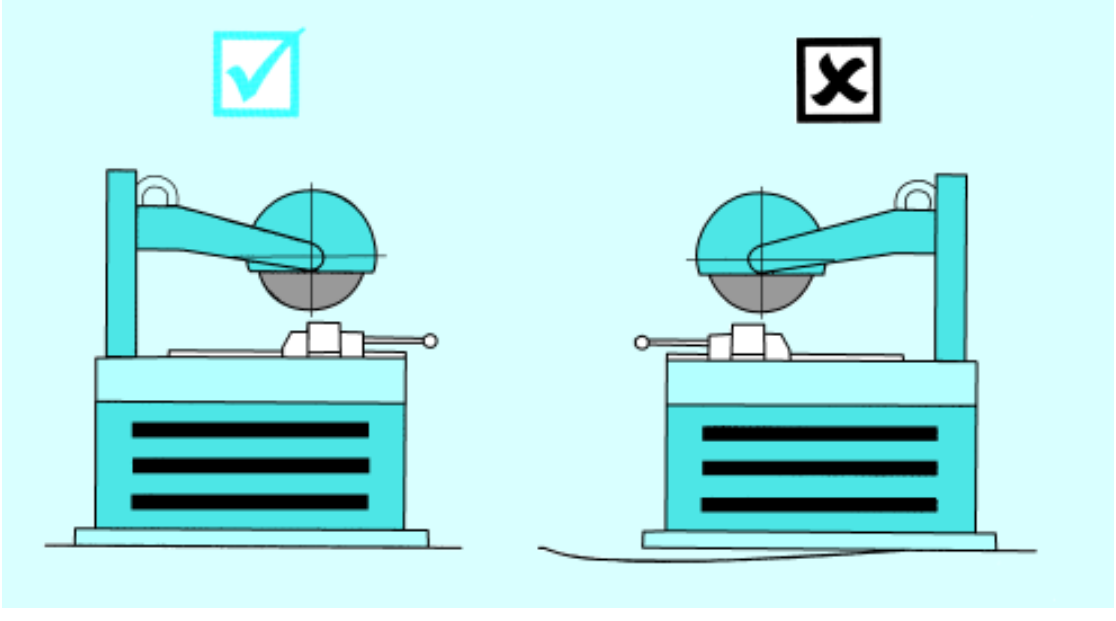
Safety measures in the usage of Grinding Wheels :

SAL grinding wheels are manufactured to very high standard specifications and are subjected to stringent quality tests before they are sold to the customer. However, much depends on their correct and safe usage. A badly handled or misused wheel can not only be under productive, but could also, in extreme cases, prove dangerous to the user. It is therefore the user's responsibility to strictly observe the safety requirements in the handling, mounting and operating of the grinding wheel.

Wheel Mounting Procedures :

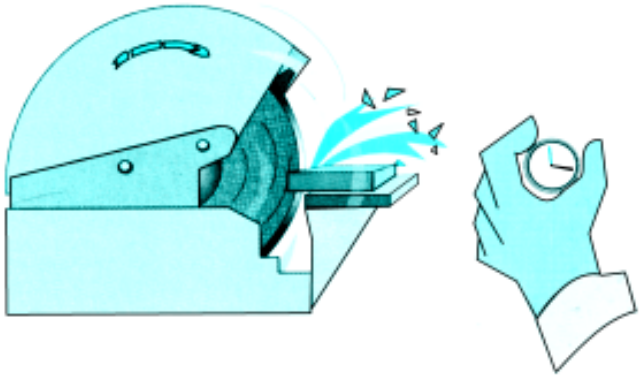
- The wheel must be mounted only by a trained and certified person, competent to carry out the job.
- Before mounting, a grinding wheel must first be checked for damage and a 'ring test' should be conducted to ensure that the wheel is in good condition.
- The wheel should be mounted only on the machine for which it is intended.



