
بسم الله الرحمن الرحیم

دانشگاه فنی حرفه ای

دانشکده فنی انقلاب اسلامی

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نام واحد درسی: نقشه کشی قید و بند کاردانی

بهار۱۳۹۹

Guiding the tools

Clip slide

- Tools may be guided directly by the plate or by case hardened steel bushes.
- Bushes are used to guide drills, reamers, boring tools and other cutting tools.
- The Jig Bushes shall support tools which are slender and delicate.
- Bushes are in interference fit in the drill plate.

Drill Bushes

Clip slide

Materials of Bush

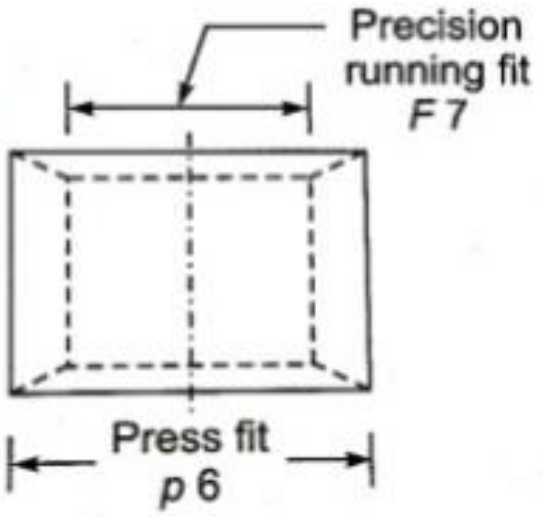
Clip slide

- Bushes are made of hardened Carbon Steel with 0.85-1% Carbon, 0.5-0.9% Manganese.
- They are hardened to RC 60-64 to minimise wear due to contact with hard, rotating tools.
- Bushes are finished by grinding the inside and outside diameters within 0.001 mm concentricity.
- The inside diameter has precision running fit (F7) with the drill / reamer
- The outside diameter is made press fit (p6), precision location fit (h6) or precision running fir (f6) depending upon application of the bush.

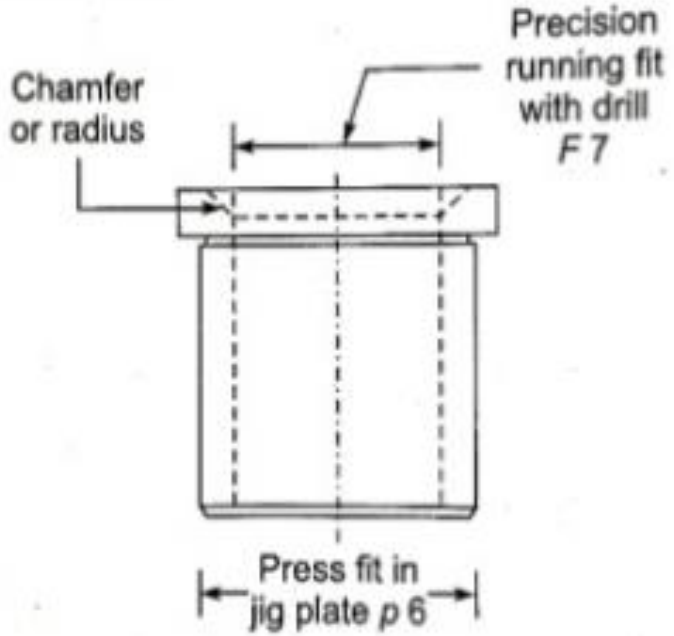
Press Fit Bushes

Clip slide

- They are most common types of bushes
- They are pressed interference fit in the bush plates
- Used for batch production
- Have long working life
- They are also used as liner for slip and renewable bushes.
- Types of press fit bushes
  - Headed Bush
  - Headless Bush



Headless press fit bush



Headed collared press fit bush

Materials of Bush

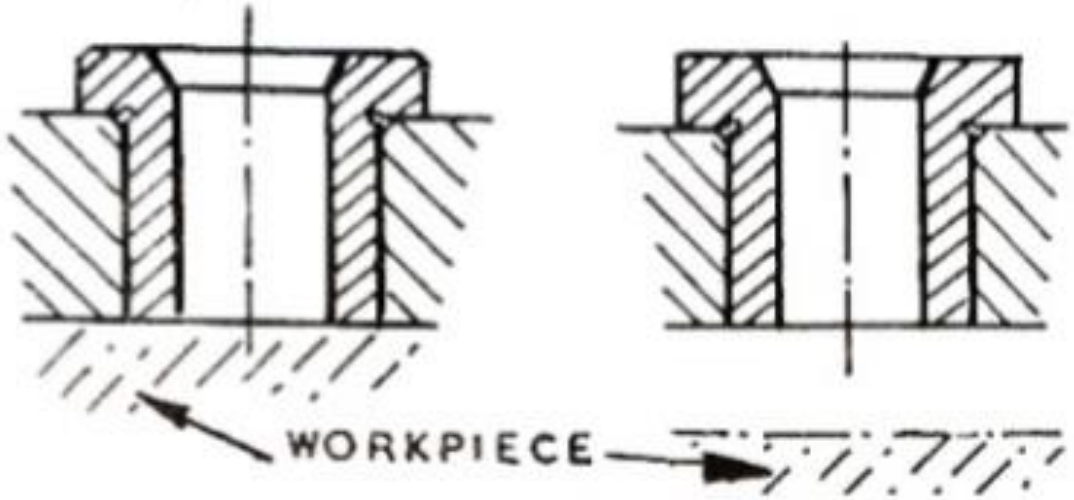
Clip slide

- Bushes are made of hardened Carbon Steel with 0.85-1% Carbon, 0.5-0.9% Manganese.
- They are hardened to RC 60-64 to minimise wear due to contact with hard, rotating tools.
- Bushes are finished by grinding the inside and outside diameters within 0.001 mm concentricity.
- The inside diameter has precision running fit (F7) with the drill / reamer
- The outside diameter is made press fit (p6), precision location fit (h6) or precision running fir (f6) depending upon application of the bush.

Headed Drill Bush

Clip slide

- They are used to control hole depth.
- The collar of the bush provides positive stop against the jig plate. The collar also prevents axial movement of the bush with the drill.
- The bush is either placed close to the workpiece or far enough away from the workpiece to permit swarf to escape between it and the workpiece.



Headed Drill Bush

- Headed drill bushes are provided with seating of the bush in the hole in the drill plate and undercutting the head of the bush.
- A lead is provided for easy entry of the bush in the drill plate.

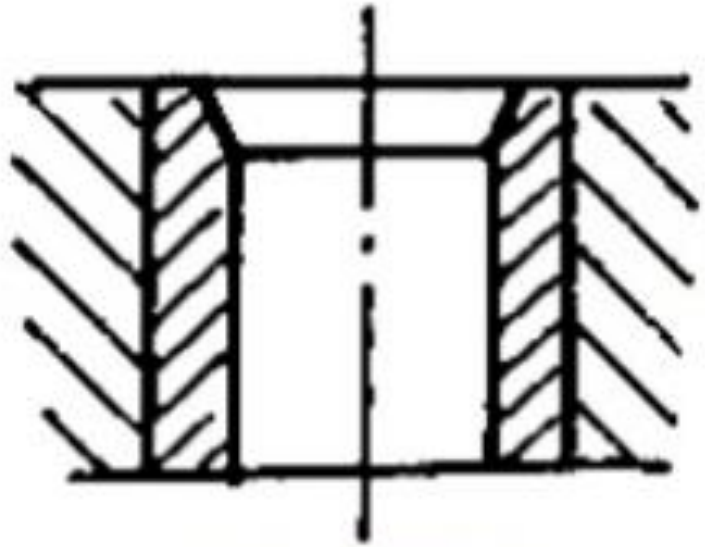
Headed Drill Bush

Clip slide

Headless Drill Bush

Clip slide

- Headless drill bush is used where the hole depth is not needed to be controlled and not important.
- When spacing of the bush is close or the top surface of the jig plate is required to be free from the projecting collars, headless bushes are used.



