

TOPIC 5 SURFACE GRINDING

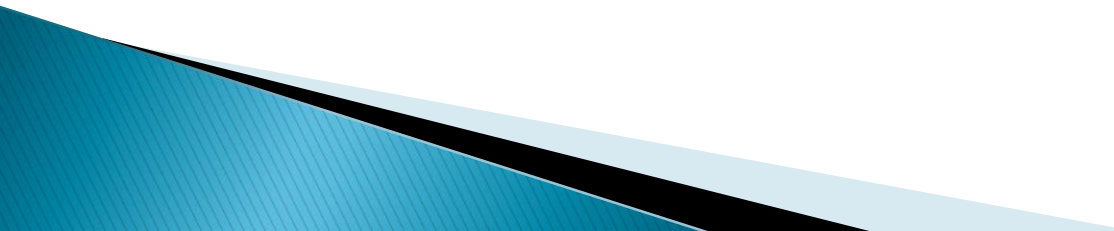


INTRODUCTION

Surface grinding is the removal of material on surfaces by the passing of the material against a revolving grinding wheel.

The grinding wheel has abrasive grains that act as individual cutting tools that remove the material.

Surface grinding is generally used to produce components to fine tolerances and improved surface finishes.



SAFETY RULES AND SAFETY PRECAUTIONS

Ensure the correct PPE is worn.

- Overall
- Safety boots
- Safety Goggles
- Gloves
- Hair net

Ensure the machine guards are in place.

- The grinding wheel guard must be in place at all times. This will protect the operator from injury if the grinding wheel breaks up during operation.

Clear the work area.

- If oil or cutting fluid is spilled on the floor it must be cleaned up.
- Floor area must free of any obstacles.
- Remove any tools or materials from the machine before operating.
- All tools and equipment must be in a safe place and returned to storage areas when job is completed.

SAFETY RULES AND SAFETY PRECAUTIONS

Check the grinding wheel for cracks and damage.

- Before mounting a grinding wheel visually check the grinding wheel for damage.
- Perform a ring test to test for cracks.

Ensure that the surface grinding machine is switched off when loading and un-loading a work piece.

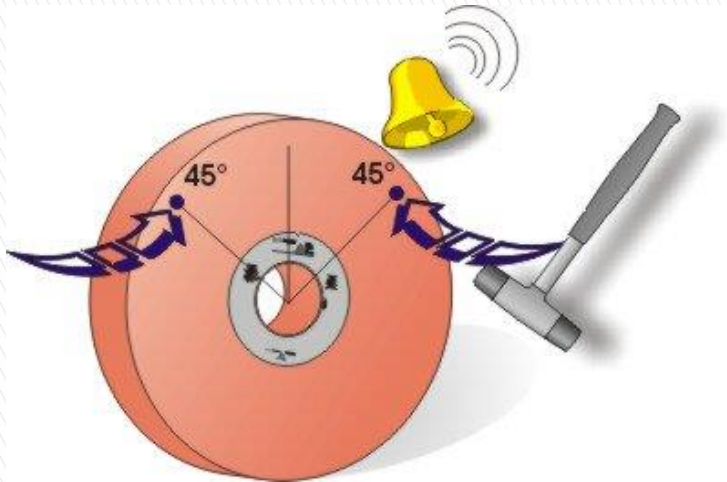
- Press the off button or emergency stop button when placing or removing a work piece, taking measurements or cleaning the machine.

Maintain the exhaust system for the grinding machine.

- The exhaust system is where the ground material is taken into. The pipes, sieves and tank must be kept clean and in good working order.

HOW TO PERFORM A RING TEST

LARGE GRINDING WHEELS



- Support the grinding wheel on a clean floor.
- Use a wooden/plastic hammer.
- Tap the wheel on each side at 45° about 20 – 50mm from the periphery of the wheel.

SMALL GRINDING WHEELS



- Hold the grinding wheel with your finger.
- Use a screwdriver handle.
- Tap the wheel on each side at 45° about 20 – 50mm from the periphery of the wheel.