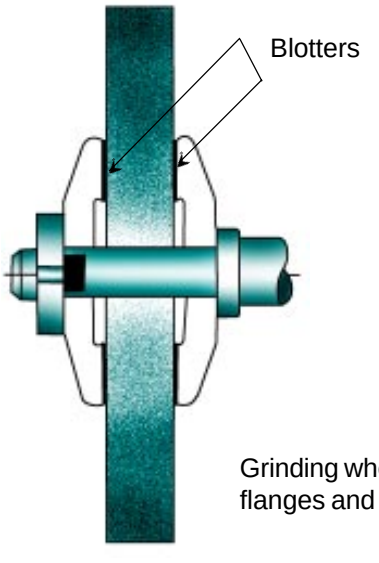
- The area surrounding a grinding machine should be free from obstruction. For wet grinding operations, splash guards should be provided to prevent the floors surrounding the machine from becoming slippery.
- Wheel guards should be securely fitted before a wheel is run. This will protect the operator by containing or diverting the fragments of an accidentally broken wheel.
- Work rests should be adjusted as close as possible to the grinding wheel.

Wheel Mounting Procedures :

- The speed marked on the machine should not, under any circumstances, exceed the speed marked on the wheel blotter or any other document. Operating wheels beyond the maximum permissible speeds or 'MOS' indicated, may cause them to break and lead to fatal accidents.



- The wheel should fit freely, but not loosely, on the spindle. The grinding wheel should be fixed to the spindle without applying force and then securely clamped to it.
- Flanges should be clamped firmly and run true to the spindle. Their bearing surfaces should be flat and free from burrs. Any foreign matter between the wheel and the flange can trigger local pressure or stress and cause the wheel to break.



Grinding wheel mounted with flanges and blotters

Blotters which are slightly larger than the flanges, should be fixed without wrinkling, on all bonded abrasive wheels, except for exceptions.

Wheel Mounting Procedures :

- The bush, if used, should not project beyond the wheel and the blotters.
- After mounting, a wheel must be allowed to run freely, at its full operating speed, for atleast 1 minute. This test run is applicable both for new wheels as well as old wheels re-mounted for grinding.

- Never grind material for which the wheel is not designed.
- Do not grind on the side of the wheel unless the wheel is specifically designed for that purpose.
- Since a grinding operation generates sparks and swarf, the operator should compulsorily wear safety goggles and face shields. Protective clothing like aprons, gloves and safety shoes should also be used to enable the operator to work safely and efficiently.
- In certain types of grinding where the swarf or dust generation is very high, operators should be provided with dust masks.
- Wheels should never be stopped by applying pressure or force to the periphery or face. Instead the wheel should be allowed to stop by itself.

RIGHT MOUNTING FOR SAFE GRINDING

Though all grinding wheels are relatively fragile, they are safe operating tools if handled and used properly. However, if abused they can pose serious safety hazards.

Most common type of abuse is in the form of wrong mounting and studies have established that 3/4 of the total number of accidents on the shop floor are the result of incorrect mounting. In many countries abroad regulations have been brought out to make training in the correct mounting of abrasive wheels mandatory.

Grinding wheels will withstand substantial compressive stresses but under tensile or bending stresses they give away easily. Besides, all major stresses that develop in a grinding wheel under operating conditions are maximum near the bore. Keeping the above two factors in view, mounting flanges are designed in such a way that wheels are subjected only to compressive stresses and such stresses act on the wheel away from the bore. Most of the wheels are held between symmetrical flanges. These flanges are relieved near the bore and the bearing area is sufficiently away from the hole. The bearing area depends upon the size of the wheel and forces acting on the wheel. The flanges should be made from good quality mild steel or similar material and possess sufficient rigidity and resist deflection when they are tightened on to the wheel.

Refer Flange Selection table Nos. 1, 2, 3 & 4 which show the important dimensions of the various types of flanges commonly used for mounting grinding wheels.

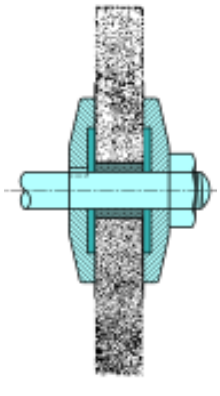
(For additional information please refer to Indian Safety Code No. IS : 1991-1993).

Types of mounting

The manner of mounting wheels depends upon the size and shape of the wheel and the grinding operation.

