

Serrated contact wheels are more aggressive than smooth contact wheels. Varying the land to groove ratio of serrations can increase effective contact pressures by more than 100 %.

### Contact area and finish

The harder the contact wheel, the faster the cut and the coarser the finish.

The smaller the contact wheel diameter, the faster the cut and the coarser the finish.

Finish and rate of cut usually go hand in hand. Coarser finishes are achieved at a high rate of cut and the fine finishes at a lower rate of cut.

High speeds give better finishes. Serrated contact wheels retard glazing of abrasive belts and prolong belt life.

### Contact wheel sizes

Contact wheels for manual abrasive belt grinding are available from 12mm to 450mm diameter.

Some portable abrasive belt grinders use contact wheels down to 12mm diameter and 12mm wide.

Contact wheels on Power Grinders can be up to 600mm in diameter.

The narrowest abrasive belt of 3 mm width and running on a tapered contact wheel 25mm diameter and approx. 1mm wide can be used on a portable abrasive belt file. The widest abrasive belt can be over 2000mm wide running on contact wheels of the same width as the belt.

The majority of contact wheels have a rubber tyre, but contact wheels are also available with canvas, leather, plastics, polyurethane and foam tyres. In some special cases contact wheels can be made of steel for max. abrasive belt aggressiveness. Some portable tool contact arms have steel contact wheels, however, these are not meant as contact wheels but rather as idlers. Work is supposed to be carried out on the slack of the belt or the platen.

Contact wheel hardness is expressed in shore or durometer. Shore hardness alone is not the correct measure for contact wheel hardness. A 60 shore contact wheel with smooth (plain) surface is less aggressive than a 60 shore serrated contact wheel. A 30 shore serrated contact wheel is softer than a 30 shore smooth contact wheel.

### Contact wheels, plain and with serrations

Contact wheels are available plain or in dozens of different serrations. We have standardised serrations and shore hardness to give you the best abrasive belt performance in over 80 % of all applications.

#### 1. Plain face

#### 2. 2:1 land to groove ratio for contact wheels from 30 to 50 shore

Use with abrasive belts J and J-flex in grit sizes 120 to 400.

For fine finishing with little stock removal.

#### 3. 1:1 land to groove ratio for contact wheels from 60 to 75 shore

For general purpose grinding and finishing.

For all grades and all grits of abrasive belts. For all operations requiring an aggressive cutting action and an even finish.

#### 4. 2:1 land to groove ratio for contact wheels from 70 shore to 90 shore

For aggressive grinding where high stock removal rates are

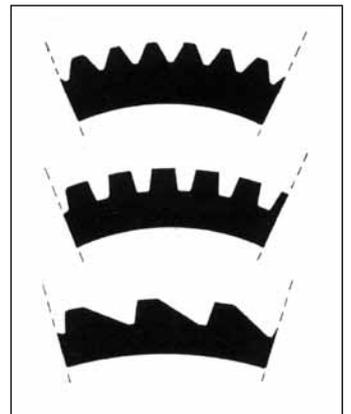
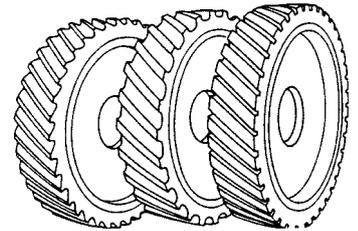
more important than finish. One

of the most aggressive contact wheel construction that still keeps well within vibration limits.

#### 5. Buttress tooth formation

For contact wheels from 75 to 95 shore.

For many operations the most aggressive contact wheel construction that still keeps within vibration limits. For aggressive grinding with coarse belts Y weight and X weight from grit 36 to 60.



## Contact wheel hardness

### Expressed in shore or durometer

- 20 - 35 shore** Very soft. For highly contoured parts. Use only with J-flex belts in fine grits from 180 to 400.
- 40 - 55 shore** Soft. Can easily be depressed by thumb. For slightly contoured parts or for fine finishing of flat parts.. Use with j-flex or flex belts from grit 120 to 400.
- 60 - 75 shore** Medium. Can be depressed with finger nail. The most popular contact wheel hardness. For general purpose grinding of most parts and with all abrasive belt types, grades and grits.
- 80 - 95 shore** Hard, cannot be dented by finger nail. For aggressive grinding of flat parts with coarse abrasive belts in grits 36 to 80 and in x and Y weight.

Choose the hardest possible wheel to suit the shape of the part. Harder wheels make the abrasive belt work more aggressively and prolong belt life.

Contact wheels must not be run at a surface speed in excess of 45 m/sec. The surface speed is determined by the drive wheel. There are two ways to establish the speed:

#### A. When the contact wheel is also the drive wheel:

Check the rev/min of the drive spindle. Read off the surface speed under the dia. of the contact wheel.

#### Examples:

- a) A typical drive spindle running at 2800 rev/min and fitted with a contact wheel of 250mm diameter results in a surface speed of 36.6 m/sec. – acceptable for most grinding operations.
- b) A drive spindle running at 1400 rev/min and fitted with a 200mm diameter contact wheel has a surface speed of 14.7 m/sec. - too slow for most grinding operations.
- c) A drive spindle running at 2800 rev/min and fitted with a 350mm contact wheel results in a surface speed of 51.3 m/sec – well above the recommended speed and dangerous.

#### B. When the drive wheel is not the contact wheel:

Follow the above recommendations but use the diameter of the drive wheel not the contact wheel for calculating the surface speed.

## Table of Surface Speeds

Diameter of contact wheel in mm	150	200	250
at 900 rpm	7	9	12
1200 rpm	9	13	16
1400 rpm	11	15	18
1800 rpm	14	19	24
2400 rpm	19	25	31
2800 rpm	22	29	37

The above recommendations concern safe operating speeds only. Speeds in excess of 45 m/sec are unsafe. Our contact wheels are tested to 45 m/sec and under no circumstance must they be used in excess of this speed.

The recommended economical cutting speeds are determined by the type of abrasive belt and the material being ground. They are quite different from the max. safe speeds.

## CONTACT WHEEL TYPES

### TYPE GL



A contact wheel with a smooth (plain) rubber tyre, otherwise the same as GS.

Recommended for medium to fine finishing with abrasive belts grit 120 and finer. The smooth tyre reduces belt life.

### TYPE GS



The most widely used contact wheel. Same tyre as GL but serrated to prolong belt life. Available in 40, 60 and 80 shore hardness as standard.

Available in 30, 70, 90 shore hardness to order.

From 100mm dia to 450mm dia. From 25mm wide to 150mm wide.

### TYPE CTP/1



Similar to Type GS but with the much harder wearing polyurethane tyre. More expensive than rubber tyred contact wheels. With a solid polyurethane tyre.

Available in 40, 60, 70, 80 and 90 shore hardness. From 100mm to 450mm dia. From 25mm wide to 150mm wide.

We recommend the use of polyurethane wheels with 90 shore hardness in preference to rubber wheels for all grinding operations requiring an aggressive, long lasting wheel used with abrasive belts grit 36 to 60.

### TYPE VLS



This is the best contact wheel for finishing non ferrous metals and parts with a contoured surface. Widely used on manual and automatic machines as well as in robots cells.

With a polyurethane foam tyre which conforms well and improves abrasive belt performance.

Leaves a smooth, shadow free finish. The polyurethane foam tyre transmits vibrations considerably less than a rubber tyre.

Not suitable for heavy duty grinding as the polyurethane foam tyre is heat sensitive.

Available in shore hardness 25, 35 and 45. Available from 100mm to 450mm dia. Available from 30mm to 150mm wide.



**Gritty says . . .**

*Hardness of contact wheels is not the only criteria for good belt performance. The design of the contact wheel serrations are equally important.*

## TYPE PS



This is our softest contact wheel. Available in 20, 40, and 50 shore.

Consists of alternating flaps of sponge rubber and canvas.

Conforms well even to extreme contours when used with j-flex abrasive belts.

Benefits from variable speeds. Softer when run at low speeds up to 1400 rpm. Harder when run at fast speeds over 1400 rpm.

From 250mm to 500mm dia, from 30mm to 150mm wide

## TYPE RE



An expanding rubber wheel which allows you to turn a polishing machine without belt arm into an abrasive belt grinder.

The abrasive belt, also called sleeve, is held in position by the rubber tyre which expands with speed.

From 75mm to 200mm dia. From 38mm to 150mm wide. Shore hardness 40.



*An expanding rubber contact wheel with an abrasive belt fitted. For more detailed information see page...*



*A pneumatic contact wheel without abrasive belt.*

A pneumatic tyre with an aluminium hub. Available in many sizes. The tyre can be inflated to the required hardness.

The aluminium hub comes with a bore suitable for the machine.

Most popular with the ROTO-SAT type of portable abrasive power tool but also suitable for some bench and pedestal machines. bench

For more detailed information see page ...

## DEDICATED CONTACT WHEELS

We can offer a range of over 10 different types of contact wheels with canvas, foam and tyres from 20 shore to 95 shore hardness.

We can also offer pre-shaped contact wheels with convex or concave tyres.

All of these contact wheels are made to order and can have fairly long delivery times.

## CONTACT WHEELS FOR ROBOT GRINDING AND LINISHING CELLS



Contact wheels used with robot grinding and linishing cells are very similar to those used for manuals abrasive belt grinding and yet differ in some important details.

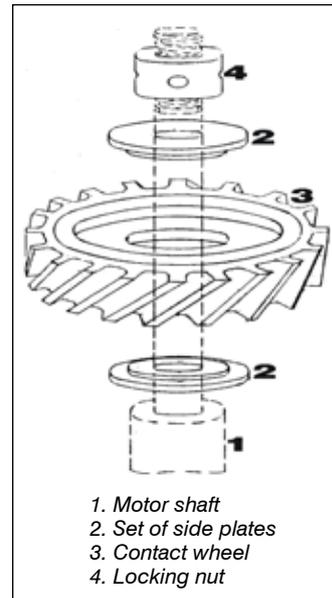
Professionally designed and built robot cells usually have sophisticated constant contact pressure controls. Robots can assert greater contact pressures than human operators, evenly and at all times. Robots do not suffer from "white finger disease"

Robots can often use an abrasive belt of one grit size coarser than that used by an operator. Therefore contact wheels for robot linishing cells are of a slightly different design and slightly harder shore hardness but with dramatically improved results.