GRINDING WHEEL SHAPES

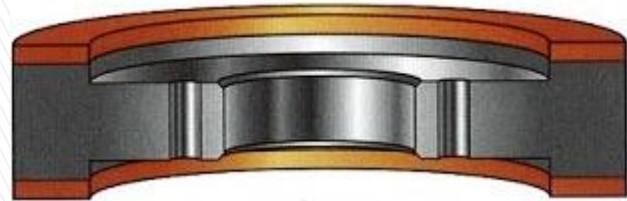


DISC/STRAIGHT

Is used for cylindrical, centreless internal and external and off- hand grinding operations



STRAIGHT CUP



DOUBLE CUP

Are used for tool and cutter grinding and surface grinding on vertical and horizontal machines. The double cup can be reversed when one side is damaged.

GRINDING WHEEL SHAPES



FLARING CUP

Is used for tool and cutter grinding for sharpening milling cutters and reamers



DISH

Are used in the tool room for sharpening cutting tools. Its thinness permits the insertion of the grinding edge of the wheel into narrow places.

DETERMINING THE TABLE'S SIDeways SPEED AND MOVEMENT

- The amount the cross feed of the grinding machine is adjusted to will determine the finish as well as the amount of material removed per stroke.
- As a guide for roughing the cross feed should be adjusted to $\pm \frac{3}{4}$ of the grinding wheels width per stroke
- For finishing the cross feed should be adjusted to $\pm \frac{1}{4} - \frac{1}{3}$ of the grinding wheels width.

DETERMINING THE SPEED AND LENGTH OF THE LONGITUDINAL TABLE TRAVEL

There are many factors that need to be considered when setting the speed of the longitudinal table travel such as:

- Material being ground
- Type of grinding wheel
- Grinding wheel manufacturer

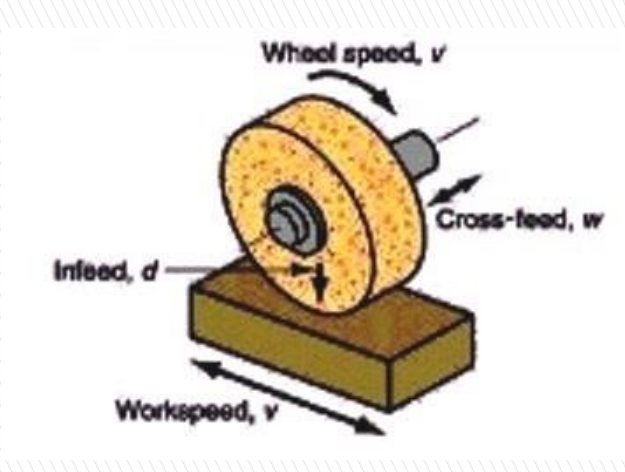
As a guide it should be set to remove the material being ground as fast as possible without wearing the grinding wheel to fast, and getting the required finish.

The length of the longitudinal table travel should be adjusted so that the grinding wheel clears the length of the work piece by $\pm 25\text{mm}$ at both ends.