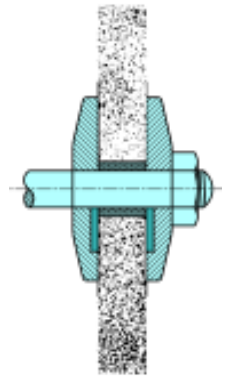
1. Straight Wheels with small holes

These wheels are generally used on Bench and Pedestal grinders (fig. 1)



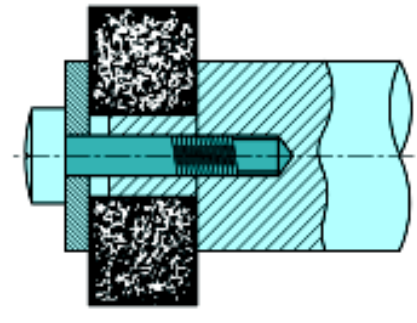
A straight-sided wheel with a small hole, correctly mounted.

Fig. 1



An incorrectly mounted wheel. Flanges not recessed and washers not fitted.

Fig. 2



Method of mounting a small wheel used for internal grinding.

Fig. 3

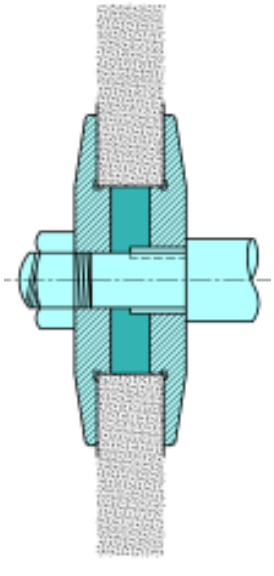
The wheel is held between 2 flanges having equal diameter. The driving flange is key to avoid slippage between the flange and the spindle. Both flanges are symmetrical in all other respects. The recesses shift the mounting stresses away from the hole. Fig. 2 shows a wheel which is incorrectly mounted. The flanges are not recessed and there is no blotter between the wheel face and flanges to provide a cushioning effect when the nut is tightened, with the result that the stresses concentrate at the bore region. This type of mounting can easily cause wheel breakage.

However when the wheel diameter is very small as in the case of the internal grinding wheel such relieving is not necessary (Fig. 3).

2. Straight wheels with large holes

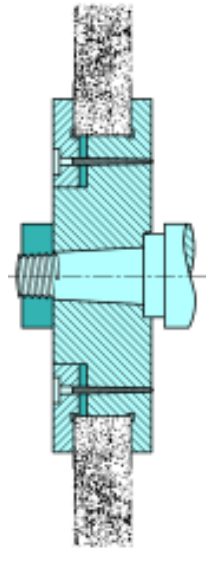
Straight wheel with large holes are commonly used for high speed snagging. Instead of mounting the wheel directly on the spindle, adaptor flanges are used (Fig. 4). These flanges are similar to the ones shown in fig. 1 in all other respects. The undercut at the corner facilitates proper sitting.

Large precision grinding wheels are mounted by means of sleeve flanges (Fig. 5 & 6). The wheel holder or collet is machined to form one of the flanges for gripping the wheel. The collet fits the tapered end of the spindle and is held in place by means of a lock knot. It is usual to keep wheels of different specifications mounted on the sleeve and kept ready so that the complete mounting can be replaced to save time.



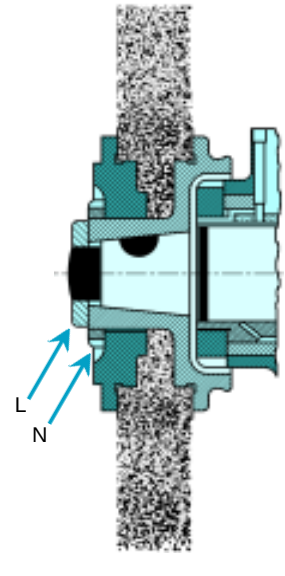
A flange assembly for a wheel with a large hole. The corners of the wheel seatings must be undercut as shown.

Fig. 4



A sleeve flange used with a wheel of large bore.