Contact wheels for robot cells are designed to suit individual requirements. Surtech can advise on the best specification and can supply contact wheels in accordance with these specifications.

## THE SURTECH CONTACT WHEEL MOUNTING SYSTEM

For wheels from 150mm to 450mm dia.

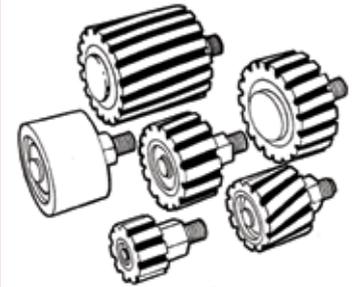
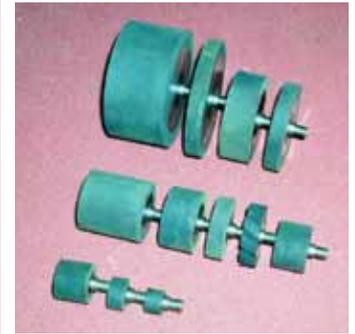


SURTECH contact wheels have a standard 65mm centre bore into which the side plates are fitted.

The side plates are then bored out to fit the motor shaft. The locking nut locks everything together.

This system allows us to supply most contact wheels from stock.

## Shaft mounted contact wheels MINI CONTACT WHEELS



Mini contact wheels are available from approx. 20mm dia to 100mm dia and from approx 6mm to 75mm wide.



There are two designs:

### 1. Metric sizes

With M8 threaded shaft and hexagonal nut to fasten. Available from 20mm to 100mm dia and from 15mm to 50mm wide.

We recommend shore hardness 50. Because of the hexagonal part the shaft on these contact wheels is considerable longer than the impe



### 2. Imperial sizes

With threaded shaft and internal hexagonal bore to fasten.

Imperial size mini contact wheels are narrower than the metric wheels. Available from 3/4" to 4" dia and from 1/2" to 3" wide. We recommend shore hardness 50.

## CONTACT ARM ASSEMBLIES



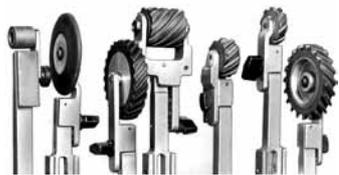
A simple contact arm assembly for metric mini contact wheels  
For use on special bench and pedestal machines.



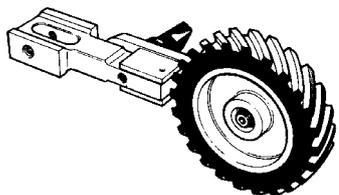
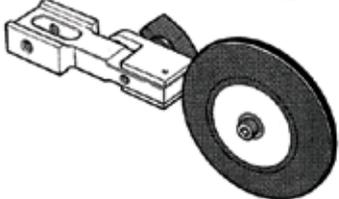
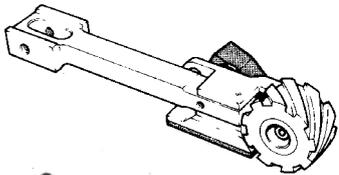
Contact arm assemblies with imperial size mini contact wheels and built in belt tracking controls.  
For use on special bench and pedestal machines.



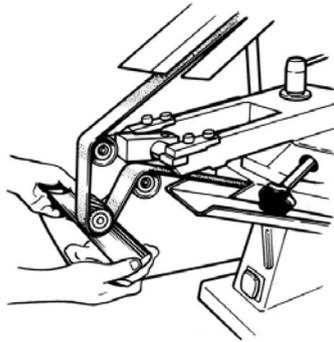
A special contact arm assembly with extended reach.  
Designed for a dedicated pedestal machine.



A selection of contact arm assemblies. Primarily for use with belt files but can also be adapted for use with bench or pedestal machines.



Contact arms complete with contact wheel assemblies



A typical traditional backstand idler with belt tensioning and tracking controls.

Abrasive belt grinding machines have a minimum of two wheels and a maximum of 4 wheels.

With two wheel machines one is the drive wheel and one is the idler wheel.

Depending on the machine design either the drive wheel or the idler wheel is the contact wheel.

With three wheel machines one wheel is the contact wheel, one wheel is the drive wheel and one wheel is the idler wheel

With four wheel machines one wheel is the contact wheel, one wheel is the drive wheel and two wheels are the idler wheels.

## SHAFT MOUNTED HOLDERS FOR ABRASIVE CLOTH SLEEVES AND CAPS



Expanding rubber holder for standard cylindrical sleeves.



Expanding rubber holder for tapered sleeves.

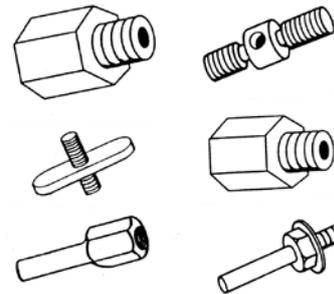
Shaft mounted rubber holders for abrasive cloth sleeves come in a vast range of sizes.

You must use the correct size rubber holder for each sleeve size.



Shaft mounted rubber holders for abrasive cloth caps.

## ADAPTORS

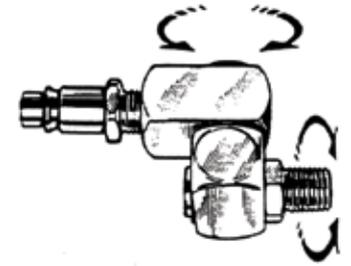


Adaptors make your machine more versatile. They allow you to use consumables which do not fit on your standard machine.

They are very popular for converting imperial fittings to metric fittings and vice versa.

We can offer a vast selection of adaptors. Let us have your requirements.

## AIR TOOL FITTINGS

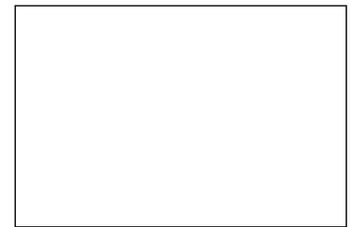


This air tool swivel lets you move the portable air power tools without having to fight the air line.

With two 360° pivot points.

There is also a model with air flow control.

The swivel comes without air line fitting and without plugs.



## SIDE PLATES CLAMPING PLATES



Side plates for SURTECH contact wheel mounting system.

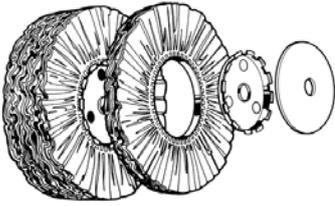
With 65mm boss to fit into 65mm bore of the contact wheel.

Side plates are then bored out to fit the shaft size of the machine.



Clamping plates for abrasive wheels, abrasive brushes and polishing buffs.

## CENTRE DISCS AND CLAMPING PLATES FOR THE MOUNTING OF BUFFS



From left:

1. Polishing buff
2. Buff centre disc, to fit internal diameter of buff and with centre bore to suit the machine shaft.  
One centre disc for each buff.
3. Clamping plate of the correct size to fit over buff internal diameter and with bore to suit the motor shaft.

One clamping plate on each side of the pack of buffs.

Because there are buffs made to imperial sizes and buffs made to metric sizes it is important to fit the correct centre plates and clamping plates.

Imperial sizes for centre plates: 3", 5", 7", 9".

Metric sizes for centre plates: 75mm, 80mm, 130mm, 150mm, 180mm, 230mm.

## TUBE SUPPORTS



Built in tube supports and transport systems for centreless grinding and polishing machines are expensive and can cost as much as the centreless machine.

With single or twin head machines the solution can often be the use of adjustable tube supports.

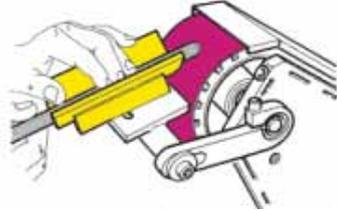
They can replace the primitive V-shape supports which create friction and limit the tube sizes the machine can handle.

The rollers of these tube supports and the working height are adjustable to suit the tube diameter.

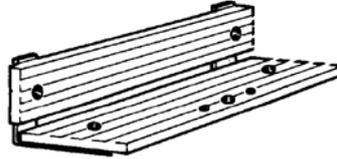
## BELT GRINDER ATTACHMENTS

These attachments extend the use of standard abrasive belt grinders.

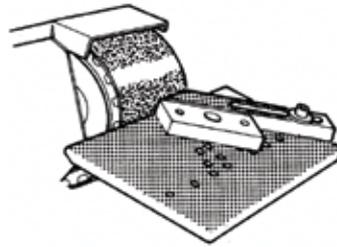
They are fitted and removed in minutes.



An adjustable tube end chamfering attachment.



A sheet chamfering attachment.



An adjustable table for different vertical and horizontal grinding angles.

## PEDESTALS, BENCH MOUNTS



A simple stand for turning bench grinders, etc. into pedestal machines.



One of our standard pedestals for belt grinding and polishing machines.



Another standard pedestal with storage shelf and access door.



A sturdy machine stand for two belt or polishing machines. With two storage shelves.

Available with or without door.

# GUARDS, CAPTURE HOODS, DUCTING AND SPIGOTS

For more information on dust extraction see our 'Easy Guide Dust'

## INTRODUCTION

Ducting and spigots are often overlooked when an extraction system is chosen, yet they are important for the functioning of the extractor to its designed capacity.

Both ducting and spigots should be regarded as part of the whole system but sizes and types must be chosen to suit individual circumstances.

## GUARDS AND CAPTURE HOODS

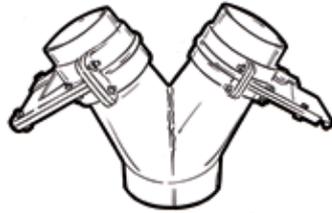
The majority of guards on our machines also act as capture hoods and have a spigot for connecting ducting.

Standard guards suffice for most grinding and polishing operations. Nevertheless each system must be checked and tested to make sure it fulfils all safety aspects and facilitates dust extraction.

