

GRINDING WHEEL SAFETY

Introduction

The risk of breakage is inherent in every grinding wheel. The number of accidents and the circumstances in which they have happened clearly indicates that they could have been avoided by adhering necessary safety precautions while usage. Many cases of wheel breakage can be traced directly or indirectly to careless handling or improper storage or wrong usage during operation. Hence the safety at every stage is very essential as mentioned below: -

- Safety in the receiving room
- Safety in storage room
- Safety during usage

Safety in the receiving room

Unpacking

All wheels are inspected by the manufacturer prior to packing and are sent out in perfect condition. They should be unpacked and inspected as soon as received to determine if the wheels have been damaged in transit.

Note first condition of the container. If it appears to have been subjected to rough handling and contents damaged, have it held intact and requests the transporter to inspect the shipment.

If the container is in good condition, Open; exercise care that the tool used does not damage the contents. There is right and wrong way of opening each of the several types of containers used in shipping abrasive wheels and a few suggestions on the subject are offered.

Opening Barrels: The top hoops should be removed before the head is knocked in.

Wooden Boxes: Remove all nails from the lid with a nail puller. Do not attempt to knock the lid with a hammer.

Cardboard Cartons: A screw driver or staple remover should be used to remove the metal staples after which the four sections of the top may be folded back. The packing material may then be loosened and the wheels lifted out and placed on a bench.

Inspection

Clean all packing material from the wheels with a brush. Check quantity, size, grit, grade and bond against packing slip and invoice.



In the case of vitrified wheels, where size permits, the wheel may be suspended by slipping one finger through the hole and tapping gently with a light instrument, such as the handle of a screwdriver. For large wheels use a wooden mallet. If evidence of a crack is found, that wheel should be set aside and notice sent to the manufacturer. Vitrified wheels emit a clear metallic ring in a normal way, but oil or water soaked wheels do not ring clearly.

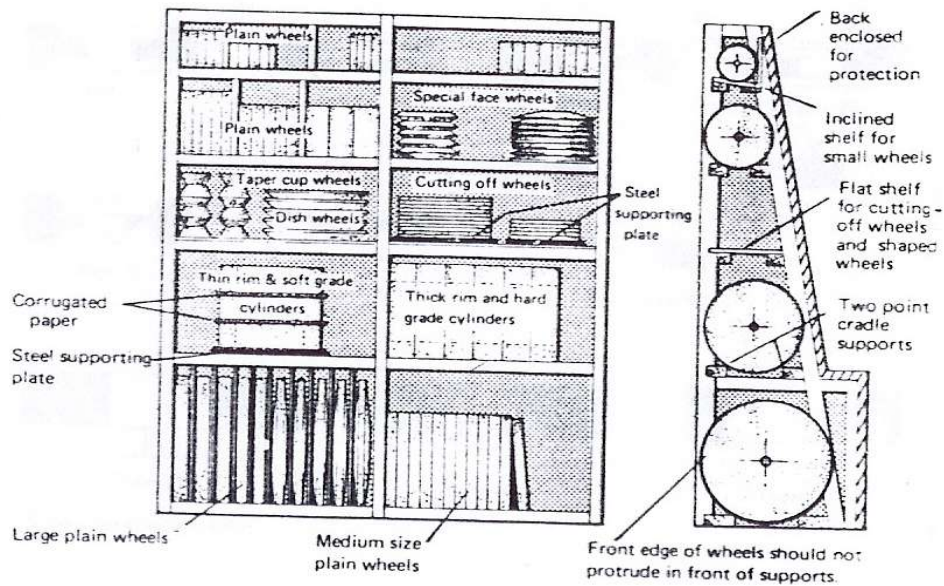
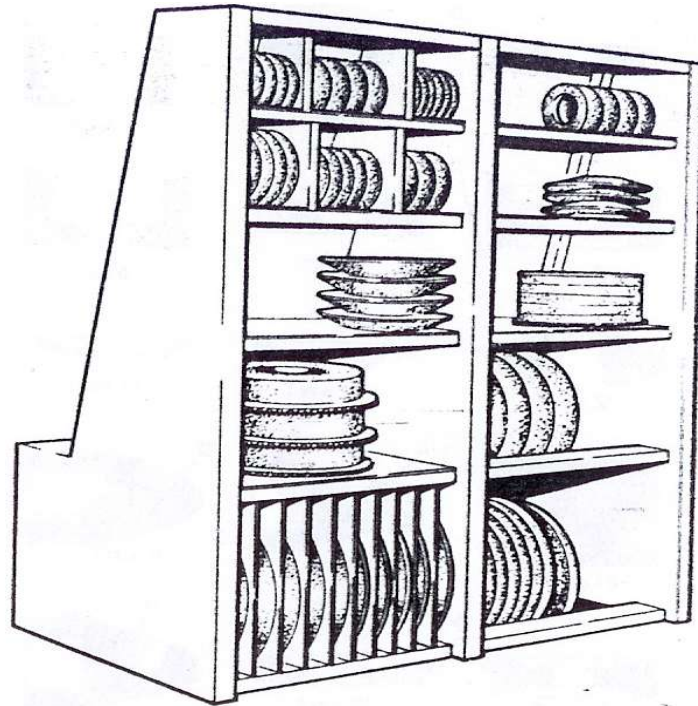
Handling