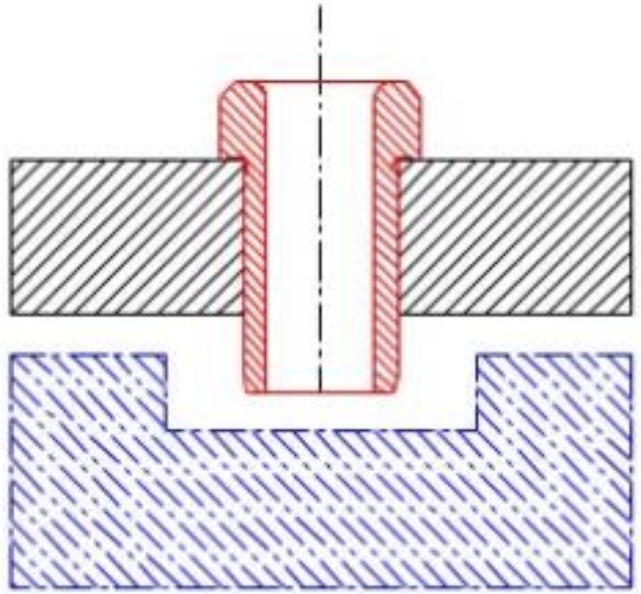
Headless Drill Bush

Headless Drill Bush

Extended Drill Bush

Clip slide

- It is used when the hole to be drilled in a face that is at some distance from the drill plate.
- When the drill bush is long, its bore is relieved so that only end near the workpiece controls the tool.



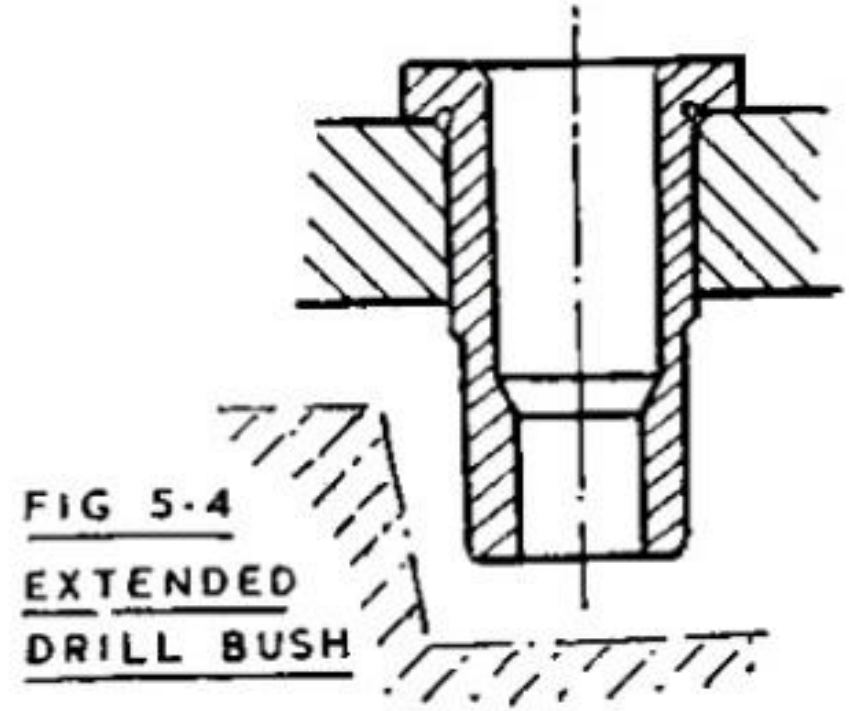


FIG 5·4
EXTENDED
DRILL BUSH

Removable Bush

There are two types of removable bushes:

- Renewable bush arrangement
- Slip bush arrangement

Renewable Bush

- Used for continuous or large batch production
- It is used when the bush wear is more and it need to be replaced frequently.
- Headed or flanged bush
- It can only be taken out of liner bush by removing the retaining screw.
- Flat is provided on the collar to prevent rotation and axial movement of the bush. The flat arrests with the collar of the retainer shoulder screw.
- The outside diameter is precision location fit (h6)