Where the standard guard is not suitable a special guard has to be designed. Wherever possible guards should incorporate spigots but in some cases this is not possible. Separate guards and capture hoods will then have to be fitted. Sometimes compromises have to be made. For example when a guard is in the way of an unwieldy part..

Spigots are also needed for the inlet of the extractor. Obviously the extractor inlet spigot and the capture hood/guard spigot will have to be of the same diameter.

Many of our machines have two spigots, one at the front and one at the rear. This means you need 2 inlet spigots for the extractor. With a double sided machine there could even be 4 spigots. You then have a choice of fitting 4 inlet spigots or to fit two Y-pieces.



Y-piece with dampers

## CAPTURE HOOD DESIGN

Efficient dust extraction needs efficient capture hood designs and positions. The closer the capture hood is positioned to the source of the dust the lower the capacity of the extractor needs to be. The air velocity drops dramatically as the distance from the hood increases.

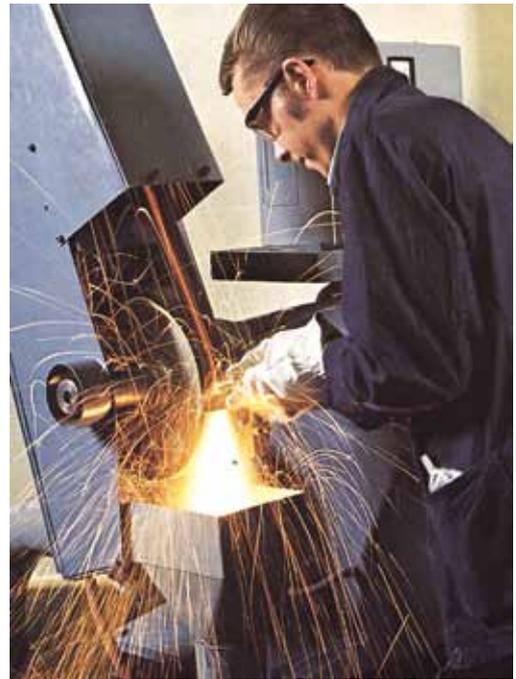
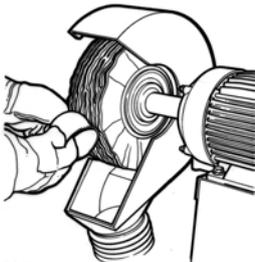
The following photos and drawings show some of the many guards, capture hoods and spigots.

A combination belt grinder and polishing machine.

The left abrasive belt head incorporates a guard, capture hood and spigot.

The right polishing head is fitted with a guard/capture hood and a built in spigot.

The drawing shows the polishing head in more detail.



A special arrangement for large amounts of hot dust. The guard is cut back to suit the operation and a separate large capture hood with spigot is fitted to catch most of the dust. Even so, you can see that some dust and sparks escape.



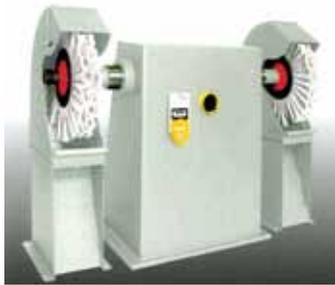
On these two machines guards and capture hoods are separate. Guards have been designed not to interfere with the grinding operation. Capture hoods are hinged and can be positioned to catch the dust from various directions.



Two typical free standing guards/ capture hoods with spigots at the back.

The photo on the left shows how they are fitted to traditional polishing lathes.

Their advantage is that they can be positioned exactly where needed. They are not suitable for abrasive belt grinders.



A rather special guard and capture hood. This was the only design that made the finishing operation possible. It does not fulfil all safety requirements but our customer overcame that by allowing only trained operators to use the machine.



A double ended polishing machine with extractors built into the stand. With oversize guards.



This is a milling, grinding and polishing machine for the orthopaedic industry. On the left a flatbed finishing head with standard guard. On the right a capture hood with spigot which is adjustable in all directions.



Photos show the typical guards, capture hoods and spigots of a flatbed liner. The guard can be adjusted and partly removed for work on the platen or the contact wheel.

The top guard can also be moved to show just the amount of abrasive belt that is necessary for the job. The guard also acts as the capture hood. A spigot is fitted to the front bottom of the liner.

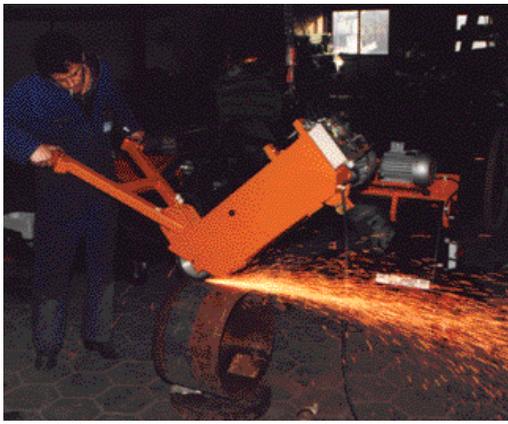
The drawing above shows a special guard/capture hood for large amounts of dust.



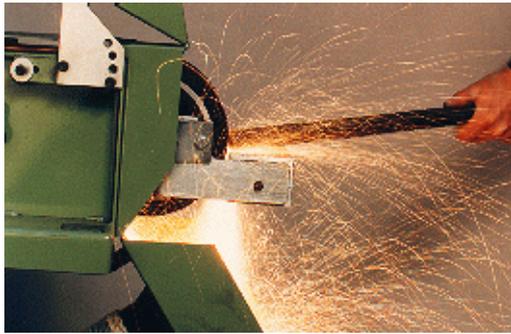
A pad sander with two spigots and flexible metal ducting joined by a Y-piece before a single flexible Duct is connected to the extractor.



The photo shows a bench polisher mounted on a wet extractor. Heavy duty flexible ducting connects the machine with the extractor. See Y-piece used as inlet spigot. The unit is suitable for polishing titanium.



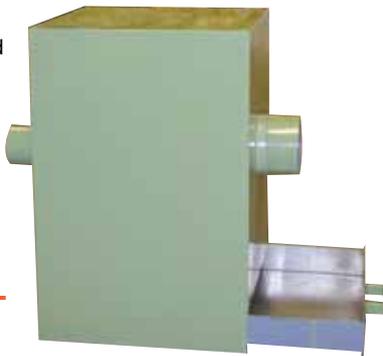
A swing grinder in action throwing a trail of sparks a long way



Mild steel being ground with a coarse abrasive belt. The hot sparks can set alight the fabric filters inside the dust extractor unless a spark arrester is fitted

To prevent fabric filter fires we recommend installing a spark arrester between the extractor and the machine. The spark arrester kills sparks and separates coarse dust.. Only the cooled down finer dust reaches the fabric filters.

Alternatively use an all metal cyclone extractor without fabric filters but it will not be as efficient for fine dusts.



A spark arrester with inlet and outlet spigots and with bottom drawer to collect heavy particles

## HIGH HAZARD DUST

The most common hazardous dusts encountered by our customers are aluminium, titanium and magnesium.

All of these present considerably increased risks of fire and explosions.

## TOXICITY OF METAL DUST

Some metals can be toxic or fatal if they enter the bloodstream, ie when smoke fumes are inhaled.

Never fight a metal fire without proper protective equipment.



The very bright 'star shaped sparks are typical for titanium

## STAINLESS STEEL DUST

Stainless steel contains a wide range and percentage of other metals to make up the various grades.

Check contents of the stainless grade you are using and consult safety sheets for the various constituents.

A typical make-up is:

1. Nickel	3%
2. Chromium	18 %
3. iron	69 %
4. Molybdenum	3 %

Of these alloys the following can present health hazards:

**1. Nickel** (above a concentration of 1%).

Nickel can cause allergic contact dermatitis.

**2. Chromium**

The primary use of chromium is as a surface finish. Due to its toxicity and suspected carcinogenicity it is regulated for human health and for the environment. It has a low max. exposure level.

Hexavalent chromium occurs in chrome plated parts and is classified as hazardous.

Stainless steel does not contain hexavalent chromium. Inhalation can cause toxicity and irritation. Ingestion may effect kidney and liver function.

The grinding and cutting of stainless steel do not appear to cause any adverse health effects.

## ALUMINIUM DUST - CAUTION!

Aluminium is not considered a fire risk unless in powder and dust form with approx. 20% of the dust in particle sizes below 44 microns.

Aluminium alloys can contain up to 15 % of alloying metals like chromium, copper, iron, magnesium, manganese, nickel, titanium and zinc.

Aluminium is very reactive and the greatest hazard is chemical reactions.

Aluminium reacts with water or even moisture in the air to form hydrogen gas. It is therefore essential that dust collectors used for aluminium are designed to vent hydrogen to the atmosphere and not to allow it to collect inside the extractor.

Aluminium dust clouds can ignite and cause considerable damage, particularly if the dust cloud has formed in a confined space, ie inside a dust collector.

Explosions have been reported with concentrations of about 40 grams of aluminium per cubic metre (0.04 ounces per cubic foot).

The finer the aluminium dust the higher the risk of fire and/or explosion. Aluminium should be extracted into a wet extractor with aluminium specification or into a dry extractor with an explosion relief and a blast barrier of the correct size and is installed with the correct specification ductwork and is sited correctly.

Extractors of the MS-EX Range supplied by SURTECH have explosion reliefs and blast barriers of the correct size.

As far as medical risks are concerned you must make sure employees are not exposed to more than the max. exposure limit set by COSHH.. Aluminium dust mixed with bodily fluids presents a serious health risk. Aluminium dust mixed with water, even that present in the atmosphere produces hydrogen gas which is highly explosive. Make sure your extractor is designed not to trap this gas but has vents for it to escape.

A leaflet is available: **Fire and Explosion hazards in the Grinding and Polishing of aluminium and its Alloys**, prepared by The Aluminium Federation, Broadway House, Calthorpe Road, Five Ways, Birmingham B15 1TN, Tel: 01212 456 1103.

The Federation strongly favours wet collectors but does not entirely rule out dry collectors. Read the leaflet before you specify equipment for your application.