All grinding wheels are relatively fragile. The following guidelines should be followed while handling the grinding wheels to avoid chipping, cracking and breakage.

1. Do not roll grinding wheel. Wherever this is unavoidable because of the larger size of the wheel, a soft resilient floor is essential.
2. Use suitable conveyors or Turks, which will provide proper support when transporting wheels, which can not be carried by hand.
3. Stack and support wheels on trucks so that they will not get damaged or chipped. Do not keep any heavy material on top of wheels while transportation.

Safety in storage room

A Typical Wheel Storage



All stocks of abrasive wheels should be stored in racks in a storeroom. In general all straight wheels 150 mm dia and larger should be placed on edge in suitable racks in such a way that they can not tip over or roll. Expiry dates on resinoid wheels should be observed and issues of such wheels should be on a "first in first" out basis. A storage rack suitable for all types of wheels is illustrated as above.

Safety during Usage

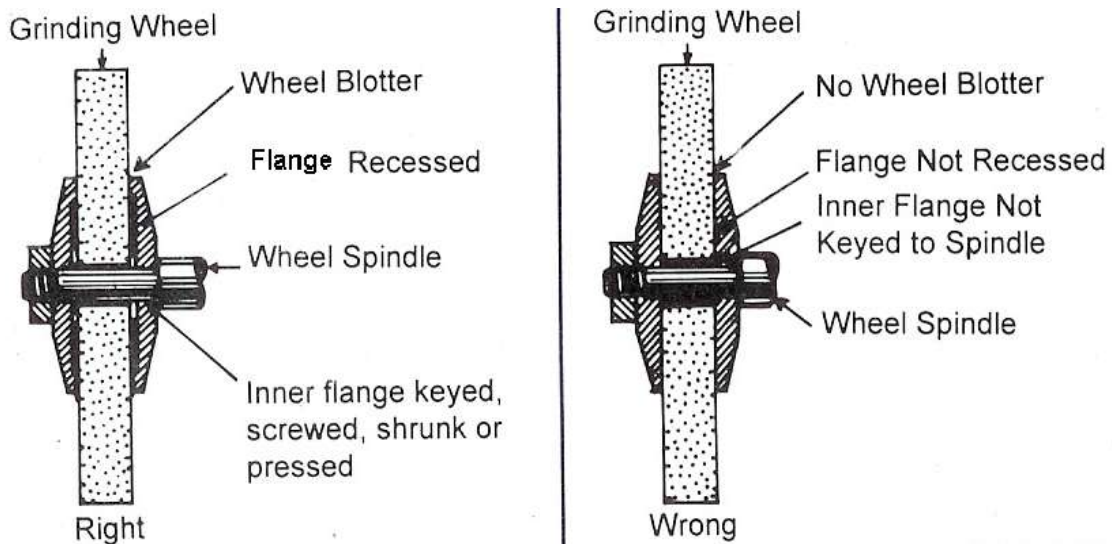
Mounting

Before mounting, every wheel should be ring tested (applicable for vitrified wheels)