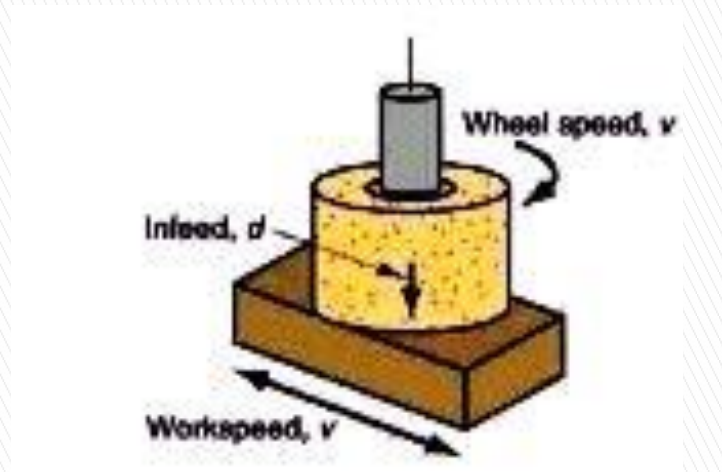
HORIZONTAL SURFACE GRINDING MACHINE



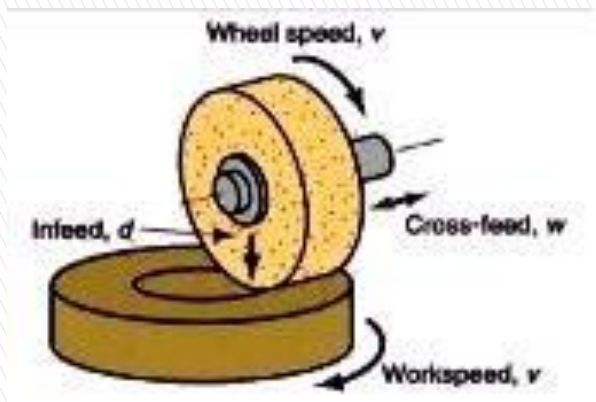
COMMON TYPES OF SURFACE GRINDERS



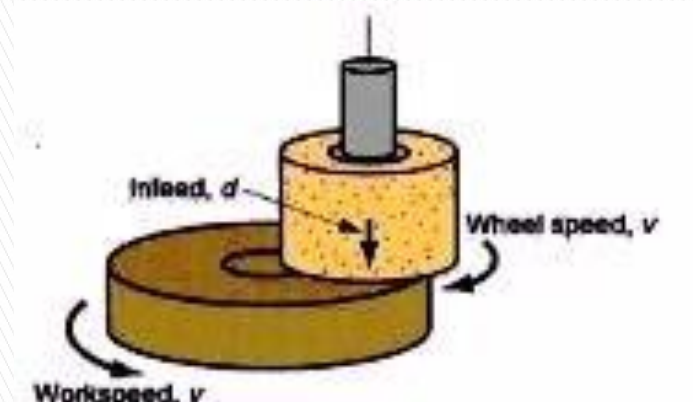
HORIZONTAL RECIPROCATING



VERTICAL RECIPROCATING



HORIZONTAL ROTARY



VERTICAL ROTARY

CHECK WHETHER TOOLS AND EQUIPMENT ARE IN GOOD WORKING CONDITION

The surface grinding machine tools and equipment must be inspected and the following checked to see if they are in good working order:

- Grinding wheel
- Arbour
- Magnetic table (chuck)
- Cross feed and table feed trips
- Spanner to tighten the wheel

MACHINE COMPONENTS TO CHECK

The surface grinder must be inspected before use and the following needs to be checked:

- Power supply
- Spindle stop, start controls
- Hand-wheels and feed dials
- Spindle-speed selection levers
- Feed selection levers
- Feed-engagement levers
- Power feed control
- Grinding fluid supply
- Emergency stop button

FACTORS TO CONSIDER WHEN SELECTING A GRINDING WHEEL

The following factors need to be considered when selecting a grinding wheel:

- The work piece material
- The hardness of the work piece material
- Required finish
- Wet or dry grinding
- Amount of material to be removed
- Wheel speed
- Contact area

ASSESSING THE GRINDING WHEEL CONDITION

New and used grinding wheels need to be checked before using them. The following checks need to be performed:

A visual check to see:

- The grinding wheel is not damaged.
- The grinding surface does not have grooves worn into its surface.
- The grinding wheel is not loaded or glazed.

A loaded grinding wheel has metal particles stuck in the pores of the grinding wheel usually caused when grinding softer metals.

A glazed wheel has a shiny appearance and the grinding wheel grit is worn down usually caused when grinding harder metals.

Perform a ring test to check for cracks, different types of wheels give a different sound.

- Vitrified or silicate wheels give a clear metallic sound
- Organic bonded wheels give a duller sound
- A cracked wheel should not give any ringing sound

SETTING THE SURFACE GRINDING MACHINE

Before using the surface grinding machine the following settings and adjustments need to be made:

- The grinding wheel needs to be dressed, trued and balanced.
- The work piece needs to be positioned and fixed correctly on the surface grinding table.
- The length of travel needs to be adjusted to clear the length of the work piece by ± 25 at each end
- The speed of the longitudinal feed needs to be set correctly.
- The amount of cross feed per longitudinal stroke needs to be set.
- The grinding wheel needs to be zeroed to the highest point of the work piece by touching the work piece with the grinding wheel rotating.

DRESSING, TRUING & BALANCING A GRINDING WHEEL

DRESSING

Dressing a grinding wheel is done to clean and sharpen the grinding wheel face.

Dressing needs to be done if the grinding wheel is:

Loaded: the pores of the grinding wheel are filled with ground material

Glazed: the grinding wheel is smooth or has a shiny appearance.