Here is a resumé of the Aluminium Federation's leaflet:-

### Aluminium and medical risks if inhaled and reaction with water

Aluminium dust can give rise to fire and explosion hazards.



A dry extractor with explosion panel and blast barrier

## DUCTING AND SPIGOTS

For more information on dust extraction see our 'Easy Guide Dust'

Ducting and spigots are often overlooked when an extraction system is chosen, yet they are important for any extractor to function within its designed capacity.

Ducting should be regarded as part of the extraction system. We offer the following types of ducting:

### STANDARD FLEXIBLE METAL DUCTING FOR GENERAL USE FOR LOW HAZARD DUST

This ducting is very flexible, easy to install and low cost. We recommend it for most of our machines with 50mm to 200mm duct diameter. Standard flexible metal ducting is normally fixed with Circlips or with ducting tape.



*This photo shows standard duty flexible metal ducting. It can be bent tighter than the heavy duty version.*

### HEAVY DUTY FLEXIBLE METAL DUCTING FOR LOW HAZARD AND SOME HIGH HAZARD DUST

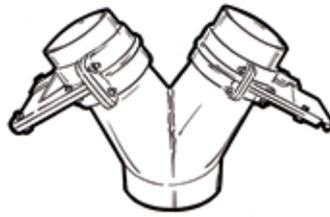
This ducting is a lot less flexible than the standard ducting. We recommend it for extractors used for aluminium when solid smooth bore ducting is not practical and when only short runs are needed. We also recommend it as a heavy duty alternative to standard ducting.

Heavy duty flexible ducting should be fixed with clamps and with screws.

*Heavy duty flexible metal ducting. Bends are larger than on the standard flexible ducting.*



*The photo on the left shows a dust extractor with heavy duty flexible metallic ducting*



*A single inlet spigot and a Y-piece. Y-piece has dampers fitted*



*A damper allows you to increase or decrease the airflow on each spigot*

### HEAVY DUTY SMOOTH BORE SOLID DUCTING FOR HAZARDOUS DUST

Made from 14 gauge galvanised sheet. This is the ducting recommended for aluminium, titanium and magnesium dust and for all larger machine installations where ducts of 200 mm diameter and larger are needed.

Heavy duty smooth bore ducting has no flexibility and can only be made to a floor plan drawing.

Heavy duty smooth bore solid ducting must be fixed with flanges and the appropriate clamps.



*A wide belt machine with three way manifold and smooth fixed metal ducting of 14 gauge steel.*

Just some of the spigot designs available for our machines

1. Flexible metallic ducting
2. Reducing spigot adaptor
3. Standard straight spigot adaptor
4. Reducing spigot adaptor
5. Y-piece spigot adaptor



## RECOMMENDATIONS FOR THE FITTING OF HEAVY DUTY FLEXIBLE DUCTING BETWEEN WET EXTRACTORS AND MACHINES

For more information on dust extraction see our 'Easy Guide Dust'

This is primarily for hazardous dusts and for mixed dusts as incurred with wide belt machines close together.

Use fixed bends where bend is too tight for flexible ducting

### MIXING OF DUSTS

Some of our machines are used for a wide variety of grinding, deburring and polishing operations on a wide variety of materials.

The general rule is: DO NOT MIX DUSTS in a single extractor. At best you could reduce its at worst you could introduce new hazards. List the materials you intend to use on our machines and estimate the percentage for each material. Then ask for advice!

The most common examples of mixed dusts are wide belt machines for deburring punched sheet. Most operators work with stainless steel and with aluminium. The standard solution is a wet extractor with aluminium specification and with smooth bore ducting of flanged 14 gauge steel. The length of ducting is usually no longer than 3m.

### Absolute filters.

#### HEPA filters

HEPA stands for High Efficiency Particle Arresters. Filtration efficiencies of up to 99.9 % are possible provided the correct HEPA filter is chosen.

There is not one single HEPA filter to suit all applications. HEPA filters are designed for individual machines, materials and applications. No dust particles escape to the atmosphere.



Typical HEPA Filters

In extreme cases and where highly dangerous dust is created it may be necessary to vent to outside the building.

### ADDITIONAL NOISE ATTENUATION

All models can be fitted with an additional silencer to reduce noise levels.

### EFFICIENCY OF DUST EXTRACTION SYSTEMS

To extract dust from the point where it is created it is necessary to catch it first and then to direct it down the duct into the dust extractor.

To improve efficiency care must be taken with the design of guards and capture hoods. The further away from the source of dust the extractor is positioned the larger its capacity must be.

Most machines are supplied with standard guards and capture hoods which are suitable for most operations. However, in some cases guards will have to be modified and in cases where guards are in the way completely new guards may have to be made.

You should also allow for a reduction of efficiency after some use when filters have clogged. And for the fact that most extractors are not maintained at a level to guarantee max. efficiency.

### DISPOSAL OF DUST

You must consult your local authority about disposal of dust. They may impose certain requirements, particularly for the more hazardous dusts.

You must also take great care not to disturb the dust during disposal. Remember that dust can present fire and explosion risks but also medical risks.

### HOW TO CALCULATE DUST EXTRACTION CAPACITY

The figures given below are very rough general estimates based on medium amounts of dust and with the extractor positioned within 3 m of the machine. For large amounts of dust or where the extractor cannot be positioned within 3 m of the machine choose the next size up.

For small amounts of dust or for intermittent use choose next size down. Machines with two extraction spigots need slightly higher capacity extractors than machines with one spigot only. Machines with well designed dust capture hoods need less extraction capacity than machines with large, poorly designed capture hoods.

We advise you to seek expert advice.

### Grinding with abrasive belts

BELT WIDTH IN MM	SPIGOT DIA IN MM	RECOMMENDED EXTRACTOR IN CFM	
		Medium amounts of dust	Large amounts of dust
Up to 40	50	250 - 400	
400 - 500			
Up to 50	50 - 75	400 - 500	500 - 650
Up to 75	75 - 100	500 - 650	650 - 750
Up to 100	100 - 125	650 - 750	750 - 1000
Up to 125	100 - 125	750 - 1000	1000 - 1200
Up to 150	100 - 150	1000 - 1250	1250 - 1500

### Buffing with polishing buffs

Buffing operations need higher capacity dust extraction than abrasive belt operations.

This is mainly due to larger size capture hoods but also due to the type of dust - a mixture of metal, sisal or cotton and polishing composition.

Buffing dust clogs extraction filters faster than abrasive belt dust. Regular cleaning of filters improves extraction efficiency but since the regular maintenance is rarely done it is safer to specify a larger extraction unit.

The figures below are based on buff widths of 50mm to 75mm. Wider buff widths require higher dust extraction capacity.

Buffing dust consisting of sisal and/or cotton fibres and greasy polishing compound presents a volatile mixture.

This mixture clings to the fabric filter. Extra care must be taken not to introduce hot sparks which would easily set the extractor alight.

BUFF DIA IN MM	SPIGOT DIA IN MM	EXTRACTOR CAPACITY IN CFM
200	75-100	500-750
300	75-100	500-750
400	100-150	750-1000

### CUBIC METRES AND CUBIC FEET

1 cubic metre equals 35 cubic feet.

Cubic metre figures are normally given per hour, i.e., cbm/hr.

Cubic feet figures are normally given per minute, i.e., cfm.

1 cbm/hr equals 0.55 cfm.

## POSITIONING OF DUST EXTRACTORS VIS A VIS GRINDING / POLISHING MACHINES

Always place the dust extractor as close as possible to the machine.

Where the extractor is installed near a wall allow space for the removal of dust trays and buckets and allow space for ducting and inlet spigots.

Our recommendations for dust extractor capacity are based on the assumption that the extractor is no further than 2 m away from the machine. If it is further away choose an extractor with higher capacity.

Never place an extractor used for hazardous dust close to where people are working. Make sure there is space on all sides and at the top to allow the shock wave of an explosion to escape.

### Air volume

The amount of air that an extractor can move is determined by the fan size and an indicator for the fan



This extractor stands next to the workbench. The closer, the better.

size if the fan motor. The larger the fan motor the larger the fan and the higher the air volume.

Many extractors are offered with different fan sizes for the same model. This means the model No. alone does not tell you the extractor's capacity. You will also need the fan motor size.

### Air velocity

The diameter of the extraction spigots and the ducting are used to calculate air velocity. The larger the ducting the lower the air velocity. Air velocity is important and must be matched to the type of dust. Too low and it will not shift the dust, too high and the dust is blown through the filter.

### Weatherproofing

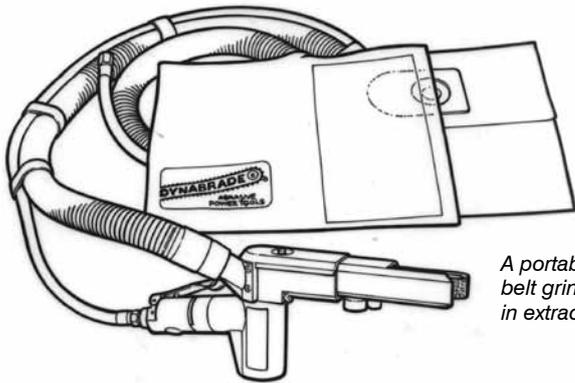
When extractors are placed outside a building they need weatherproofing, including a frost stat.

## DUST EXTRACTION AND PORTABLE ABRASIVE POWER TOOLS

It is extremely difficult to capture dust from a portable abrasive power tool. The working angle changes constantly and with most tools a capture hood would be in the way and render the tool unworkable.

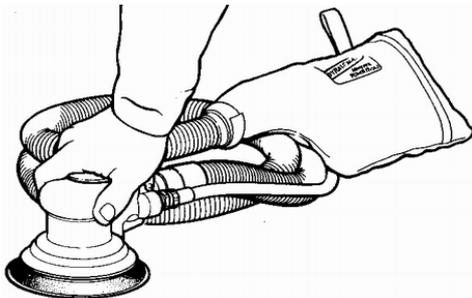
Very few manufacturers offer dust extraction systems and the few that do offer them only for a limited range of tools.