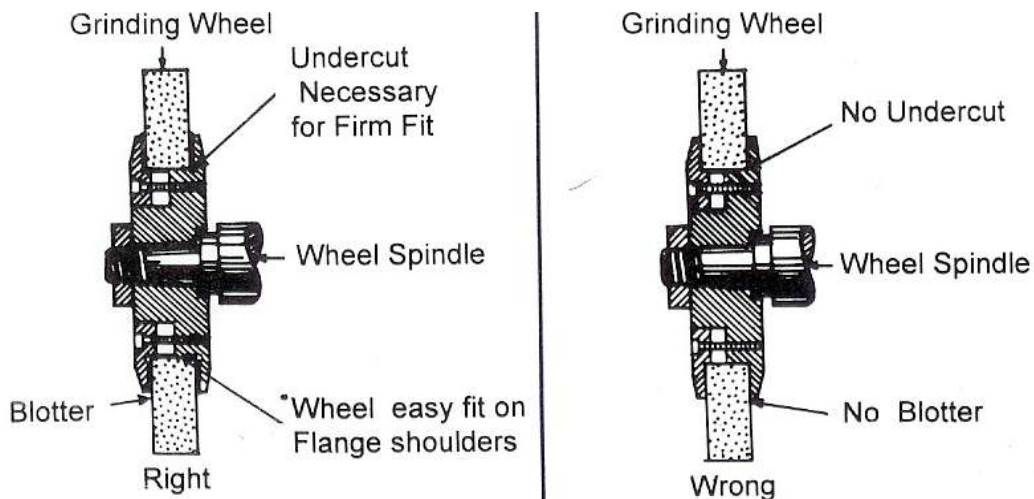
See that wheel slips freely on the spindle without binding. In general the bore size should be about 0.127 mm larger than the spindle diameter for the bore size larger than 127 mm.

As illustrated, there must be a flange on each side of wheel and these flanges must of equal diameter. All flanges must be relieved in the center so that the bearing surface will be on the outer unrelieved portion of the flange. Refer annexure 1 for the flange dimensions as per IS 1991 – 1993

Proper and improper methods of mounting wheels having small holes



Proper and improper methods of mounting wheels having large holes



The inner flange should be keyed or otherwise fastened to the wheel spindle. When mounting the wheel on the spindle should be pushed snugly against the inner flange with blotter between them. The purpose of blotter is: -

- a) To compensate for slight irregularities of the surface of the flange and the abrasive product
- b) To increase the coefficient of friction between the abrasive product and the flanges
- c) To distribute the equally the clamping force over the entire flange clamping area of the abrasive product and to reduce wear of the flanges.

Blotters need not be used when mounting the following wheels: -

Depressed Centre Wheels, Type 27 and 28

Semi Flexible wheels, Type 29

Plain cut off wheels, Type 41 with thickness less than 1 mm

Small wheels with outside diameter less than 20 mm

Segments, Type 31,

Honing Stones,

Wheels tapered on both sides, Type 4

(Source EN12413 : 1999)

For the large wheels, mounting on the spindle should be as per "Mount Up" mark marked on the grinding wheel. For details refer annexure 2.

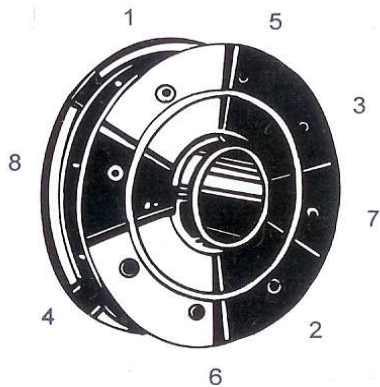
Check to make sure that wheel bears uniformly around the bearing surface of the flange. The outer flange should have an easy, sliding fit on the spindle, so that it can adjust itself slightly to give a uniform bearing on the wheel and blotter.

Correctly mounted, the wheel should be held that tightly enough between the flanges to prevent wheel slippage and to transfer the driving torque

Care must be exercised in tightening the several bolts to give uniform pressure. First run up all the bolts with the fingers. Then tighten one bolt and do the same with the bolt diametrically across. Continue as shown in the diagram until all of the bolts have been tightened.

Excessive tightening should be avoided. Tightening can be done with the help of torque wrench or by uniform hand pressure with a spanner. The maximum permissible torque is dependent on flange design and the material and since these are determined by the machine builder and their recommendations should be followed.

