How to select the Right Grinding Wheel

FACTORS AFFECTING GRINDING WHEEL SELECTION

As the grinding wheel is a form of cutting tool, the abrasive, grit-size, grade and bond type should be correctly selected to fit the particular job. There are 6 factors which affect the choice of a grinding wheel specification.

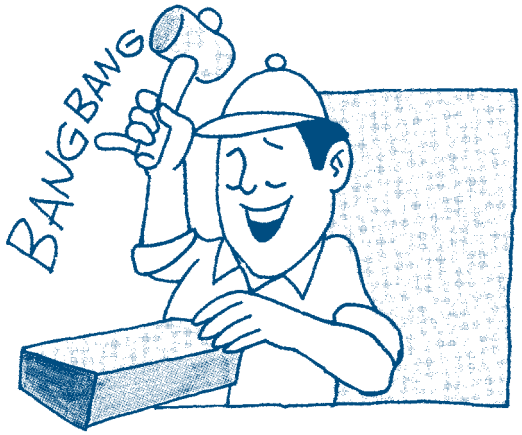
1. Material to be ground and its hardness.
2. Amount of stock removal and finish required.
3. Whether the grinding is done wet or dry.
4. Wheel speed.
5. Area of grinding contact.
6. Severity of the grinding operation.

MATERIAL TO BE GROUND AND ITS HARDNESS

Let us first consider the material to be ground, and its hardness which affects the choice of abrasive, grit-size and grade.

Abrasive : Generally, Aluminium Oxide abrasives are well suited for steels and ferrous metals, while Silicon Carbide abrasives are ideal for grinding cast iron, non-ferrous metals and non-metallic materials.

Grit Size : A relatively fine grit-size works best on hard and brittle material. A coarser grit capable of taking heavier cuts can be used advantageously on soft and ductile materials that are readily penetratable. The figures given below illustrate this.



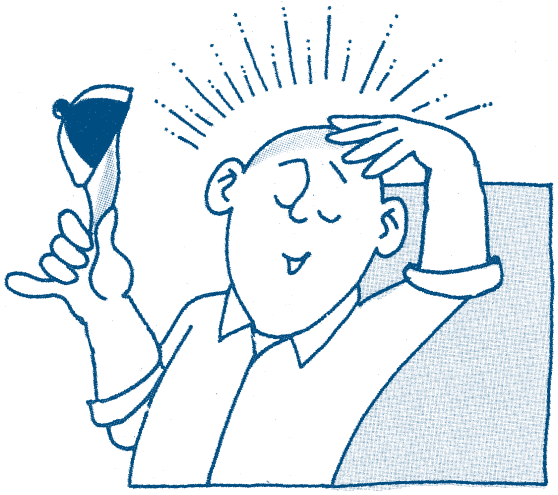
To explain, on hard materials the increased number of cutting points, on the face of a moderately fine grit wheel (Fig. 1) will remove stock faster than the fewer cutting points presented by a coarser wheel (Fig. 2). The larger abrasive grains in a coarser grit wheel can not penetrate as deeply into the hard work-piece without burning it.

HARD MATERIAL Fig. 1 | HARD MATERIAL Fig. 2 | SOFT MATERIAL Fig.3

On soft ductile materials, however, the larger grains penetrate easily and provide the necessary chip clearance to minimise wheel loading (Fig. 3) and heat generation.

Grade : The hardness of the material to be ground also affects the choice of the wheel grade or hardness. A harder grade can be used on soft, easily penetrated materials than on hard materials which naturally tend to dull the wheel faster. However, the softer grade wheel releases the dulled grains more readily, enabling the new, sharp grains lying under it to do the work.

AMOUNT OF STOCK REMOVAL AND THE FINISH REQUIRED

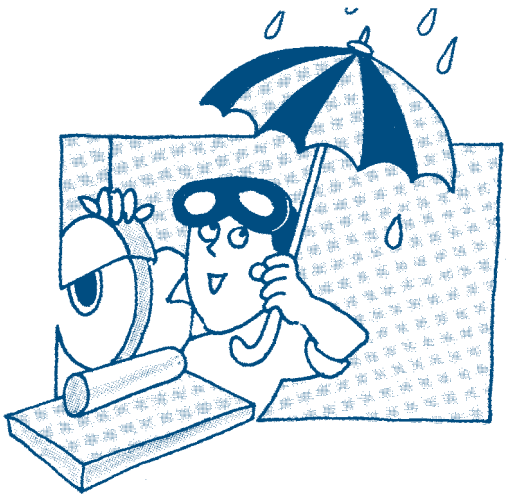


The second factor in selecting the correct wheel is the amount of stock to be removed and the finish required. These affect the choice of grit-size and bond.

Grit-size : As a rule, coarser grit is selected for fast-cutting action and fine grit where a high finish is required.

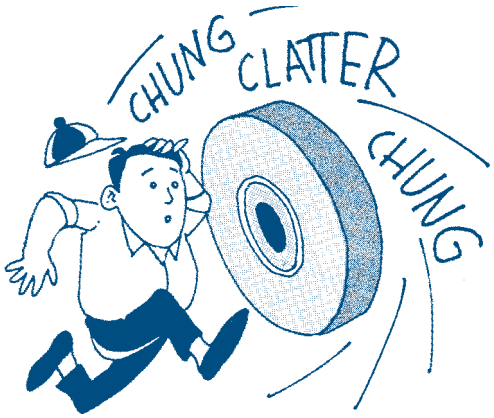
Bond : Vitrified bonded wheels are generally used for fast-cutting action and commercial finish. Resinoid, Rubber and Shellac bonded wheels produce the highest finish.