Where dust extraction for a portable tool is essential individual solution have to be sought. Alternatively bench extractors can be used.



A portable abrasive belt grinder with built in extraction system

A random orbital sander with built in dust extraction.



A portable abrasive belt grinder used with a bench extractor

## WOOD DUST AND DUST FROM NON-METAL MATERIALS

It is rare that we get enquiries for machines for grinding, deburring and polishing other materials than metal.

We can therefore give only the shortest explanations and advise you to obtain expert advice before you commit yourself to a system

We can assist with obtaining this expert advice.

## HEALTH & SAFETY RECOMMENDATIONS

Most of the foregoing recommendations for metal are valid also for abrasive machines used for the sanding, denibbing and polishing of wood. In addition, the following additional recommendations should be observed.

The Health and Safety Executive (HSE) has published guidelines for every application in the wood industry. See [www.hsebooks.co.uk](http://www.hsebooks.co.uk)

### COSHH in the Woodworking Industry

Wood dusts, resins, adhesives, paint strippers, paint, varnishes, stains and preservatives are examples of substances used in the woodworking industry which may be hazardous to health. The HSE has published a number of information sheets setting out guidelines and recommendations, of which you should make yourself fully aware.

Wood dust does not only present a fire and explosion hazard but can also damage the health of workers by irritating the skin and causing respiratory problems.

### Dust Extraction in the Woodworking Industry

At the time this article was written the maximum exposure limit for both hardwood and softwood was 5mg/cu.m.

It is therefore essential that correctly chosen collectors of adequate capacity are fitted to all SURTECH sanding, denibbing and polishing machines used in the woodworking industry. All dust collectors must be inspected and tested by a competent person every fourteen months.

Never use a dust collector with a large plastic bag to extract sanding dust. This type of extraction is designed for wood chips only.

### Dust Extraction and Portable Sanding, Denibbing and Polishing Machines in the Woodworking Industry

Some of SURTECH'S portable abrasive machines have integral dust extraction, like the *Dynorbital* random orbital sander or the *Dynafile II* vacuum abrasive belt sander. Other portable tools will need to be connected to mobile or central vacuum extractor units. Alternatively, down-draught work benches with local exhaust ventilation can be used.

The use of dust respirators is recommended in addition to the control of dust at source. Respirators are not a substitute for proper dust control.

Wood dust is classified as toxic and masks recommended for nuisance dusts are not suitable.

## WOOD DUSTS AND FIRE EXPLOSION HAZARDS

Wood dust will burn readily if ignited. Fires can start from overheated electric motors and sparks, eg. abrasive belts rubbing against metal casings. Clean all machines and surrounding areas regularly. Do not use compressed lines to move dust.

Check that dust control equipment incorporates explosion precautions, eg. explosion relief.

## METAL CLEANERS, PRESERVATIVES, RUST INHIBITORS, ETC.

The other area to watch in our industry is where chemicals are used to clean, protect, passivate, lubricate.

Make sure you have safety sheets for all chemicals used in your factory and follow recommendations concerning fire and explosion risks.

You should not use chemicals without wearing a suitable respiratory (dust) mask unless the chemical's safety sheet declares it to be totally safe.

## COOLANT SYSTEMS

Some of our machines run wet with a coolant system. This is the preferred method for throughfeed flatbed machines and for centreless tube polishing machines.

The coolant reduces the temperature of the part, reduces distortion of the part, removes dust and debris and extends the life of abrasive belts.

The coolant system consists of a coolant tank with Pump, pipes to the coolant nozzles on each head,

A tap to regulate coolant flow and a coolant tray incorporated into the machine body to recirculate the coolant.

Simple coolant tanks have three sediment compartments where dust settles. More sophisticated coolant tanks have manual or automatic paper filters which separate dust and debris from the circulating coolant and deposit it into a disposal container.

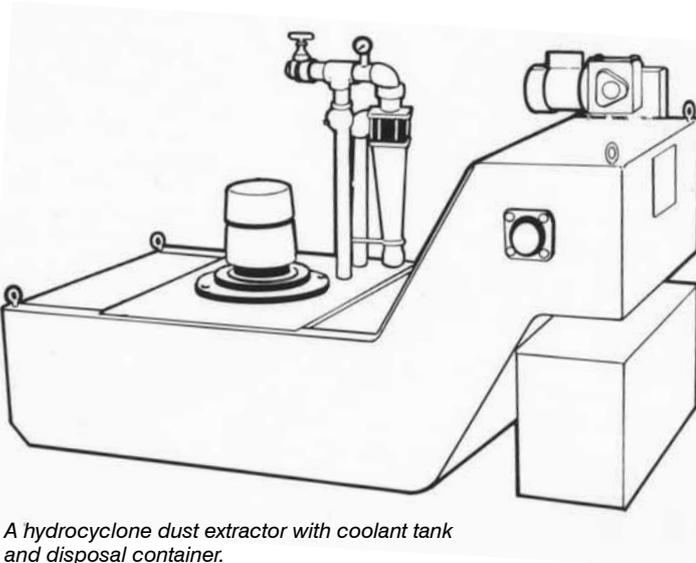


*A coolant tank with pump and paper filter and disposal container.*

For large grinding and polishing machines with wet operation we recommend hydrocyclones. They can handle much larger amounts of coolant than coolant tanks with paper filters.

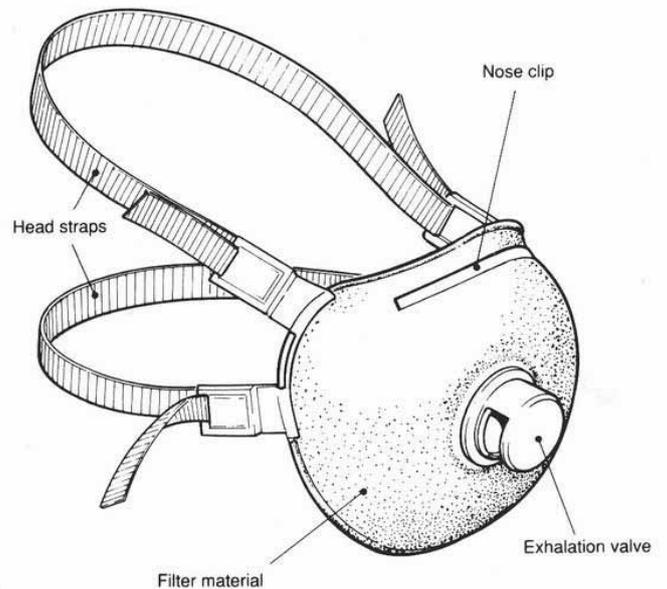
Hydrocyclones consist of a large coolant tank, a pump and a centrifugal unit that separates dust and debris from the recirculating coolant.

Dust and debris are automatically deposited into a disposal container.



*A hydrocyclone dust extractor with coolant tank and disposal container.*

## DUST MASKS



Dust mask is not dust mask. There are many models each designed for a specific application but none suitable for all dusts from all materials.

Respirators are sophisticated dust masks. We will therefore include them in this report.

There are dust masks for mists, fumes, gases, etc. but here we will concentrate on dust masks suitable for dust from grinding, deburring and polishing.

### CAUTION !!!

We do not recommend nuisance dust masks for use with any of our machines. Nuisance dust masks are not classified as personal protection equipment.

Look for CE marked dust masks which conform to EN 149, the European standard.

### LOW EFFICIENCY DUST MASKS

#### FFP1 (S)

Fine non toxic dust and fumes.  
4xOEL for particulates.

#### FFP1(S) valved

Fine non toxic dust and Fumes.

#### FFP1(S) odour

Odours, vapours and fine Non toxic dust.

#### FFP1(S) odour

Odours, vapours and fine Non toxic dusts.

### MEDIUM EFFICIENCY DUST MASKS

#### FFP2(S)

Fine toxic dust and Aqueous mists.  
10xOEL for particulates.

#### FFP2(SL)valved

Fine toxic dust, fibres and Aerosols.

#### FFP2(S) valved

Fine toxic dust, fibres and aqueous mists.

### HIGH EFFICIENCY DUST MASKS

#### FFP3(S)valved

Very fine toxic dust, fibres And aqueous mists.  
Suitable for wood sanding and working with chrome and lead based paints.

#### FFP3(SL)valved

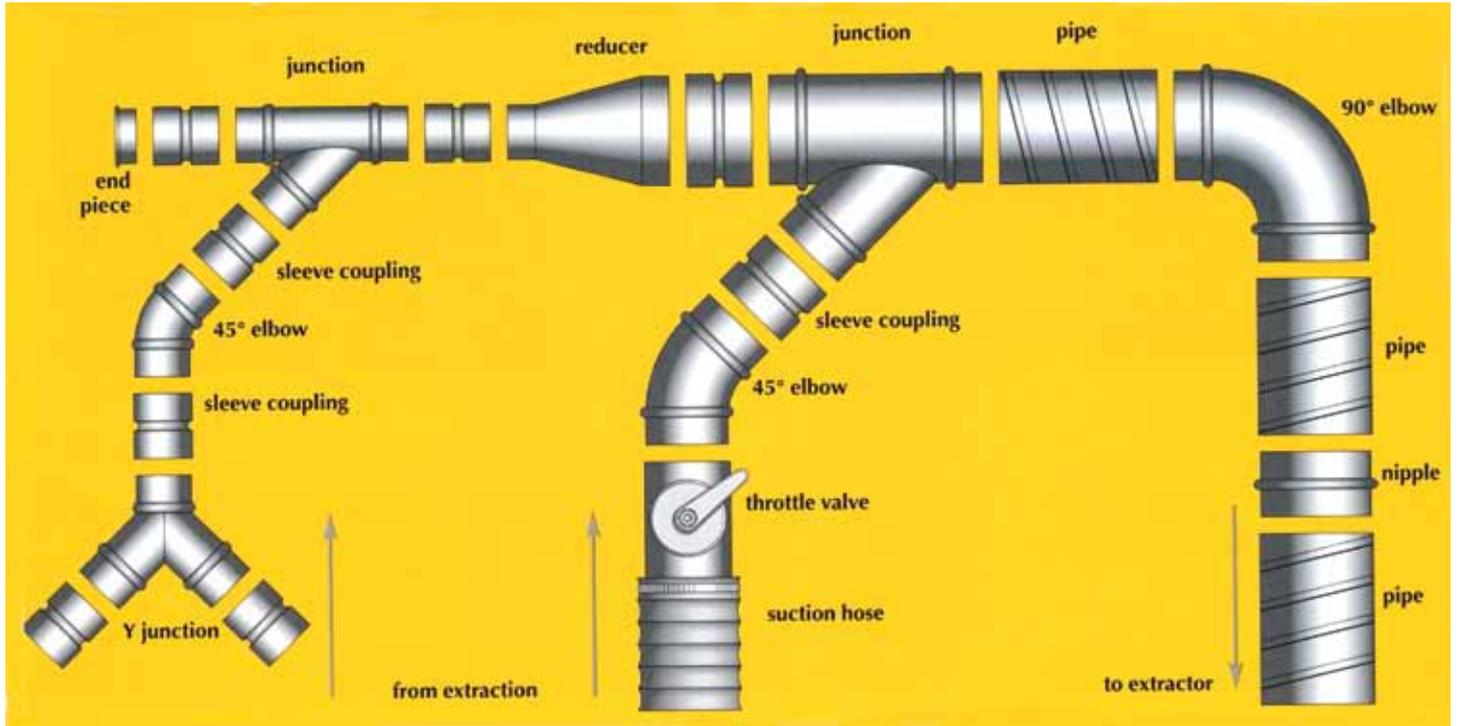
Very fine toxic dusts, fibres And aerosols.  
20xOEL for particulates.