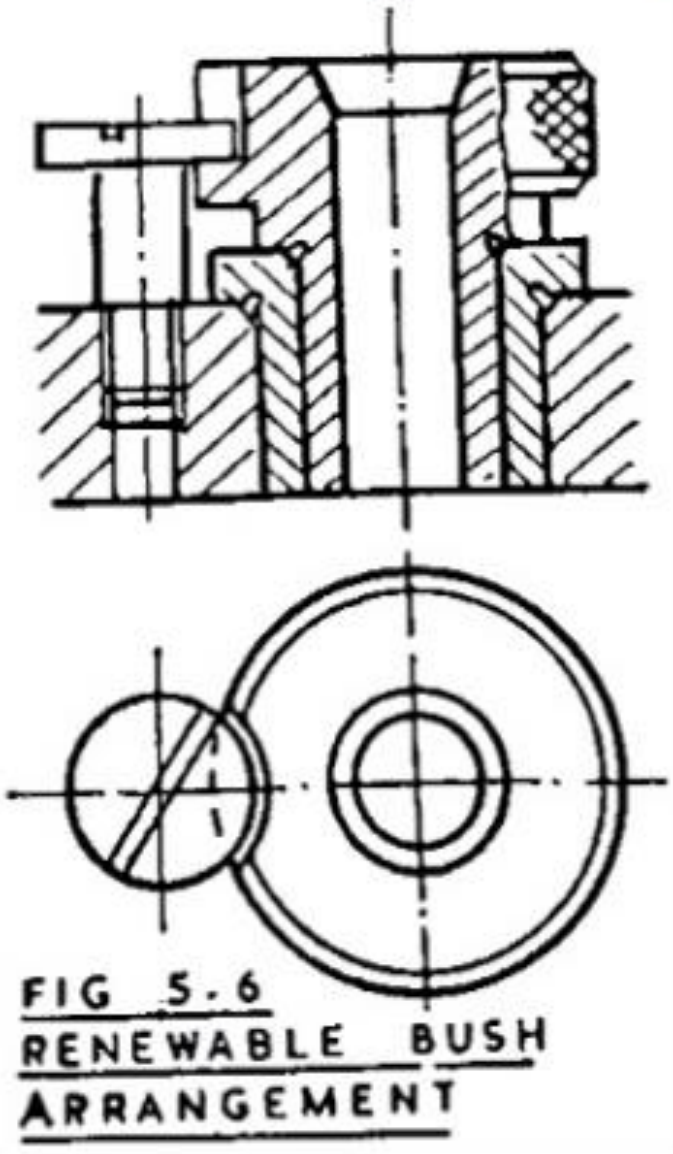


FIG 5.6
RENEWABLE BUSH
ARRANGEMENT

Renewable Bush

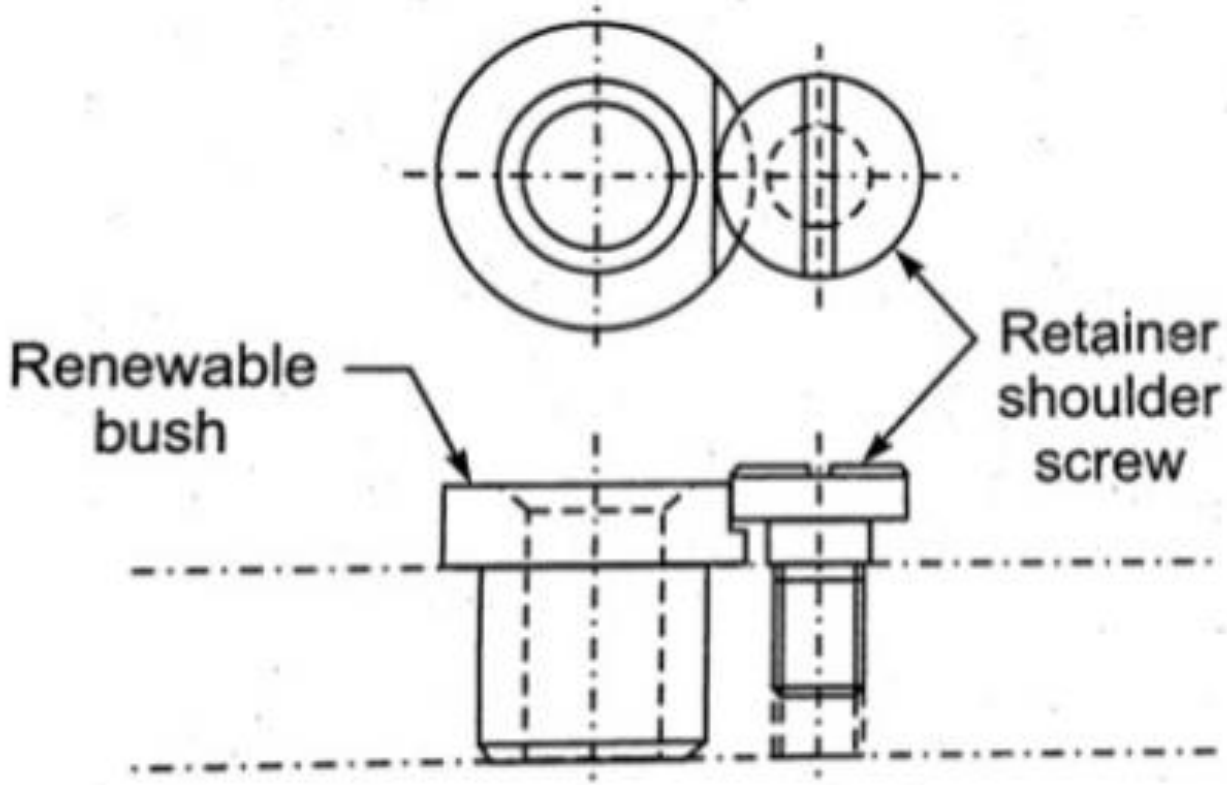
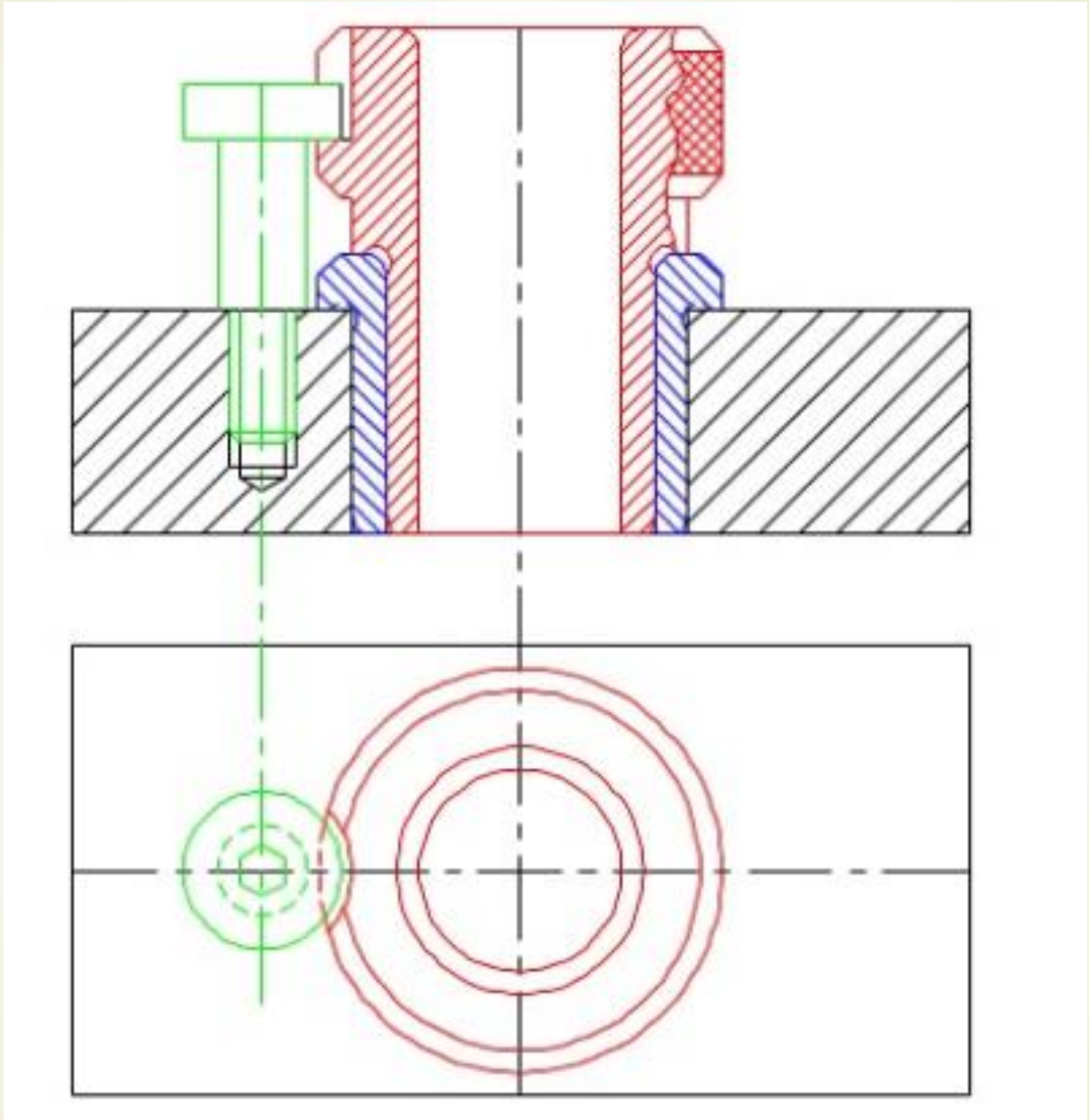


Fig. 5.3

Renewable bush

Renewable Bush

Clip slide



Slip Bush

Clip slide

- They are used when two or more operations are performed on the same axis such as drilling and reaming, it is necessary to use two different guide bushes for different tools.
- Headed or flanged bush
- Slip bush is used with Liner bush.
- Slip bush is used when quick changeover is required.
- Retaining screw is provided to prevent the rotation of the slip bush.
- Flat is provided on the collar and circular cut-out in the flange to facilitate quick assembly and removal.