IS THE OPERATION WET OR DRY?



Generally for precision grinding, coolant is necessary. However, in some cases (e.g. Tool Regrinding) the process may be dry, in which case a softer grade wheel may be necessary. Whereas for wet grinding, a one grade harder wheel can be used as the coolant reduces the heat generated in grinding.

WHEEL SPEED



The speed at which the grinding wheel is to be operated often dictates the type of bond. Vitrified Bonded wheels should not be used at peripheral speeds over 33 meters per second except for specially designed wheels.

Standard organic bonded wheels (resinoid, rubber and shellac) are used in most applications of over 35 meters upto 45 meters per second, and specially designed wheels for speeds upto 80 meters per second.

The speed at which a grinding wheel revolves is important. Too slow a speed means wastage of abrasive without much useful work achieved, whereas an excessive speed may result in a hard grinding action and may introduce the danger of breakage. **Hence the safe operating speed marked on the wheel or blotter, in revolutions per minute must never be exceeded.**

As a general rule, it is best to operate a grinding wheel at somewhere near the speed recommended for a certain grinding operation. The wheel design is based on the assumption that approximately the recommended speeds will be employed.

Some of the more common operating speed guidelines for particular types of grinding wheels are listed below, in surface meters per second.

A mild abrasive such as 86A, 32A or 38A is best

Type of Operation	Common Oper. Speed in mtrs/sec
Cut-off (Rubber, Shellac and Resinoid)	45 – 80
Crankshaft Grinding	36 – 60
Cylindrical Grinding	25 – 45
Disc Grinding	20 – 45
Internal Grinding	20 – 80
Mounted Points (Speed varies with shape, mandrel diameter and overhang)	45 – 48
Snagging – Resinoid	45 – 48
Snagging – Vitrified	28 – 33
Surface Grinding	20 – 33
Tool Grinding	25 – 33
Cutting off (Below 400 mm diameter)	48 – 80
Thread Grinding	33 – 80
Track Grinding	33 – 125
Camshaft Grinding	33 – 80
Centreless Grinding	33 – 60

Note: Higher speeds are recommended only where the bearings, protection devices and machine rigidity are adequate.

The speed table given on Page 47 will be of assistance to you in determining the recommended revolutions per minute for various diameters of grinding wheels.

As a general rule, wheels are expected to be operated at or near the recommended optimum speed for the specific application. This is to be borne in mind when selecting the specification. If, however, the operating speed is different from the one recommended, then at least a change in grade would be necessary.

AREA OF GRINDING CONTACT

The area of grinding contact between the wheel and the work affects the choice of grit-size and grade.

Grit-size : A coarser grit is required when the area is relatively large, as in surface grinding, to provide adequate chip clearance between the abrasive grains. As the area of grinding contact becomes smaller and the unit pressure tending to break down the wheel-face becomes greater, finer grit wheels should be used.

Grade : On large areas of contact, a soft grade wheel provides normal breakdown of the grit, ensuring a continuous free-cutting action. On the other hand, a harder grade is needed to withstand the increasingly higher unit pressure, as the area of contact becomes smaller.

SEVERITY OF THE GRINDING OPERATION

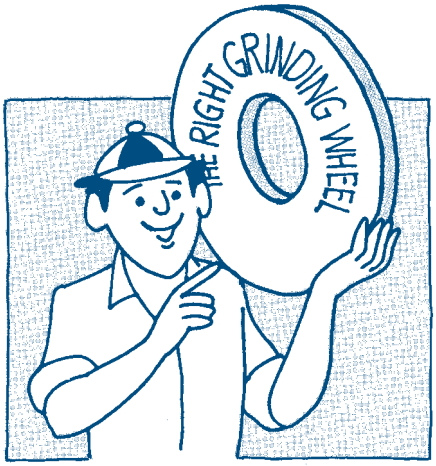
This affects the abrasive and grade.

Abrasive : A tougher abrasive like A is required for a severe grinding operation like snagging.

for light grinding operations. An intermediate abrasive like 68A or 19A is used for grinding jobs of average severity.

Grade : The severity of the grinding operation also influences the 'grade'. Hard grades provide durable whels for rough grinding such as snagging, while medium and soft grade wheels are generally used for less severe precision grinding operations.

CONCLUSION



Selecting the right grinding wheel for a specific application, if properly understood, is not difficult. In actual practice, where rate of production as well as accuracy and surface finish are important, the grinding wheel must be selected with the utmost care.

Sometimes, the first selection of the wheel may not turn out appropriate and modifications in grade or grit-size, or both, may be necessary. In such cases, a correct specification could be established after conducting trials in two or three different grits and arriving at the optimum grade.

The skill of the operator also plays an important role in the correct use of a grinding wheel. A skilled operator can make a wheel act one grade softer or harder by varying the other parameters like work speed, traverse, feed, etc.