## DUCTING SYSTEMS FOR MULTI MACHINE INSTALLATIONS

The drawing below shows a typical ducting system for connection to several machines.

The main duct reduces towards the machines and increases towards the extractor.

Observe how secondary ducts are connected to the main duct at an angle to aid airflow.



# ELECTRIC MOTORS ELECTRIC MOTOR FAILURES ELECTRIC MOTOR CONTROLS

## INTRODUCTION

This guide does not attempt to be a technical treatise on electric motors and their controls. It tries to explain to the novice some of the very basic features of electric drives as used in our machines.

It concentrates on the main motor types used in our industry which also happen to represent the vast majority (some say 90%) of all motors used in industry.



Motor housing and windings. Shown without rotor.

## TYPES OF ELECTRIC MOTORS USED FOR OUR GRINDING, DEBURRING AND POLISHING MACHINES

**Electric motors convert electric energy into mechanical energy.**

### MAGNETIC FIELDS

The electric current supplied to the motor generates magnetic fields in both the rotor and the stator. These fields push against each other with the result that the rotor experiences a torque and consequently rotates.

### AC MOTORS Three phase

An AC motor is an electric motor that is driven by alternating current. *It consists of:*

1. An outside stationary stator with coils, supplied with AC to produce a magnetic field.
2. An inside rotor with a shaft that is given a torque by the rotating magnetic field.

*The speed of the AC motor depends on:*

1. The fixed number of winding sets (poles) built into the motor, which determines the motor's base speed.
2. The frequency of the AC line voltage (Variable speed drives (VSD) change this frequency to change the motor speed.)
3. The amount of torque loading on the motor which causes slip.

There are two main types of AC motors:

#### Synchronous

The synchronous motor rotates exactly at the supply frequency or a sub multiple of the supply frequency. The magnetic field on the rotor is either due to current transported with slip rings or a permanent magnet.

#### Asynchronous - Induction

Asynchronous (also called induction) motors are by far the most widely used motors. They are simple, rugged and reliable and they are cheap to produce.

The asynchronous (induction) motor turns slightly slower than the supply frequency. The magnetic field on the rotor is created by an induced current.

In induction motors two types of rotors are used: Squirrel cage rotors and wound rotors.

Most common motors use the squirrel cage rotor. It takes its name from its shape - a ring at either end of the rotor, with bars connecting the rings running the length of the rotor.

The wound rotor used to be chosen when variable speed was required. The rotor has the same number of poles as the stator and the windings connect to slip rings on the shaft. Carbon brushes connect the slip rings to an external controller.

Since the introduction of variable frequency controllers it is no longer necessary to use wound rotors for variable speed applications. Variable frequency controllers work perfectly well with squirrel cage motors.

Multi windings motors are more expensive as are the motor controls for two speed motors.

#### Variable speed AC motors

An AC motor can operate at more than one speed if provided with multiple windings: eg 2, 4, 6 or 8 pole. Typical in our industry are motors running at 2800 rpm and 1400 rpm.

*AC motors do however have some disadvantages:*

1. Speed controls for AC motors are a lot more expensive than speed controls for DC motors.
2. AC motors cannot run at low speeds unless a separate cooling fan is fitted. AC motors run below 25 Hz without a cooling fan are certain to fail
3. An AC motor run at 25 Hz will have lost a lot of its power. Applying more pressure will draw more current and will precipitate motor failure.

#### Starting an AC motor

Starting an AC motor direct on line (DOL) draws a high starting current. The number of starts in a given time are limited to prevent motor failure.

To reduce the start current a star delta switch, a soft start unit or a VSD (variable speed drive) should be installed.

At SURTECH the rule of thumb is to use DOL for motors up to 7.5 KW and soft starts or star delta starts over 7.5 KW.

#### Single phase AC Induction Motors

Three phase motors produce a rotating magnetic field. However when only single phase power is available the rotating magnetic field must be produced by some other means.

The operating principle of a single phase induction motor is the same as the squirrel cage motor, except that the stator windings are at right angles and a capacitor is connected with one part of the windings.

Such motors are called split phase induction motors.

Single phase motors are rarely used in industrial applications. They are bulkier and less efficient than 3 phase motors.

VSD's (variable speed drives) for single phase motors are difficult to find and their performance is limited.

#### DC MOTORS

A DC motor is designed to run on DC current.

The most common DC motors are the DC brush or the DC brushless types which use internal or external commutation to create an oscillating AC current from the DC source. They are really not pure DC machines.

DC motors have an electromagnet with two poles which serve as a rotating armature. A commutator or rotary switch is used to reverse the current direction twice in each cycle. This causes the poles of the electromagnet to push and pull against the external permanent magnets.

When the poles of the armature pass through the poles of the permanent magnet, the commutator reverses the polarity

of the armature. The inertia maintains the current direction at the instance when polarity is switched.

Permanent magnet DC motor = PMDC.  
Electro magnetic windings. Shunt wound DC motor = SWDC  
PMDC motors are preferred for fractional HP motors and for motors up to 3HP.  
SWDC motors are preferred for motors over 5 HP

DC motors fitted with VSD can run as low as 10% of their base speed and as high as 180%.  
This would make the speed range for a 2800 rpm motor from approx. 300 rpm to approx. 5000 rpm.

#### Brush DC Motors

In a brush DC motor the brushes make the mechanical contact with a set of electrical contacts on the rotor called the commutator. This forms an electric circuit between the DC source and the armature coil windings.

A brushed DC motor is an internally commutated electric motor designed to be run from a DC power source.

Brush DC motors use carbon brushes and slotted slip rings to form a mechanical switch (commutator) which creates current in the armature (rotor) to produce a magnetic field. An interacting magnetic field in the stator causes the armature to rotate.

There are several types of brush DC motors.

#### Brushless DC Motors

In a brushless motor the electromagnets do not move. Instead the permanent magnets rotate and the armature stays static. The brush system is replaced by an electronic controller using a solid state circuit.

A brushless DC motor is a synchronous electric motor which is an electronically controlled commutation system rather than the mechanical commutation system of a brush DC motor. There are quite a number of problems associated with brush DC motors.

Most are eliminated by brushless DC motors.

With this motor the commutator/brush gear assembly is replaced by an external electronic switch synchronised to the rotor's position.

Brushless DC motors are often used where precise speed control is necessary.

#### BRUSH VERSUS BRUSHLESS

Brushless motors are more expensive but also more efficient and more reliable. They require complicated electronic speed controllers

whereas a brush motor needs only a variable resistor.

Based on the type of rotor there are two major types of motors: synchronous motors and induction (asynchronous) motors.

The synchronous motor rotates at the frequency of the input current or its fractions. The induction motor can turn at lower speed than the input frequency. It is also called a squirrel cage motors.

## MOTOR FAILURE

When an electric motor fails it is not always obvious whether the motor is defect or a control unit is damaged. (overload, fuse, etc.)

Checking a motor with a simple multimeter can only establish whether the motor is defect. To find the defect or even the cause of the defect requires more sophisticated equipment and experience.

## AC motor failure

### Insulation failure

Check with digital ... at highest level, ie 20 MOhm all three motor connections against the motor housing.

If you record a high Ohm reading you can condemn the motor with insulation failure.

With the low currents used by Multimeters there should be no throughput recorded.

To check windings you will have to check the resistance of each winding against the others.

Most motors will record slight variations between windings. As long as these are within approx. 3% they are acceptable. Above 3% it is doubtful that the motor is not damaged.

This check is not conclusive for motors over approx. 5 KW. These motors have thick wires in their windings and the windings have very little resistance. To prove a difference with a Multimeter is virtually impossible.

### Nose test

It may sound odd yet subjecting the motor to a smelling test is often more reliable than the use of instruments:

Open the connection ? box If you notice a stinging, smoky smell then the motor will almost certainly be useless.

### The following is a list of motor failure causes:

#### 1. Single phased winding failure

Result of an open in one phase of the power supply to the motor. The open is usually caused by a blown fuse, an open contactor, a broken power line or a bad connection

#### 2. Insulation failures

Caused by contamination, abrasion, vibration or voltage surge

#### 3. Thermal deterioration of insulation

Caused by unequal voltages between phases. Also by load demands that are beyond the designed limits of the motor.

#### 4. Severe insulation failure of all phases.

Usually caused by very high currents in the stator windings due to a locked rotor. Also possible as a result of too many starts and reversals.

## TORQUE

The torque of a motor is a measure of the turning ability of its rotor.