Tightening Sequence



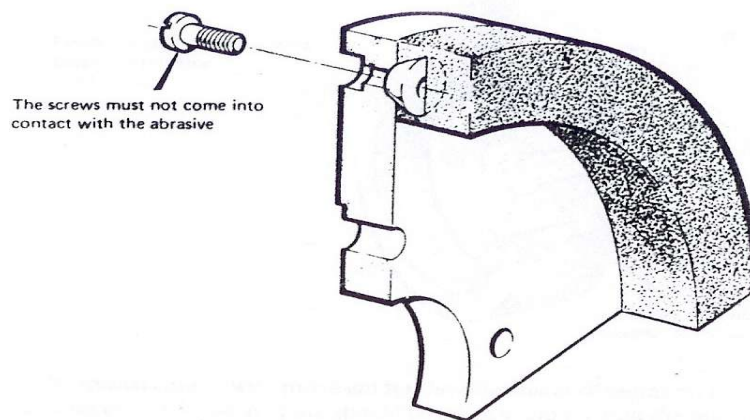
After mounting, wheels should be balanced.

Multiple or gang mounted wheels

The mounting of several wheels to the spindle is only permissible when the wheels and the grinding machine are designed as appropriate for the purpose of the wheel and machine manufacturer. Wheels to be multiple or gang mounted shall be marked in a manner to assure that they are correctly mounted on the machine spindle. Additionally each wheel shall be identified as being part of the set.

Nut inserted wheels or F type wheels 1

While mounting nut inserted wheels, thread engagement should not exceed the nut depth and it must not come in to contact with the abrasive. This may cause nut pulling out problem.



The back plate should be maintained true and flat to provide the even support to the area of contact between plant and wheel.

Wheel Speed

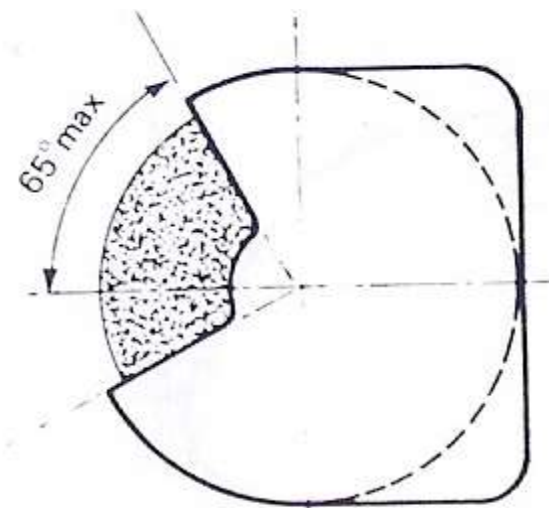
The grinding wheel manufacturer specifies maximum operating speed (MOS) for various types and grades of wheels. The operating speed of the wheel spindle should not exceed MOS.

Before the wheel is run, the guard should be properly adjusted and secured. If the machine is fitted with work rest, it should be adjusted as close as possible to the wheel and the wheel should be rotated by hand to ensure that it is all clear the way round.

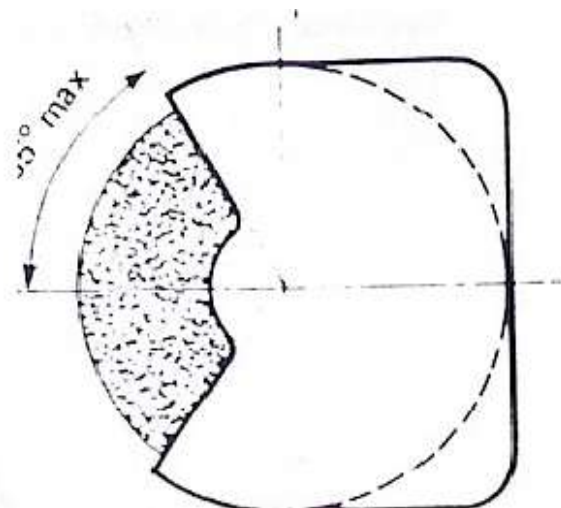
Wheel Guard

The wheel guard should have adequate strength to prevent injury from flying fragments. Wheel enclosure angles for various fixed machines are illustrated below:-