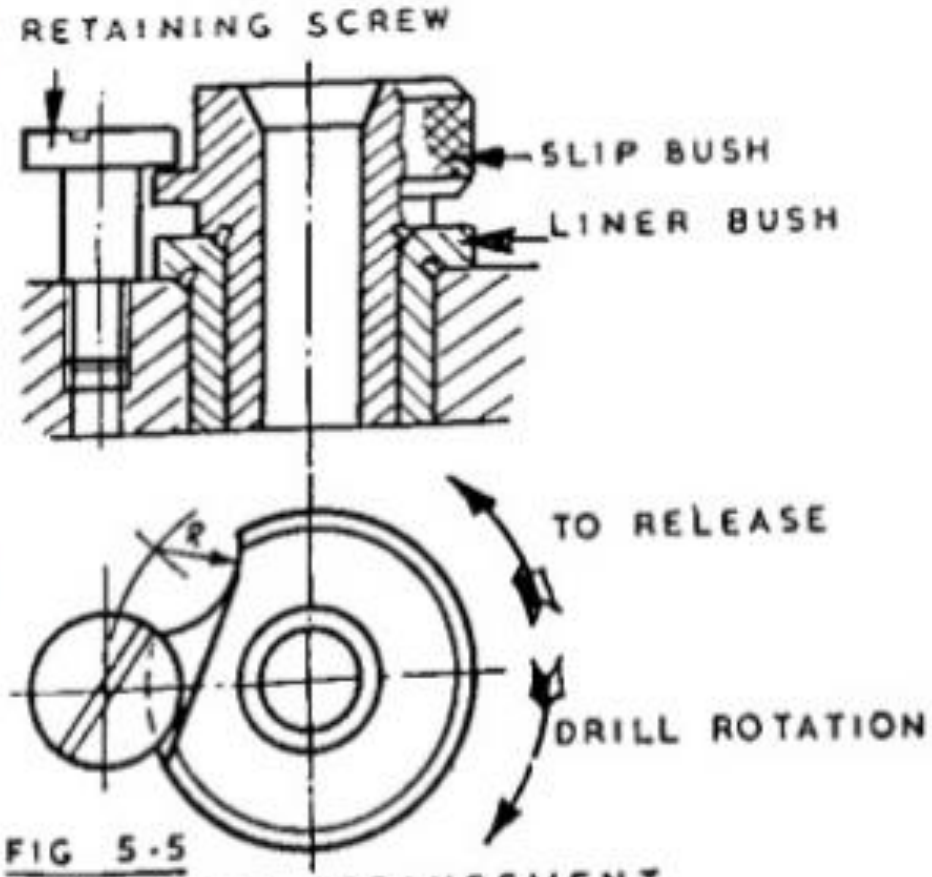
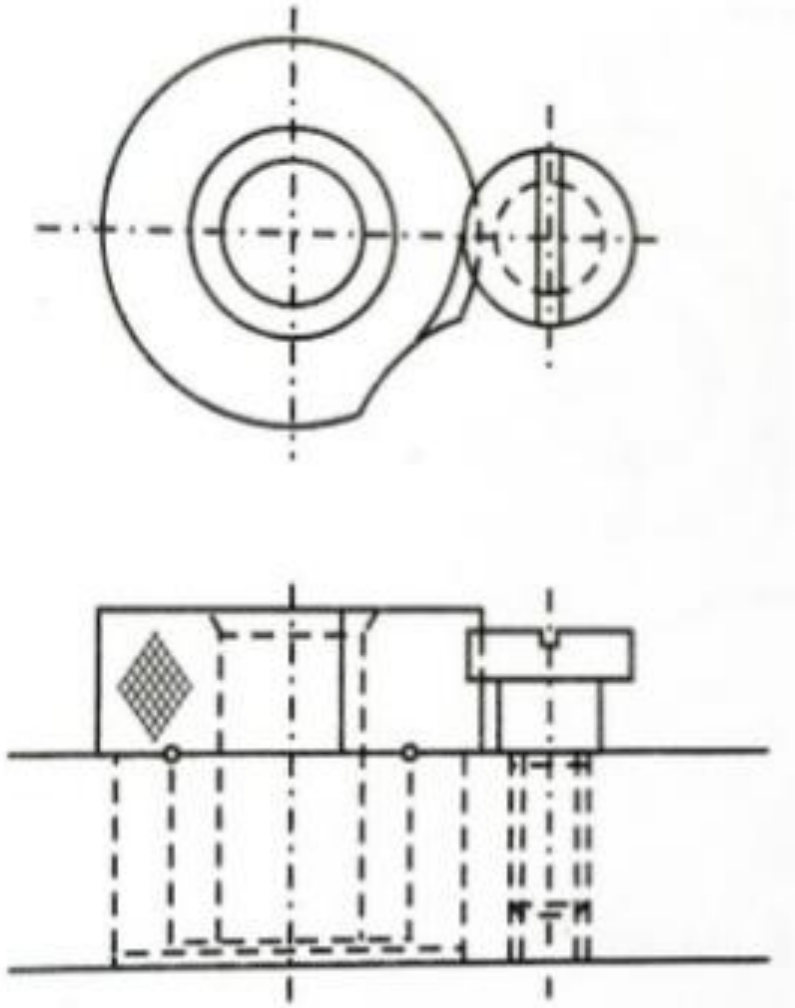


FIG 5·5
SLIP BUSH ARRANGEMENT

Slip Bush

- The straight flat is replaced by a circular step.