Fig. 5

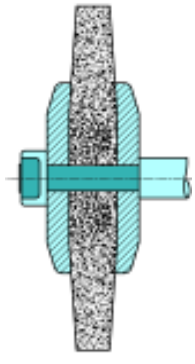


A method of mounting a precision wheel for external cylindrical grinding.

Fig. 6

3. Taper Wheels

Whenever it is impractical to fit the guards on the machine the breakage risk can be reduced by using a taper wheel and protection flanges as shown in (Fig.7). The taper on the wheel prevents it from flying apart and causing injury to the operator in case of wheel breakage. However, this will not eliminate such risks.



Protection flanges used with a tapered wheel. To be effective the degree of taper of the flanges must correspond with that of the wheel

Fig. 7

CAUTION :

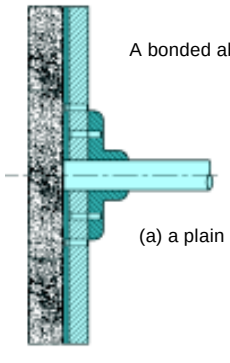
It has been proved that protection flanges can cause wheel breakage if the wheel face and bearing surface are not absolutely parallel. Such flanges will cause stress concentration, which may develop cracks in the wheel. Therefore, protection flanges should be used only if the guard cannot be used.

Protection flanges provide no protection if a portion of the wheel breaks up outside the flanges. For this reason minimum exposure of the wheel is important.

Table 4 specifies the minimum diameters of protection flanges for various diameters of taper wheels used on portable machines. Here also it can be seen that no blotter is used between the wheel face and protection flanges.

4. Cylinder Wheels and nut inserted discs.

(a) **Cylinder Wheels** are mounted to a back plate or wheel head by means of mechanical clamps or by using cements. When mechanical clamps are used they should conform to the OD of the wheel and provided good gripping (Fig. 8, 9, 10).



A bonded abrasive disc cemented to

(a) a plain backplate and

(b) a lipped backplate

Fig. 8

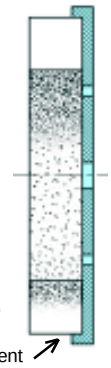


Fig. 9

A cylinder wheel mounted in a protection chuck. The chuck should be kept adjusted for minimum exposure of the wheel.

Fig. 10

(b) Nut inserted discs. These wheels are commonly used for disc grinding operations and are mounted by means of steel nuts embedded on the side. The hole on the face plate and nuts on the wheels should be accurately matched. The penetration of the screw should be less than the depth of the nut otherwise the screw will pull the nut off the wheel. The face plate should be of adequate thickness and flat and provide even support over a large area of contact. Before mounting, the face plate should be thoroughly cleaned. The screws should be tightened uniformly in a diametrical sequence (Fig. 11).

Incorrect nut mounting for a cylinder wheel. The screws must not come into contact with the abrasive material.

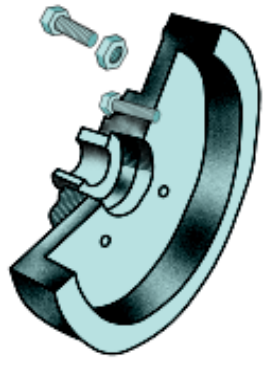


Fig. 11

A typical mounting for abrasive segments

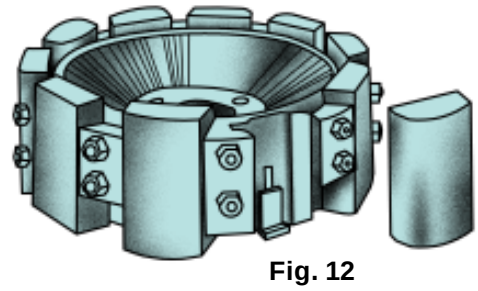


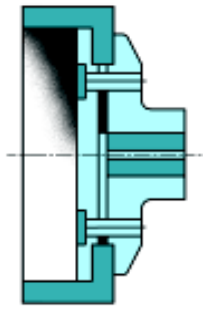
Fig. 12

5. Grinding Segments

Fig. 12 shows typical arrangements for mounting segments. The segments are held in position by dovetailed wedges fitted on the periphery of the chuck. It is advisable to use blotters between the segments and the wedges. These wedges should be regularly checked to see that worn out wedges are not used for clamping. Such wedges will develop uneven mounting stresses and cause breakage. The overhang of the segment should not exceed its thickness.