## MOTOR CLASSIFICATION

### Ingress protection - First digit

0. No protection
1. No entry for bodies with a diameter larger than 50mm
2. No entry for bodies with a diameter larger than 12mm
3. No entry for bodies having a diameter larger than 2.5mm
4. No entry for bodies having a diameter larger than 1mm
5. Protection of dust likely to impair the functioning of the motor.
6. Prevention of entry of dust.

### Second digit

- 0 No protection.
- 1 Drops of water falling vertically
- 2 As 1 but motor axis may be tilted up to 15 degrees.
- 3 Water falling at an angle less than 60 degrees from the vertical.
- 4 No effect from water sprayed from any direction.
- 5 No effect from water sprayed under pressure from any direction.
- 6 Flooding must not enter the motor.
- 7 Water must not enter the motor when immersed.
- 8 Water must not enter the motor when permanently immersed.

### THERMAL CLASSIFICATION Motors over 600 Watt

- |   |   |                     |
|---|---|---------------------|
| A | = | 60 degrees Celsius  |
| E | = | 75 degrees Celsius  |
| B | = | 80 degrees Celsius  |
| F | = | 105 degrees Celsius |
| H | = | 125 degrees Celsius |

## MOTOR CONTROLS

There are as many different motor controls as there are manufacturers of grinding, deburring and polishing machines.

On top of that each manufacturer has a range of budget machines, standard machines and top of the range machines.

## BASIC ELECTRICAL CONTROLS FOR BENCH AND PEDESTAL MACHINES



A very basic control unit for low cost bench and pedestal machines.



The inside of the very basic motor control. With on/off switch and thermal overload in the centre and terminal block on the right.



A variation on the basic budget control unit. This model has a built in socket.



Another basic switch for a budget machine. With 2 speed selector switch, on/off push buttons and socket. Also with overload .

Over the last five years competitive pressure has forced manufacturers of low cost abrasive belt grinding and buffing machines to install simple, very basic electrical controls that just about meet regulations but are not always the best solution for heavy duty applications.

Some of these very basic controls do not even have overload protection or if they have the overload cannot be adjusted to suit the work and the motor.

Overload protection is not a legal requirements as it does not affect Health and Safety.

Machines with these basic controls and no overload protection have only a limited guarantee for the motor and the electrical control gear.

Unfortunately for competitive reasons, some machines cannot be fitted better controls. They are , however, available as Optional Extras at additional cost.

## STANDARD ELECTRICAL CONTROLS FOR BENCH & PEDESTAL MACHINES

### DIRECT ON LINE STARTER (DOL CONTROL)



Open DOL starter to show components. On/off push buttons, overload relays and E-stop

Direct on line is the most common method of starting motors on our bench and pedestal machines.

We recommend direct on line starting for motors up to a max. of 7.5 KW. Above that star delta start units or soft starts should be used.

Direct on line starting draws a lot of current initially. Motors fitted with DOL starters should not be started more often in a given time than recommended by the manufacturer.

Star delta starters and soft starters draw a lot less current and eliminate problems inherent with DOL starters.



Control box for a twin speed Bench top abrasive belt grinder, incl. E-stop.

## TOP OF THE RANGE ELECTRICAL CONTROLS FOR BENCH & PEDESTAL MACHINES



Control box for a 2 speed abrasive belt machine. With speed control switch, on/off push buttons, isolator switch, emergency stop and two indicator lamps.



Control box for an abrasive belt throughfeed conveyor machine. With isolator switch, ammeter for contact pressure control, oscillation on/off switch, conveyor motor and main abrasive belt drive motor switches. In metal enclosure with large access door.

## 24V ELECTRICAL CONTROLS



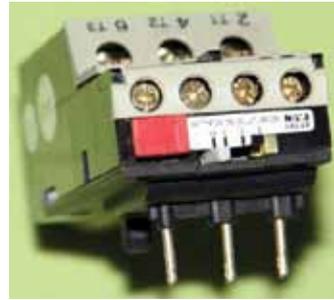
A 24 V control unit. Top from left: Overload relay, main motor on/off contactor, Bottom from left: Transformer, fuses, terminal block.

Some customers specify 24V control systems. They are available as optional extras and of course at additional cost.



Control box for an abrasive belt tube polisher. With emergency stop, on/off push buttons, switch for main motor, switch for feed motor, isolator. Bottom left shows the variable speed control for the feed wheel motor. Inside are also overload relays.

## OVERLOADS



A typical overload relay as used in our Control boxes for top of the range machines. The relay can be set to the amperage required and has a reset button.

There is no legal requirement to have overload protection devices fitted to our motors. The overload protects the motor and has no effect on Health & Safety.

The cheapest overload relays have a fixed setting. Some are incorporated in the switch, which means if the overload fails the complete switch/overload unit has to be changed.

The better overload relays can be adjusted over a certain Amp range. They are also separate from the switch and can be removed.

Another method of protecting the motor is to use motors incorporating thyristors. Thyristors sense the temperature of the motor and will stop it before damage is done.

Grinding has to do with pressure applied to the abrasive. Increase this contact pressure beyond the capacity of the motor and you will stall it, resulting in overheating and eventual burning out. An overload protection control can prevent this if properly set.

Overloads react to thermal changes in the motor. As the stalled or overworked motor begins to overheat, the overload control switches off the current before any damage is done (provided it is set correctly). Proper setting should be carried out by a qualified electrician, having due regard to the contact pressures involved.

### Circuit breaker

Generally most circuit breakers trip within 0.4 seconds. If the residual current exceeds 30 mA. It does not prevent the user getting a shock nor does it reduce the current, it only limits the duration of the shock.

## MACHINE CONVERSIONS AND MODIFICATIONS

## SPECIAL MACHINES DEDICATED MACHINES

## UPGRADING USED MACHINES

We can modify standard machines to suit your particular circumstances.

We can convert and upgrade existing machines.

We can design and build dedicated machines. Send us your requirements and we will let you have our proposals within 48 hours.

## OPTIONAL EXTRAS FOR ELECTRICAL CONTROLS FOR BENCH AND PEDESTAL MACHINES

## VARIABLE SPEED DRIVES (VSD) FOR 3 PHASE AC MOTORS

Also called **FREQUENCY CONVERTER, FREQUENCY INVERTER, VARIABLE FREQUENCY DRIVE (VFD)**



A Telemecanique Altivar 31 inverter. Programmable and with overload protection. This is the standard inverter we use unless requested otherwise.

A variable frequency drive controls the rotational speed of an AC electric motor.

Variable speed frequency drives (VSD or VFD) take the constant frequency sinusoidal AC input, rectify it to DC and then chop it into a variable frequency AC output with blocky wave form. By changing the frequency of the wave form these are able to control the speed and by altering the voltage they are able to control the power available.

The best motor for this speed control system is a three phase induction (asynchronous) motor

Inverters can be fitted to all our machines. They allow operators to set the correct cutting speed for the material to be finished and the recommended cutting speed of the abrasive tool.

Recommended material speeds can range from approx. 10 m/sec for titanium to 40 m/sec for aluminium.

There is, however, a limit to the speed range a motor can run at without problems.

Any motor running below 25 Hz no longer cools itself sufficiently to prevent overheating and eventually failure. This is because the fan only turns at the speed of the motor and at slow speeds can no longer produce enough cooling air.

Example: A standard 2800 rpm motor can be slowed to 25 Hz and is the running at rpm

If that is too fast you need to fit a 1400 rpm motor which can then run as slow as rpm

Alternatively a fan assisted motor has to be fitted. With these motors the fan runs at a speed independent from the motor speed and maintains sufficient airflow to cool the motor.

Another alternative is to fit a motor with a thyristor. The thyristor senses the temperature of the motor and will stop it before it reaches the level where the motor burns out.

Our inverters are available in 1.5, 2.2, 3, 4, 7.5, 11, and 15 KW.

## VARIABLE SPEED DRIVES (VSD) FREQUENCY INVERTERS



*A 40 year old polishing machine with independent motors for each spindle end. Each motor fitted with frequency inverters (variable speed drives = VSD) to allow speeds between 2000 rpm and 3200 rpm to be used.*

We prefer fitting frequency inverters (VSD) to modern motors although we have on numerous occasions fitted them on traditional 30 to 40 year old polishing lathes and abrasive belt backstand machines.

Because of the age and the design of these 30 to 40 year old motors it is not always possible to achieve smooth infinitely variable speeds. Some electronic noise has to be accepted at certain speeds but the noise often disappears when slight speed changes are made. Our recommendation is not to run AC motors fitted with inverters (VSD) at more than 1/3 Overload relays protect the motor against phase failure or overload. The auxiliary contacts disconnect the motor via the DILM contactor.



*A control box with DC injection brake, overload relay and direct on line starter control (DOL). In IP 65 GRP enclosure and with motor overload.*



*Two DOL starters, two motor brakes, overloads and two emergency stop switches fitted to a heavy duty double ended abrasive belt grinder.*

## MOTOR BRAKES

A DC injection unit is an electronic device that provides smooth frictionless braking of AC motors. It creates a DC stationary 0Hz magnetic field in place of the rotating 50 Hz field. This brakes the motor until it is stopped. DC injection brakes for fast stopping of AC electric motors. Brakes are activated by a push button, a telescopic trip switch, a foot kick switch or a large mushroom button switch.

Three models cover most abrasive bench and pedestal machines:

For motors up to 1,5 KW  
For motors up to 4 KW  
For motors up to 7,5 KW

Also available with star delta starter

DC injection brakes are electronic devices that provide smooth braking of AC motors.

The brake unit creates a DC stationary 0Hz Magnetic field which brakes the motor until it is stationary.

## CAUTION !!!

Care must be taken where a machine is connected to the mains via a residual current breaker. Ask for wiring diagram. Motors with star delta starters need modified versions.

SURTECH'S Health and Safety notes on motor brakes

Below is our warning for motor brakes fitted to polishing machines with tapered spindles:

**THIS MACHINE HAS BEEN FITTED ON YOUR INSTRUCTIONS WITH AN ELECTRONIC BRAKE. THE BRAKE CAN BE SET TO VARIOUS STOPPING SPEEDS**

On machines fitted with tapered spindles it is possible for mops to unscrew and fly out of the guard if the stopping speed is set too fast.