Bench and Pedestal Grinders

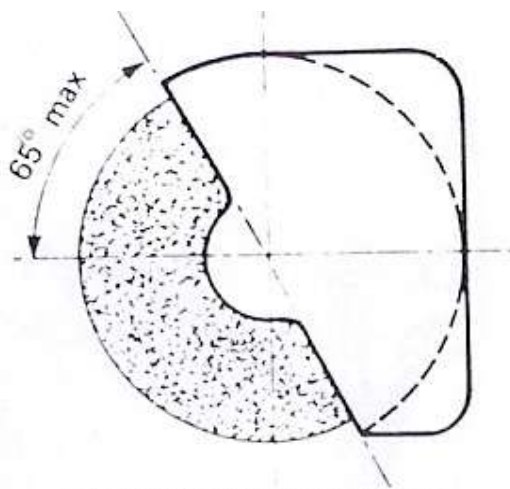


Minimum Enclosure 270 deg



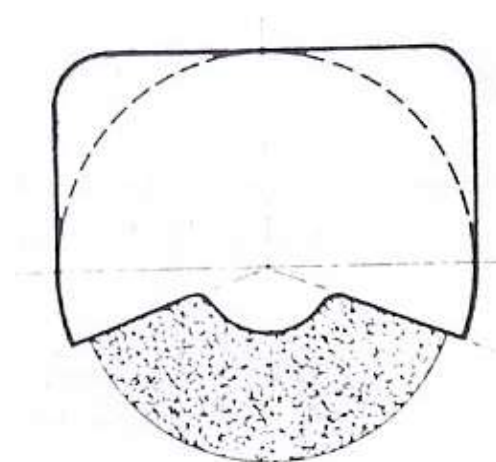
Minimum Enclosure 235 deg

Cylindrical Grinder



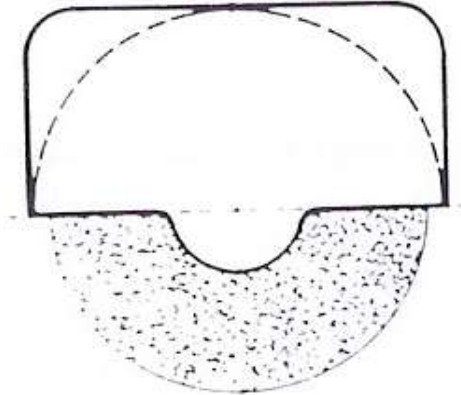
Minimum Enclosure 180 deg

Surface Grinding and Cutting off M/c



Minimum Enclosure 210 deg

Swingframe Grinder



Minimum Enclosure 180 deg

Personal Safety

- Wear Safety goggles at all times when performing any grinding operation.
- Avoid personal contact with moving wheel or work
- See that all safety equipment (guards and hoods) is in place.
- See that clothing does not come into contact with the moving wheel or work. A loose necktie or shirt may catch between the fast moving wheel and the work and draw into the machine.

Annexure - I

Flange Dimensions

(Source : IS1991 -1993)

TABLE-1

IMPORTANT DIMENSIONS OF FLANGES FOR STRAIGHT WHEELS WITH SMALL HOLES

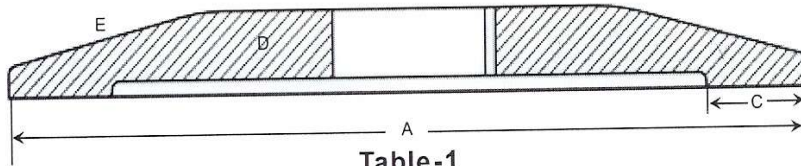


Table-1

Diameter of Wheel	B Minimum Outside Dia. of Flanges	C Radial Width of Bearing Surface		D Minimum Thickness of Flanges at Bore	E Minimum Thickness of Flanges at edge of Recess
		Maximum	Minimum		
25	10	2	3	2	2
50	20	3	5	3	2
75	25	3	6	5	2
100	32	5	10	5	3
125	38	5	10	6	3
150	50	6	13	10	5
175	63	6	13	10	5
200	75	6	13	10	5
250	88	8	16	10	6
300	100	8	16	13	8
350	114	10	20	13	8
375	125	13	25	13	8
400	140	13	25	13	8
450	150	13	25	16	10
500	175	16	32	16	10
550	190	16	32	16	11
600	200	20	32	16	11
650	215	20	32	16	13
700	225	20	32	16	13
750	250	22	38	20	13
825	275	25	50	22	20
900	300	25	50	22	20
1050	350	25	50	22	20
1125	375	32	50	29	25
1200	400	32	50	29	25
1350	450	32	50	32	29
1500	500	32	50	32	29
1575	525	32	50	32	29
1800	600	32	50	38	21