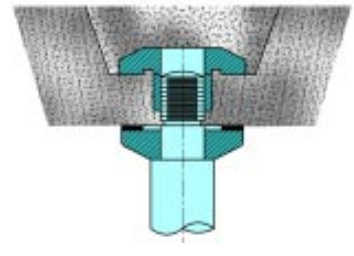
6. Cup Wheels

(a) On fixed machine situations cup wheels are commonly used on tool and cutter grinding machines, for sharpening cutting tools (Fig. 13). Flanges used for mounting cup wheels are similar to the sleeve type flanges described earlier.



A cup wheel mounting for a fixed machine.

Fig. 13



An adaptor flange for an unthreaded-hole cup wheel. To provide proper support, the adaptor flange and back flange should be equal in outside diameter and diameter of recess.

Fig. 14

(b) On portable machine situations cup wheels with plain or threaded holes are used. Plain wheels are mounted by means of adaptor flanges as shown in Fig. 14. Wheels with threaded holes are screwed on to the end of the machine spindle against the flange. The flange should be flat and not recessed (Fig. 15). Recessed flanges (Fig. 16) would tend to strain the threaded bushings. Blotters are not necessary.

A correctly mounted threaded-hole wheel.

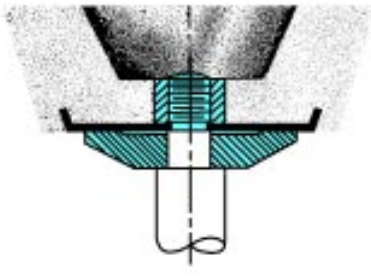


Fig. 15

An incorrectly mounted threaded-hole wheel. The recessed flange does not provide proper support.

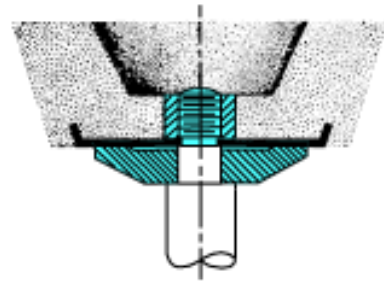
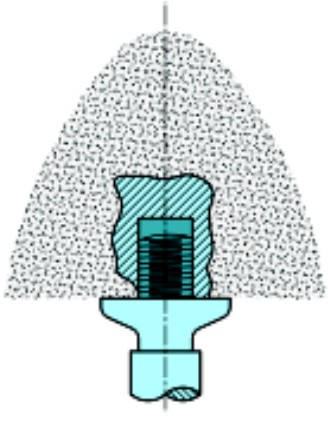


Fig. 16

7. Nut inserted cones

These are used on portable grinders in place of mounted points. Before mounting, the hole should be checked to see that it is free from foreign matter. Threaded spindles should be shorter than the depth of the nut but long enough for sufficient threaded engagement. Flanges should be flat and not recessed, otherwise the nut will be pulled out while tightening (Fig. 17 & 18).



A correctly mounted cone wheel.