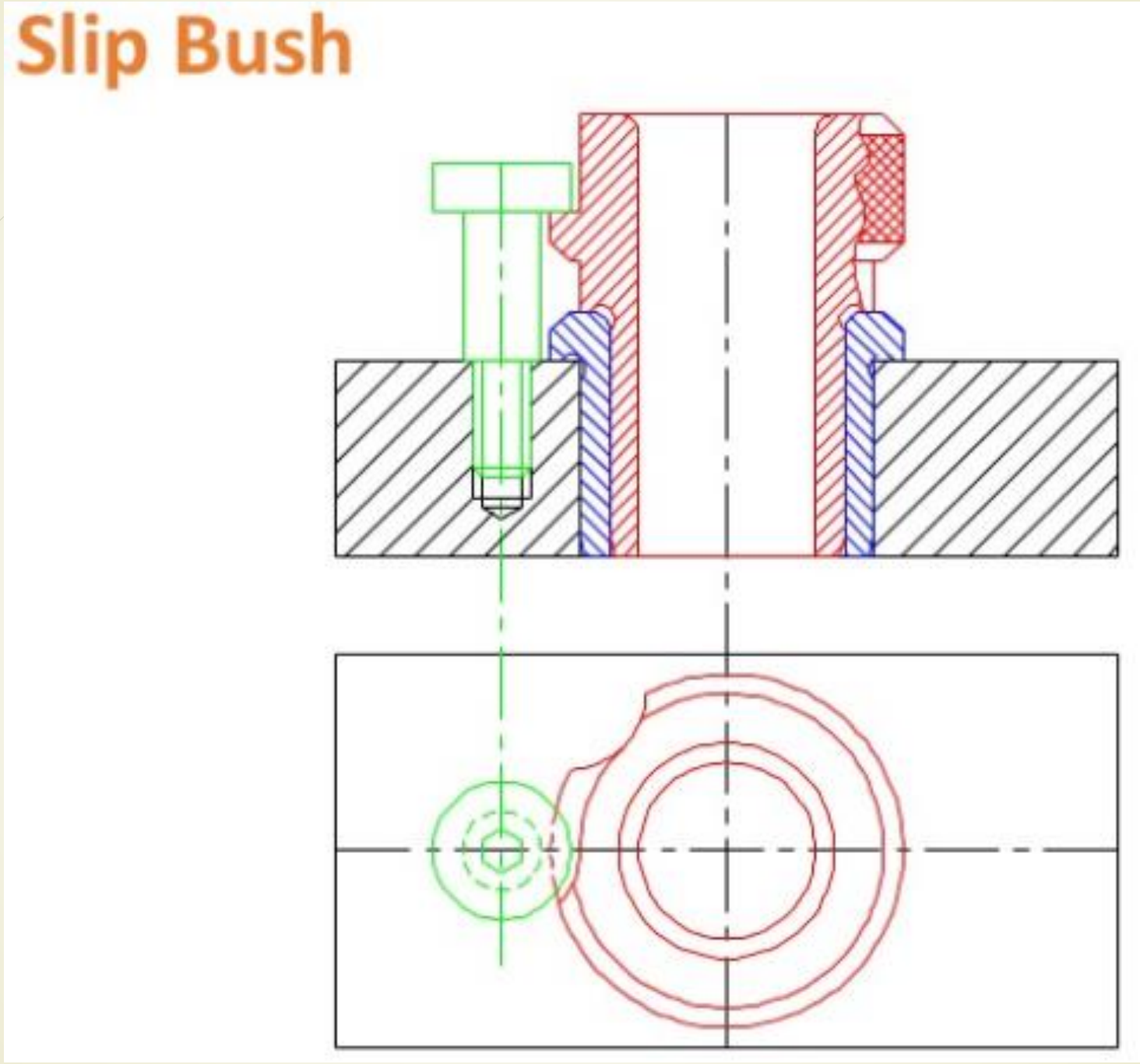


Slip Bush

Slip Bush

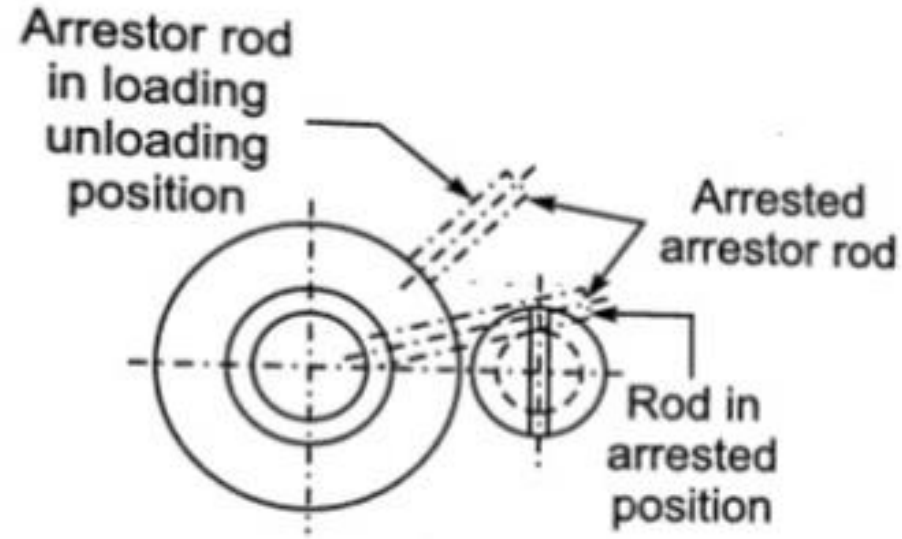
Clip slide

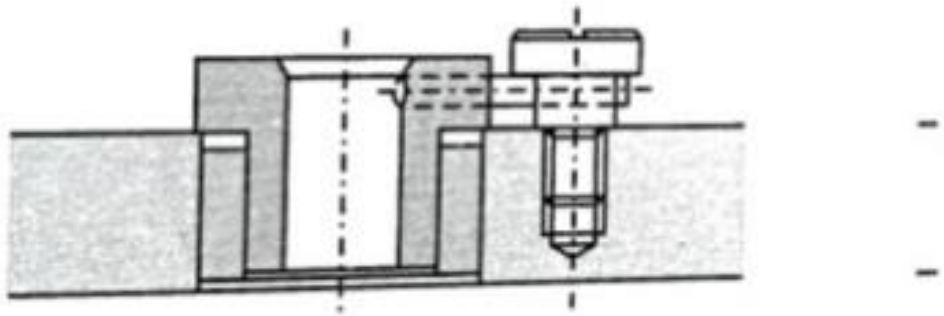
Slip Bush



Slip Bush

- The head of the slip bush is fitted with a rod.





Slip Bush

Liner Bushes

- Some times these bushes are also known as master bushing.
- They are permanently fixed to the jig body.
- They act as guides for renewable type bushing.
- They may be bushes with or without head.

Threaded Bushes

- These bushes are threaded on the outside.
- Liner is used to locate threaded bush in jig plate.
- A grub screw is provided to prevent axial rotation of the liner bush.
- A drill bush can be used to lightly clamp the workpiece in the region of cutting.
- The axis of the drill bush is located positively.

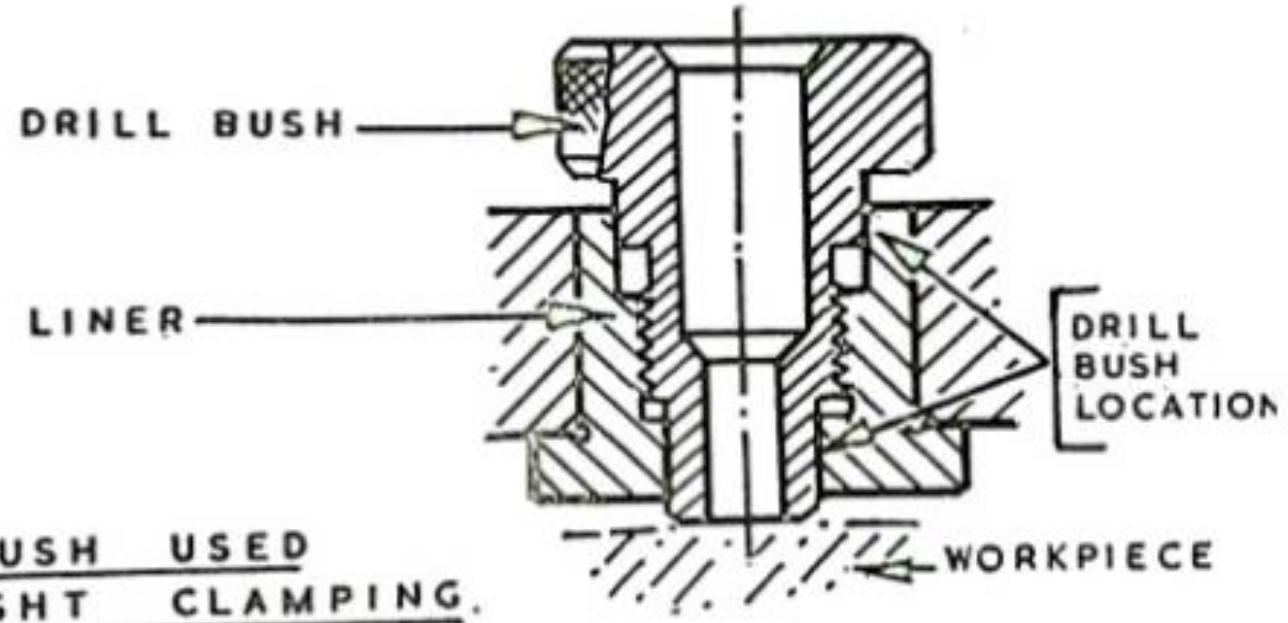


FIG 5.7
DRILL BUSH USED FOR LIGHT CLAMPING.