TABLE-2
IMPORTANT DIMENSIONS OF FLANGES FOR STRAIGHT WHEELS WITH LARGE HOLES

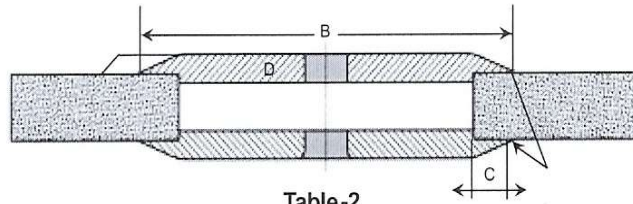


Table-2

Wheel Diameter	Hole Diameter	B Minimum Flanges Dia.	D Minimum Thickness of Flanges at Bore	E Minimum Thickness of Flanges at edge of Recess
300 to 350	100	150	16	10
	125	175	16	10
	150	200	16	10
Larger than 350 upto 450	100	150	16	10
	125	175	16	10
	150	200	16	10
	175	225	16	10
	200	250	16	10
Larger than 450 upto 600	150	200	20	13
	175	225	20	13
	200	250	20	13
	250	300	20	13
	300	350	20	13
Larger than 600 upto 900	300	375	20	13
	400	500	29	22
	500	600	32	25
Larger than 900 upto 1200	300	400	25	20
	400	500	29	22
	500	600	32	25
Larger than 1200 upto 1500	400	500	29	22
	500	600	32	25
	600	725	32	25

TABLE - 3

MINIMUM DIMENSIONS OF STRAIGHT COLLET FLANGES USED AS WHEEL SLEEVES FOR PRECISION GRINDING ONLY

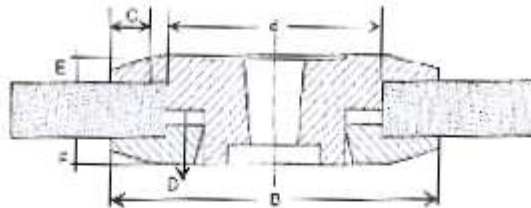


Table-3

Wheel Diameter	Wheel Hole	B Minimum Outside Diameter of Flanges	D Minimum Thickness of Flanges at Bore	E Minimum Thickness of Flanges at edge of Recess
300 to 350	125	175	13	11
	125	175	13	11
	150	200	16	11
Larger than 350 upto 500	200	250	16	11
	250	290	16	11
	300	340	16	11
Larger than 500 upto 750	200	250	20	13
	250	290	20	13
	300	340	20	13
	400	440	20	13
Larger than 750 upto 1250	300	340	20	13
	400	440	20	13
	450	490	20	13
	500	540	20	13
Larger than 1250 upto 1700	400	500	25	20
	500	600	25	20
	600	725	29	22