Fig. 17

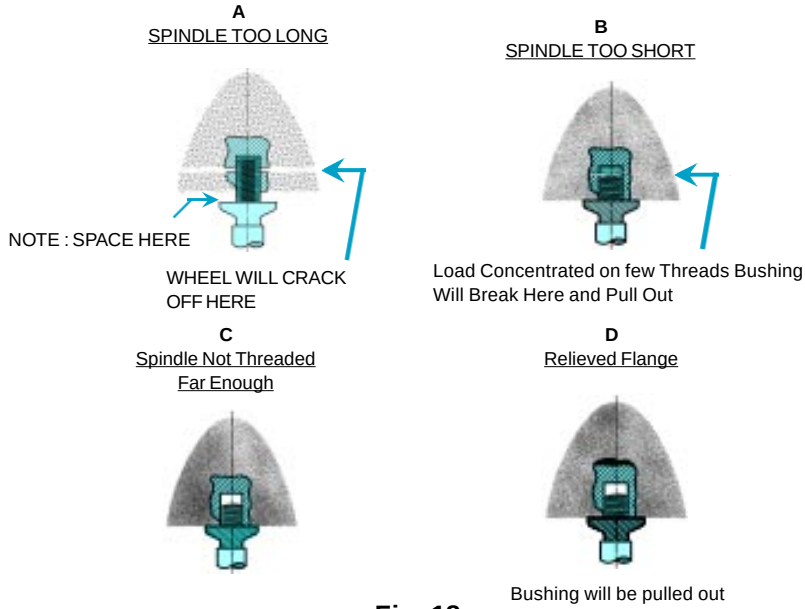


Fig. 18

TABLE-1

IMPORTANT DIMENSIONS OF FLANGES FOR STRAIGHT WHEELS WITH SMALL HOLES

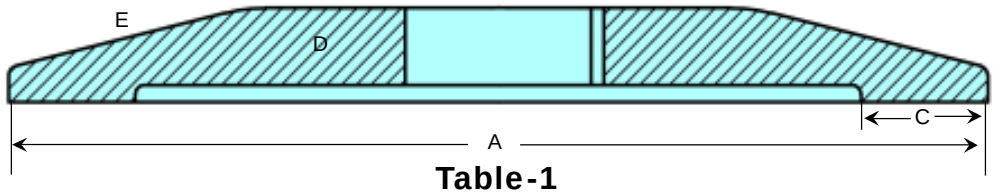


Table-1

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

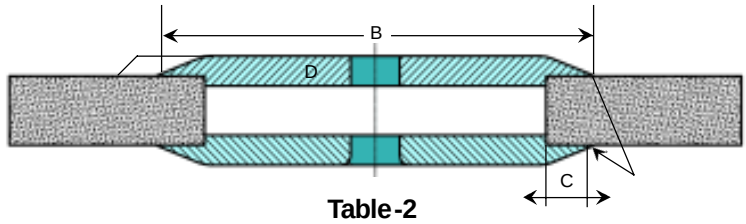


Table-2

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 WHEELS SLEEVES FOR PRECISION GRINDING ONLY

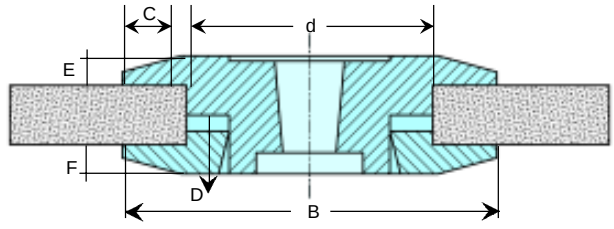


Table-3

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

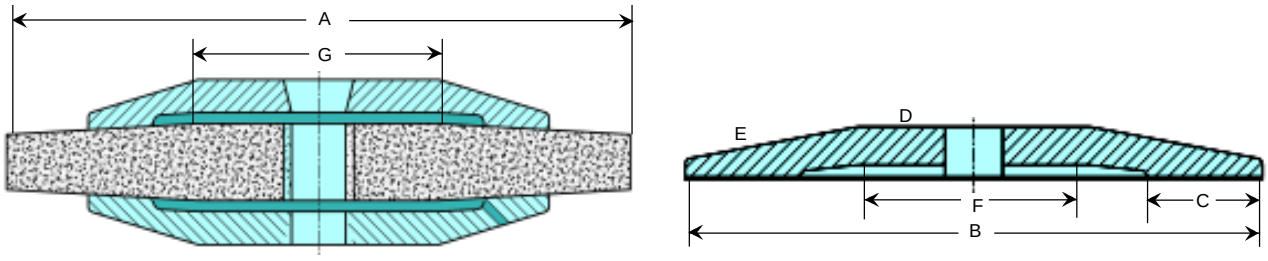


Table-4

Wheel Dia.	B Minimum Outside Diameter of Flanges	C Radial Width 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