Threaded Drill Bush

Special Bushes

Clip slide

- A twist drill tends to slide down inclines and curves. This causes bending and breakage of the drill.
- This problem can be countered by altering the shape of the bush to provide better support and resistance against bending.
- Bush matching the end of the profile of the workpiece.

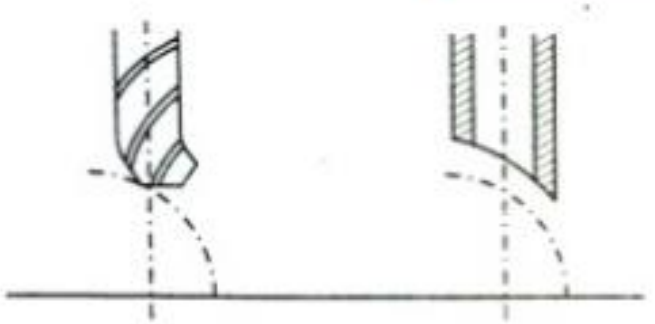


Fig. 5.8

Drill bush for curved surface

Fig. 5.9

Drill bush for inclined surface

Special Bushes

Clip slide

- Sometimes the centre of the drilled holes are placed so close to each other that it is impossible to provide any drill bushes in the jig plate.
- Under such circumstances, a combined plate-type of bush is used.
- The plate bush is made of Tool Steel.
- A number of bushes can be combined into a single plate bush. The plate bush is screwed and dowelled to the jig plate.