TABLE - 4

MINIMUM DIMENSIONS FOR TAPERED PROTECTION FLANGES
FOR SPEED UPTO 33 PERIPHERAL METERS PER SECOND

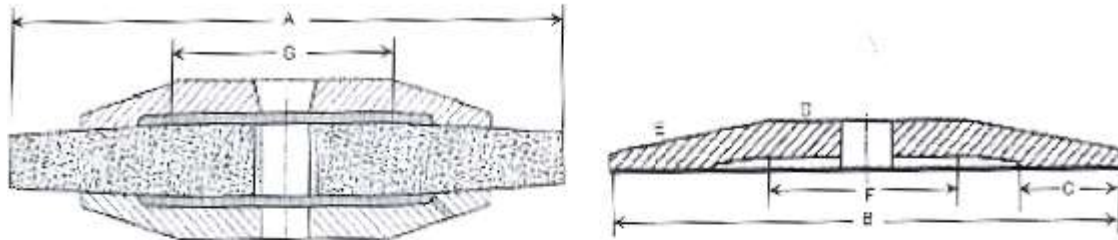


Table-4

Wheel Dia.	B Minimum Outside Diameter of Flanges	C RadialWidth of Bearing Surface		D Minimum Thick- ness of Flange at Bore	E Minimum Thick- ness of Flanges at edge of Recess	F Maxi- mum Flat spot at Centre of Flange Inside	D Maxi- mum Dia. of Flat spot or Hub of Wheel
		Maximum	Minimum				
150	75	6	13	10	5	100	25
200	100	8	16	10	6	100	25
250	125	13	25	13	6	100	50
300	150	13	25	16	8	100	114
350	200	16	32	16	10	100	114
400	250	20	38	16	10	100	50
450	300	25	50	20	13	100	150
500	350	32	63	20	13	100	150
550	400	35	75	20	14	100	150
600	450	20	75	14	14	100	150
650	500	38	83	20	16	100	150
700	550	45	95	22	16	100	150
750	600	50	100	22	20	100	150
900	700	50	100	25	22	100	150

Annexure - II

Mount Up Mark For Large Dia Wheels

In order for a grinding wheel to slip onto the machine mount properly, the arbor hole has to be "oversize" with .005 to .010" clearance. This is sufficient to cause excessive and unnecessary dressing of the periphery if the wheel is not mounted in the same relative position that it was when our finishing room cut the outside diameter on the lathe.

To reduce the amount of dressing required on the grinding machine, and to assure the best possible balance and concentricity initially, it is our standard practice to mark the wheels to show how they were mounted on the lathe. The words "Mount Up" indicate this position.

Operators and setup men should duplicate this position when mounting the wheel for the grinding machine.

When the wheel is mounted directly on the machine, as on a #2 Centerless or medium size Cylindrical grinder, with the wheel handing before the flanges are tightened, the "Mount Up" (figure #1) should be at the top or 12 o'clock position.

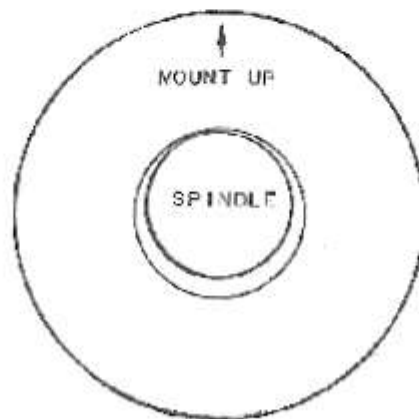


Figure 1

With the arbor mount resting on the floor, and the wheel in a horizontal position, the wheel should be pulled over to touch the arbor at a point closest to the words "Mount Up" (Figure #2).

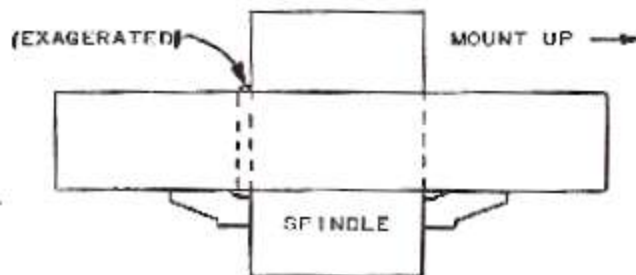


Figure #2

However, when the wheel, or wheels (as on a Twin Grip Centerless) are lined up in a vee block, the words "Mount Up" should be DOWN so that when the arbor is inserted through the wheels, it will contact the wheels in the area closest to the "Mount Up" position (Figure #3).

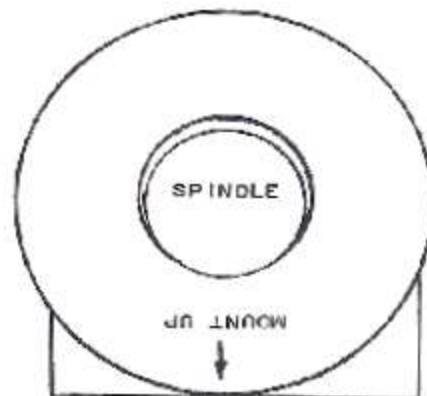


Figure #3

Use of an overhead crane requires the wheel to be in a position so that the "Mount Up" is at the top as in Figure 2. After the shoulder of the spindle is seated against the side of the wheel, lift the assembly off the wooden V-block so that the spindle and wheels are suspended by the crane. Using a wooden mallet, tap both the wheels to be sure they rest squarely on the spindle and are not cocked. The flange should be mounted to the spindle while it is suspended by the crane.