TRUING

Truing a grinding wheel is done to correct out of round conditions on a grinding wheel.

Truing needs to be done when a grinding wheel is mounted onto the spindle and during balancing.

BALANCING

Balancing a grinding wheel is needed when a very accurate and fine finish is needed on work piece.

Counter balance weights are adjusted to eliminate any vibration.

APPLY QUALITY CHECKS ON MACHINED COMPONENT

Once the component has been machined on the surface grinder it needs to be checked against the specifications given in the engineering drawing.

The **TWO** most important thing to check are

- **Quality of the surface finish**
- **The work piece is machined within tolerance**

Some of the measuring instruments to be used:

- **Micrometers (Outside, depth, inside)**
- **Precision Engineer's Square**
- **Dial test indicator**

RECOGNISE AND REPORT PROBLEMS, CHANGES AND MALFUNCTIONS IN OPERATIONS

While performing surface grinding operations the operator may experience various problem or malfunctions. The operator then needs to try to correct them or report them to someone above.

The **THREE** most common problems that occur on the work piece are:

- **Scratches** – caused by dirty coolant, dirt from under the wheel guard or the grinding wheel too hard.
- **Chatter marks** – caused by a vibration such as, unbalanced grinding wheel, machine not level, wheel not trued and dressed properly, too much pressure on the spindle etc.
- **Burn marks** – insufficient coolant, grinding wheel is pressing too hard, table speed too slow, stock removal too great, wheel too hard and wheel is dull and clogged.

RECOGNISE AND REPORT PROBLEMS, CHANGES AND MALFUNCTIONS IN OPERATIONS

While performing surface grinding operations the operator may experience various problem or malfunctions. The operator then needs to try to correct them or report them to someone above.

| SCRATCHES IN THE WORK PIECE | |
|--|---|
| CAUSES | SOLUTION |
| <ul style="list-style-type: none">• Dirty coolant | <ul style="list-style-type: none">• Replace with clean coolant |
| <ul style="list-style-type: none">• Loose particles | <ul style="list-style-type: none">• Wash the particles away |
| <ul style="list-style-type: none">• Dirt coming from under the wheel guard | <ul style="list-style-type: none">• Make sure that the wheel guard is cleaned |
| <ul style="list-style-type: none">• Grinding wheel too hard | <ul style="list-style-type: none">• Use a softer grade wheel |

RECOGNISE AND REPORT PROBLEMS, CHANGES AND MALFUNCTIONS IN OPERATIONS

CHATTER MARKS ON THE WORK PIECE

| CAUSES | SOLUTION |
|---|--|
| <ul style="list-style-type: none">• The levelling screws in machine base are loose | <ul style="list-style-type: none">• Tighten and lock them |
| <ul style="list-style-type: none">• Table not fully supported | <ul style="list-style-type: none">• Re-scrape the contact surfaces of table and bed sideways |
| <ul style="list-style-type: none">• Flanges do not fit firmly on the grinding wheel spindle taper | <ul style="list-style-type: none">• Make sure both flanges are cleaned and fitted correctly |
| <ul style="list-style-type: none">• Wheel is not dressed correctly | <ul style="list-style-type: none">• Dress wheel correctly with diamond point dresser |
| <ul style="list-style-type: none">• Too much pressure on grinding spindle | <ul style="list-style-type: none">• Reduce the depth of cut or feed rate |
| <ul style="list-style-type: none">• A worn wheel spindle | <ul style="list-style-type: none">• Replace spindle |
| <ul style="list-style-type: none">• Wheel out of balance or not running true | <ul style="list-style-type: none">• Balance and true the grinding wheel |

RECOGNISE AND REPORT PROBLEMS, CHANGES AND MALFUNCTIONS IN OPERATIONS

BURN MARKS ON THE WORK PIECE

| CAUSES | SOLUTION |
|--|--|
| • The grinding wheel pressing too hard | • Reduce the depth of cut |
| • The table speeds are too slow | • Increase the table speed |
| • Stock removal too great | • Reduce cross feed |
| • Grinding wheel too hard | • Use a softer wheel or increase table speed |
| • Grinding wheel is dull and clogged | • Dress the grinding wheel |
| • Not enough coolant | • Increase the amount of coolant |