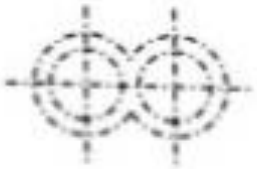


Fig. 5.10

Problems due to close centre distance in drilling holes

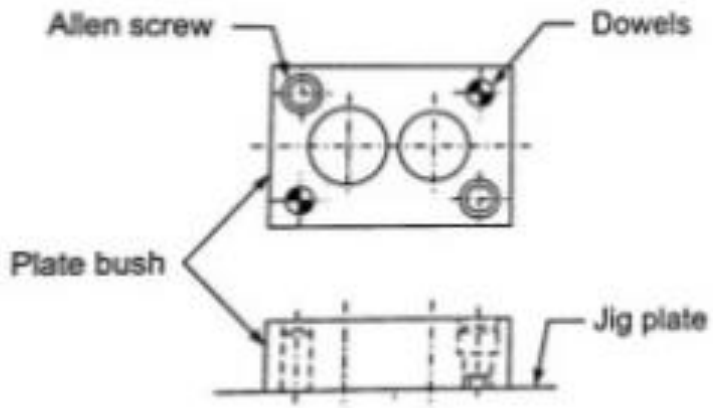


Fig. 5.11

Plate bush

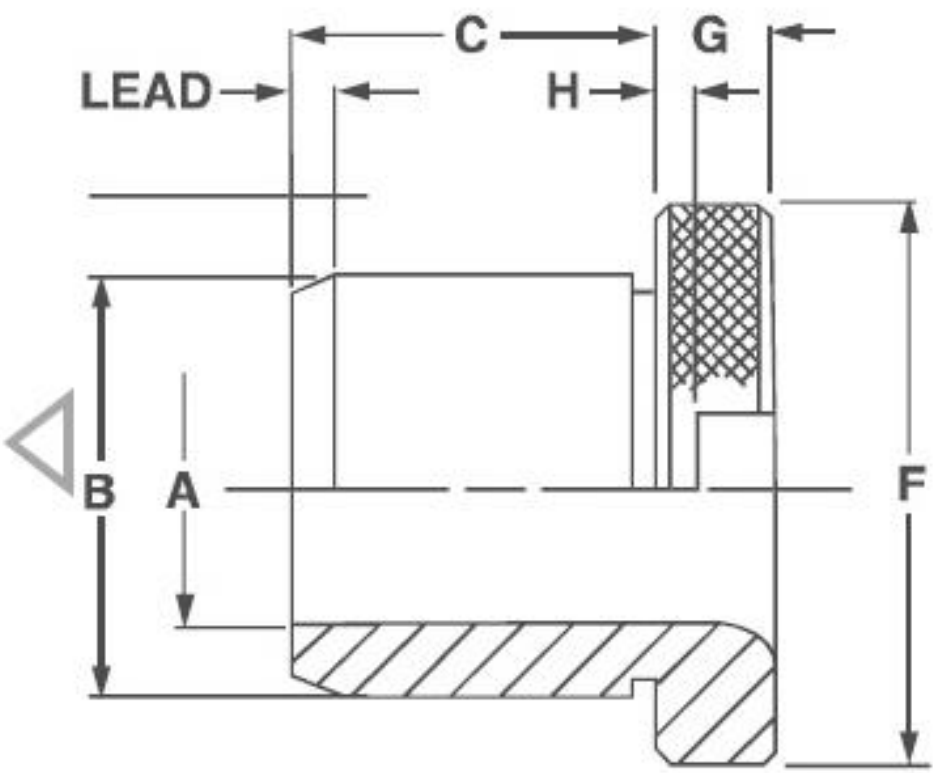
Summary

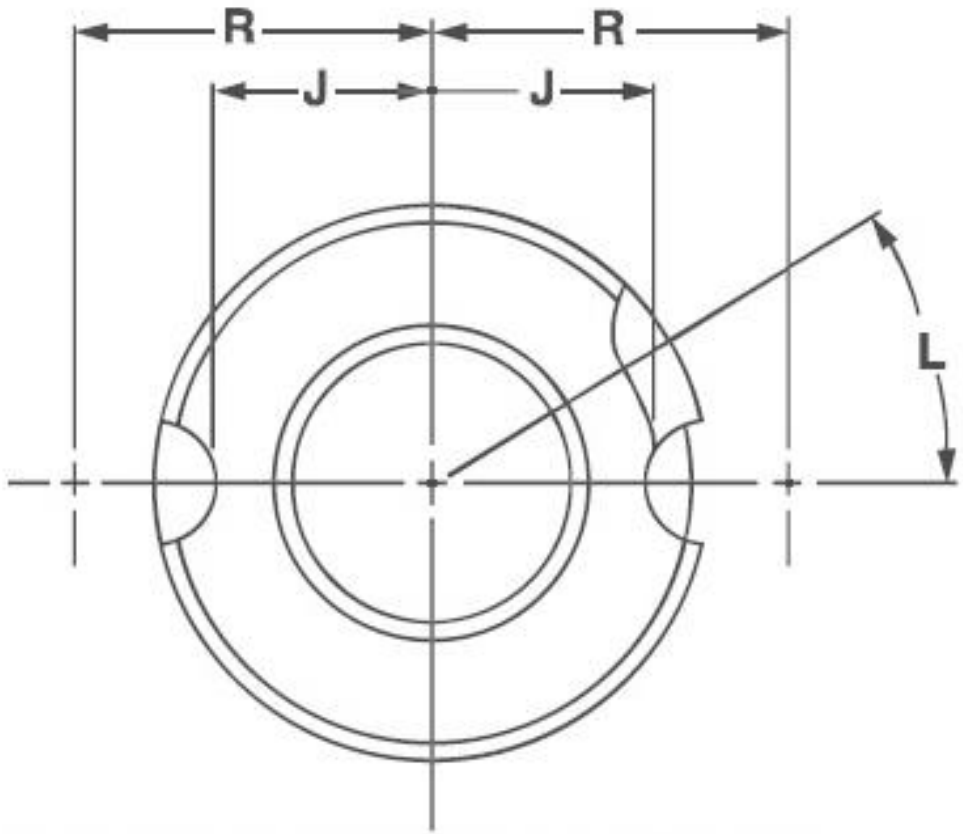
Clip slide

- Drill bushes have G7 / F7 hole to guide the drill.
- Drill bushes are made of Steel hardened to RC 62/65.
- Press fit bushes are used for short runs.
- Renewable bush is used for high wear application.
- Slip bushes are used for multiple operations like drilling, reaming, counter-boring.
- Threaded and spring-loaded bushes to combine clamping with guiding.
- Special bushes with end shaped are used to prevent drill deflection.
- Plate bushes combining two or more bushes for very closely spaced holes.

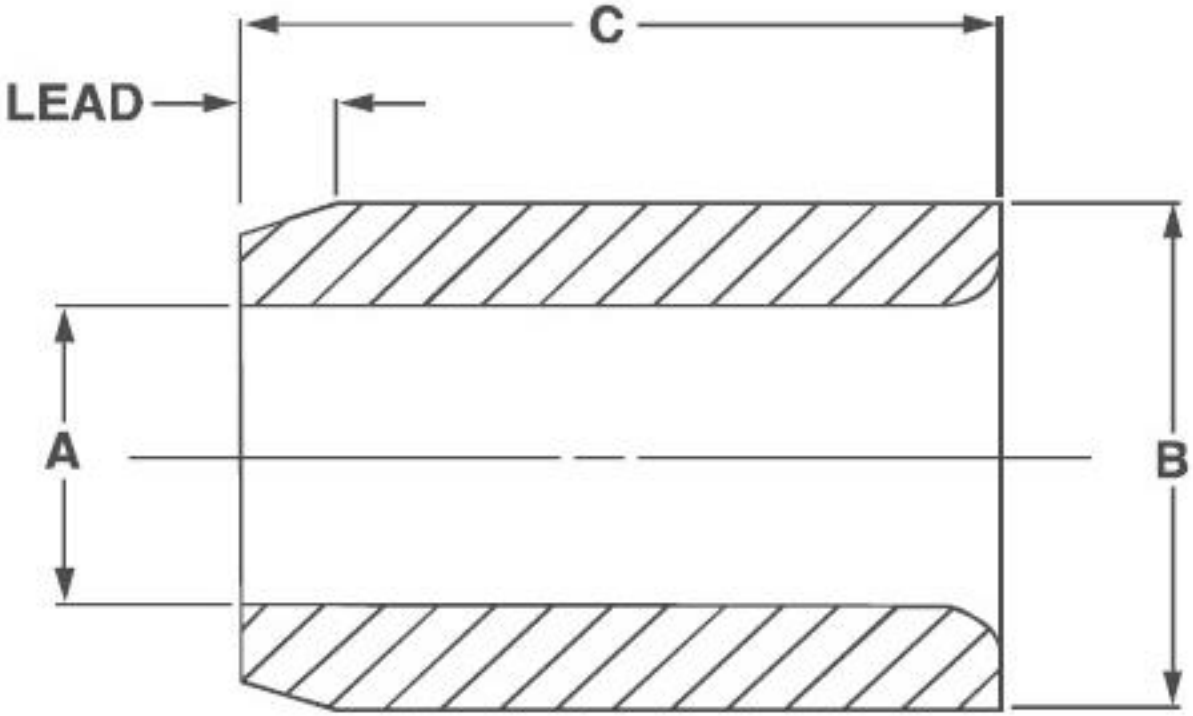
References

1. *Jig and Fixture Design Manual*, Erik K. Henrikson, Industrail Press.
2. *Jigs and Fixture*, P.H. Joshi, THM.
3. *An introduction to jig and tool Design*, M.H.A. – Kempster, III Ed.Pub ELBS.