You must also make sure that mops have proper tapered centres and that they are mounted on the tapered spindle with part of the spindle showing on the outer end.

If you experience problems you can change to parallel spindles but you must talk to your mop supplier to make sure you can get mops with the correct bore size.

We can supply parallel spindles but need a dimensional drawing from you concerning max. mop width and how far out from the machine body you want to work.

You must also take into consideration the positioning of the guards.

with our type of machines emergency brakes should not be seen as being able to prevent accidents.

They cannot prevent an accident from flying debris and they cannot prevent an accident from entanglement as both happen far too fast for the operator to activate the controls and the motor to stop.

At best the brake can prevent more serious injuries by stopping debris to continue to fly and by stopping earlier than without a brake in the case of entanglement.

Most of the UK polishing machines are secondhand and were designed well before today's safety regulations.

To bring them up to current h & s regulations requires careful risk assessment.

Your attention is drawn to the fact that you may have to guard both the spindle and the spindle end.

Used machines can be retrofitted with guards but since these guards are tailor made, we need drawings.

You will not know exactly what is required until you have established your work sequences.

## EMERGENCY SWITCH Foot Kick Switch



## EMERGENCY STOPS

Emergency stops must switch off a drive as quickly as possible.

The emergency stop function must take priority over all other functions.

An emergency switch must cut off the energy supply to the machine drives.

Resetting an emergency switch must not cause restarting of any of the machine's drives.

Emergency stop switches must have a red push button with a yellow background. They must be easy to reach.

## MUSHROOM BUTTON SWITCH



The red mushroom button switch must not be used for any other reason than to stop the machine in an emergency.

Once the red mushroom button is activated you must immediately turn off the motor switch even though the motor has already been turned off via the red mushroom button switch.

Failure to follow these instructions can lead to premature failure of electrical controls and can result in personal injury.

Our mushroom button switch costs £45.

## E-STOP PUSHBUTTONS



*The E-stop push button must be red and the background must be yellow.*

E-stop (emergency stop) switches must minimise risk as quickly as possible.

Once operated it must lock into position before generating the E-Stop command.

According to the current Machinery Directive E-Stop push buttons must be installed on all machines.

The E-Stop must have priority over all other functions.

## INTERLOCKS

There are many makes of interlocks on the market. We recommend FERROGARD but will also fit any make our customers specify.

The FERROGARD range of magnetically actuated interlock switches are used to stop machine power when a guard is opened.



*An interlock fitted.*



*The parts that make up an interlock installation: switch, actuator, cables.*

## RESIDUAL CURRENT BREAKERS

The Residual Current Breaker senses any imbalance between the live and neutral return wire and in the case of any fault will cut off the electricity supply in a hundredth of a second - not guaranteed to prevent a shock but considered fast enough not to cause serious injury or death.

Residual Current Breakers are recommended for tools used at 240 V mains supply.

Residual Current Breakers must be installed at the mains and tested before each use.

## APPLIANCE CLASSES

IEC protection classes are used to determine protective earth connections for appliances, industrial and domestic.

As far as our portable electric tools are concerned Class IIA and IIB are the most important.

**Class 0** Illegal in the UK.

**Class 01** With an earth cable that is not being used. Has two core cable only.

**Class 1** Must have a machine body connection to earth. A fault should trip a fuse or Circuit breaker to cut off the electricity supply.

**Class II A** All over insulated by plastic body and connected to power supply by two core cable.

**Class IIB** Double insulated. With unearthed metal case. Does not need an earth connection. Usually with two layers of insulation. Must be marked by a square within a square.

**Class III** For supply from a separate low voltage source. The voltage is such that under normal condition an electrical shock is not possible. (Not suitable for medical equipment).

Most of our portable abrasive power tools are Class IIA

## VOLTAGE RATING

The UK is one of a few countries where both 240 V and 110 V power tools are sold. A number of European portable tool manufacturers no longer make 110 V tools. 240 V must be double insulated. Class IIB or all-insulated to Class IIA. In the UK 240v tools are mainly used inside factories. Industrial or 'rough use plugs' and sockets must be used for sitework. 110 V is recommended with 'construction standard' plugs, sockets and leads.



General Warning



Flammable Materials



Explosion Risk



Toxic Materials



Corrosive Materials



Danger Electricity



Risk of Electric Shock



Electricity Danger of Death



Harmful or Irritant Materials



Explosive Atmosphere



Explosion Hazard



Danger of Entrapment



Hot Surface



Do Not Touch Surface



Cutting Hazard



Entanglement Hazard



Rotating Parts Hazard



Rotating Parts Hazard



Rotating Pinion Hazard



Entrapment Hazard



Entanglement Hazard



Hearing Damage Hazard



Hazard of Cutting



Warning of Flying Splinters



Electricity Hazard



Electricity Hazard



No Fire, Open Light or Smoking



No Smoking



Ear Protection Must Be Worn



Safety Boots Must Be Worn



Safety Gloves Must Be Worn



Eye & Ear Protection Must Be Worn



Head & Eye Protection Must Be Worn



Ear, Eye Protection and Safety Helmet Must Be Worn



Wear Face Mask



Wear Safety Shoes



Anti-clockwise Sign



Clockwise Sign



Extremely Flammable



Corrosive



Irritant



Harmful



Read Instructions

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At the Surtech Abrasive Test Centre where you will find the UK's largest selection of the very latest grinding, deburring, polishing, satin finishing & brushing machines.

Bring your own parts and discuss your requirements with our skilled engineers who will also set up practical demonstrations. See for yourself how our machines can be used to solve problems and improve efficiency.

Surtech was formed in 1973 to specialise in the manufacture and distribution of mechanical surface finishing equipment and materials.

Within this field we aim to provide the latest available technology from anywhere in the world. We are constantly reviewing the needs of our customers and we tailor our product range accordingly.

## HOW TO ARRANGE A VISIT

Please Ring our sales office on 0121 359 4322 and tell us when you want to visit. We can fit you in most days. Please give a brief outline of what you want to see so that we can arrange to have the most suitable machines available. Surtech trained engineers will be on hand to advise and demonstrate.

*Look at what's on offer*

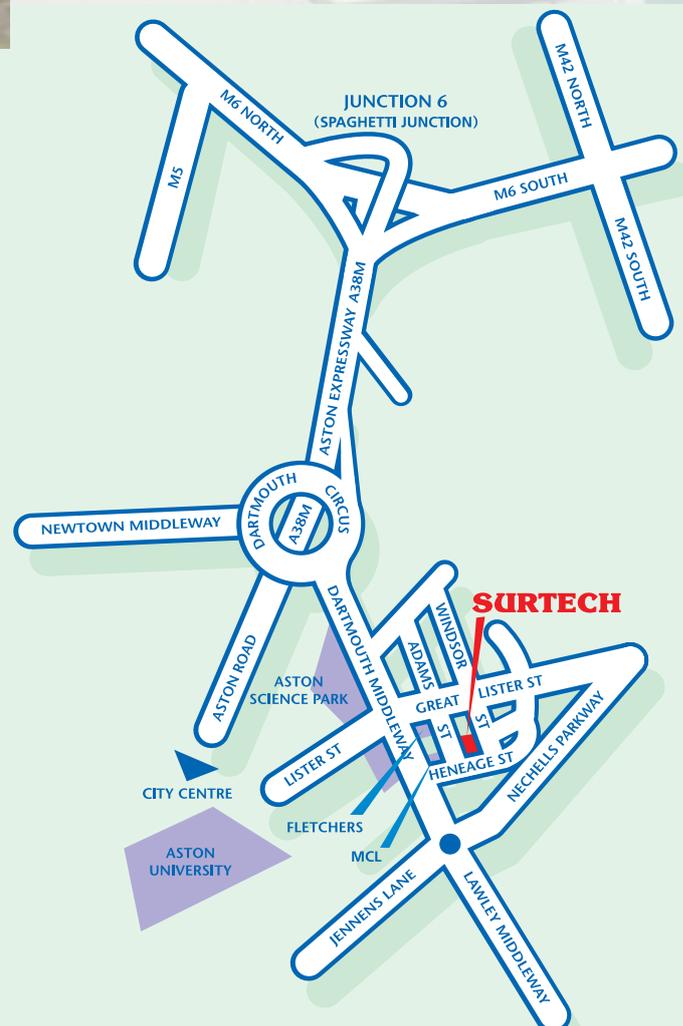
## HOW TO FIND US

Coming from **M6 North** or **South** exit at '**Junction 6**' (**Spaghetti Junction**) following signs '**Birmingham Central A38 (M)**' stay in left lane. Ignore first A38 (M) exit signposted '**Aston, Perry Barr**'.

Follow overhead signs to '**Ring Road, City Centre, Bromsgrove (A38)**'. Stay in left lane to leave roundabout at first exit and follow signs '**Wholesale and Indoor Markets**' then signs to '**Convention Centre, National Indoor Arena**' and finally '**Ring Road And Other Routes**', '**Birmingham Airport, NEC, Lichfield**'.

Stay in left lane to set of traffic lights outside '**Fletchers Autostore**'. Stay in left lane for approx another 100m and take first left turning into '**Heneage Street**', also signposted '**The Parkway Industrial Centre**'.

Surtech are the first Company on the left after '**Adams Street**'. Park outside or opposite on the industrial estate.



# Surtech

**Surface Technology Products Ltd**

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Tel: 0121 359 4322 Fax: 0121 359 1817

Email: [sales@surtech.co.uk](mailto:sales@surtech.co.uk) [www.surtech.co.uk](http://www.surtech.co.uk)

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Newly designed dedicated machines for deburring, corner rounding and oxide removal



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Bench top belt grinders



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Portable belt files and tube finishing tools



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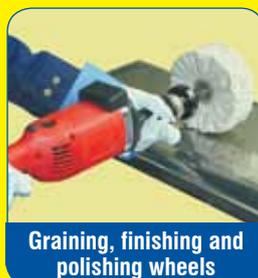
Multi-purpose belt grinders



Pneumatic, expanding & standard contact wheels



Polishing mops and compo



Graining, finishing and polishing wheels



Narrow and wide abrasive belts for all applications