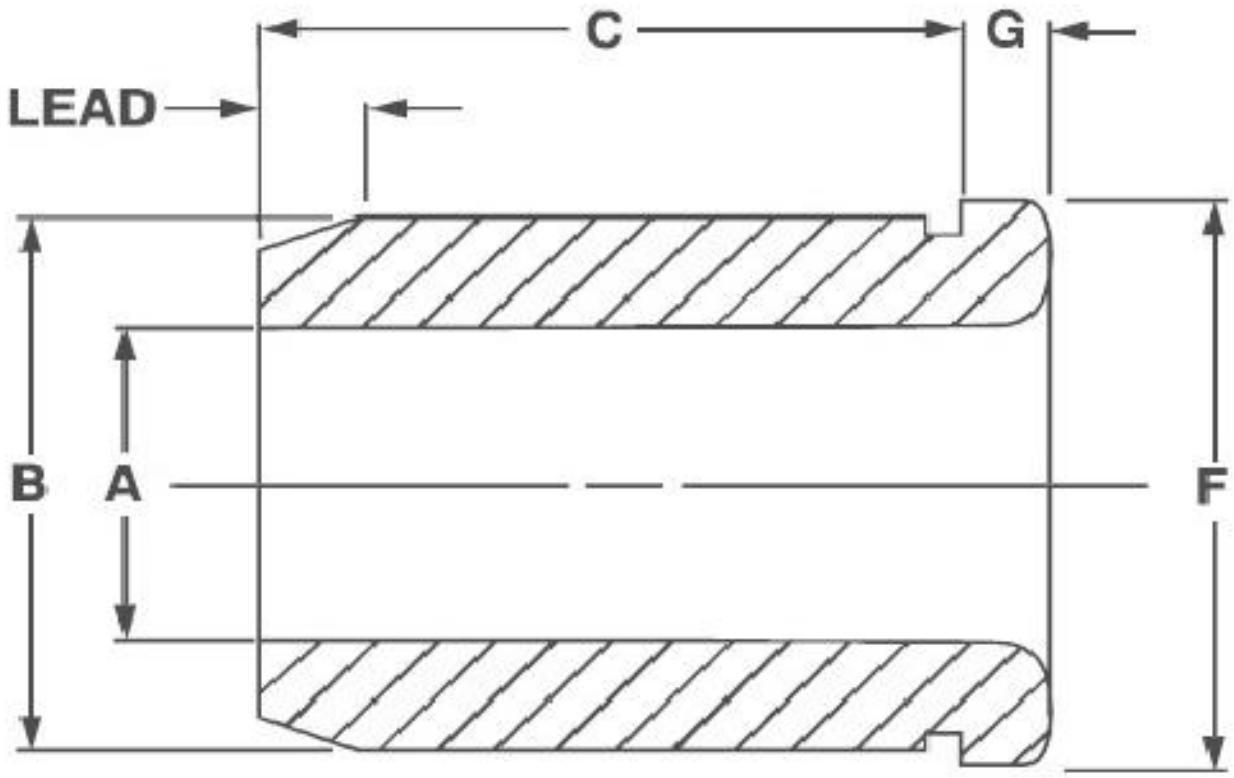




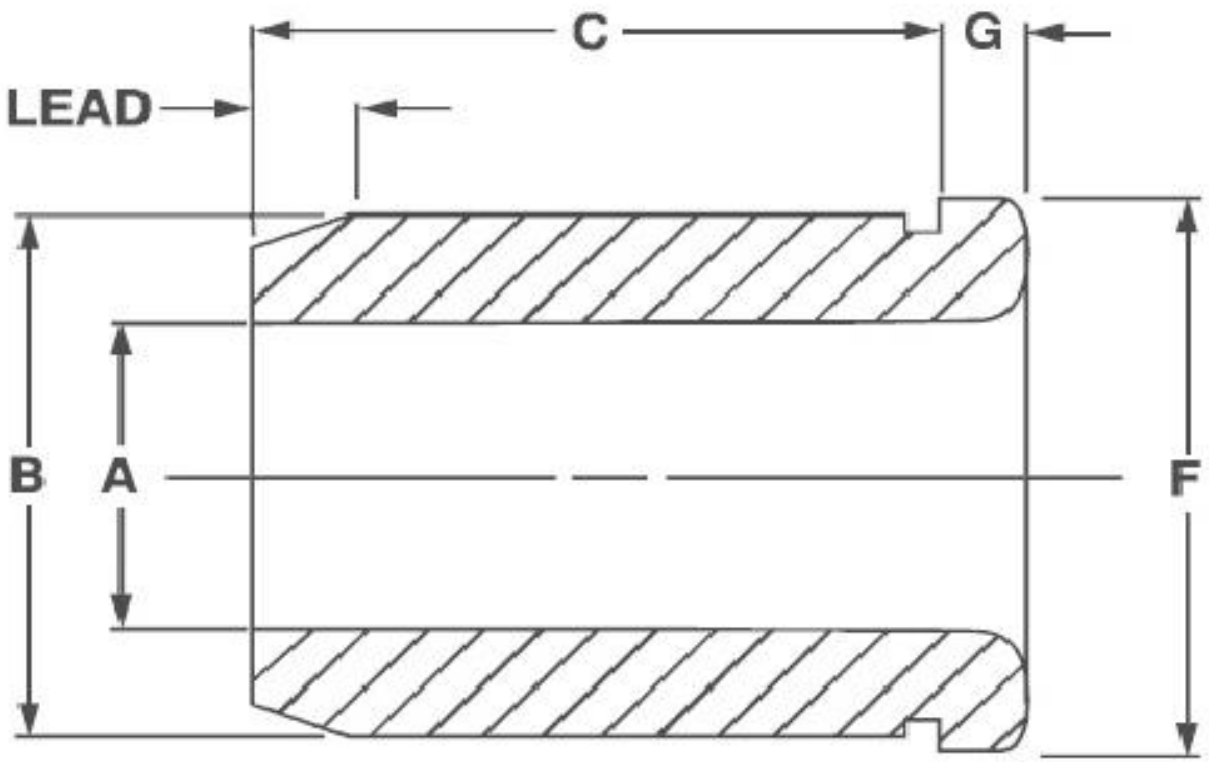
ANSI - TYPE SF Slip-Fixed Renewable Combination Drill Jig Bush



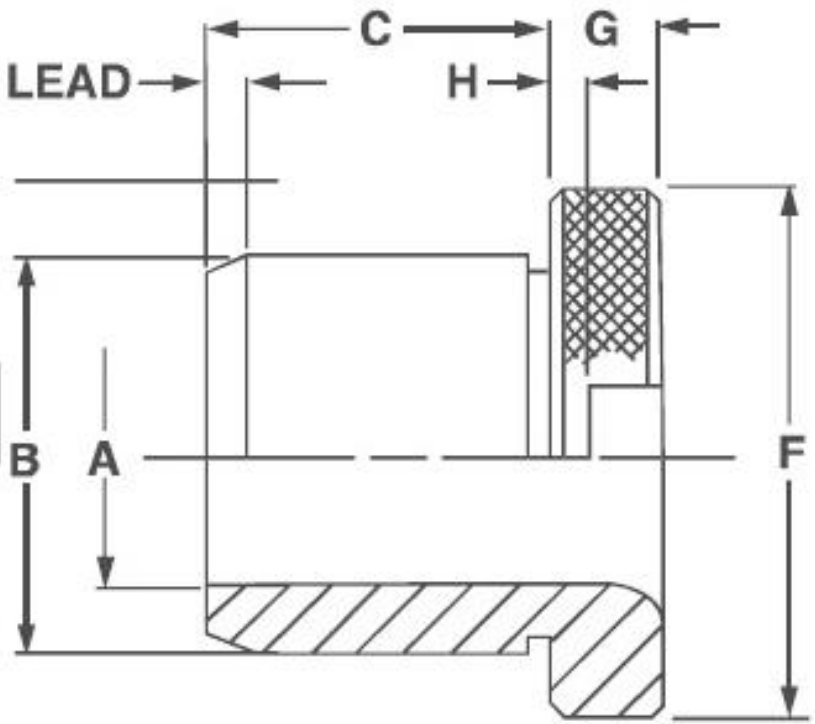
ANSI -TYPE -L Headless Liner Drill Jig Bush

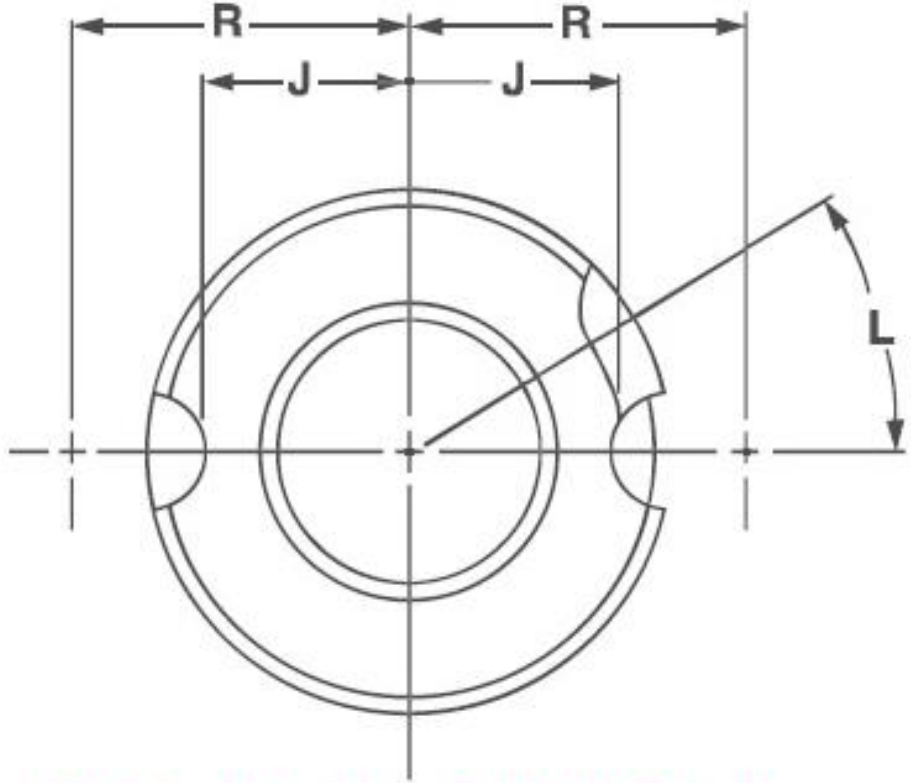


ANSI -Type HTW -Thin Wall
Headed Press Fit Drill jig Bush

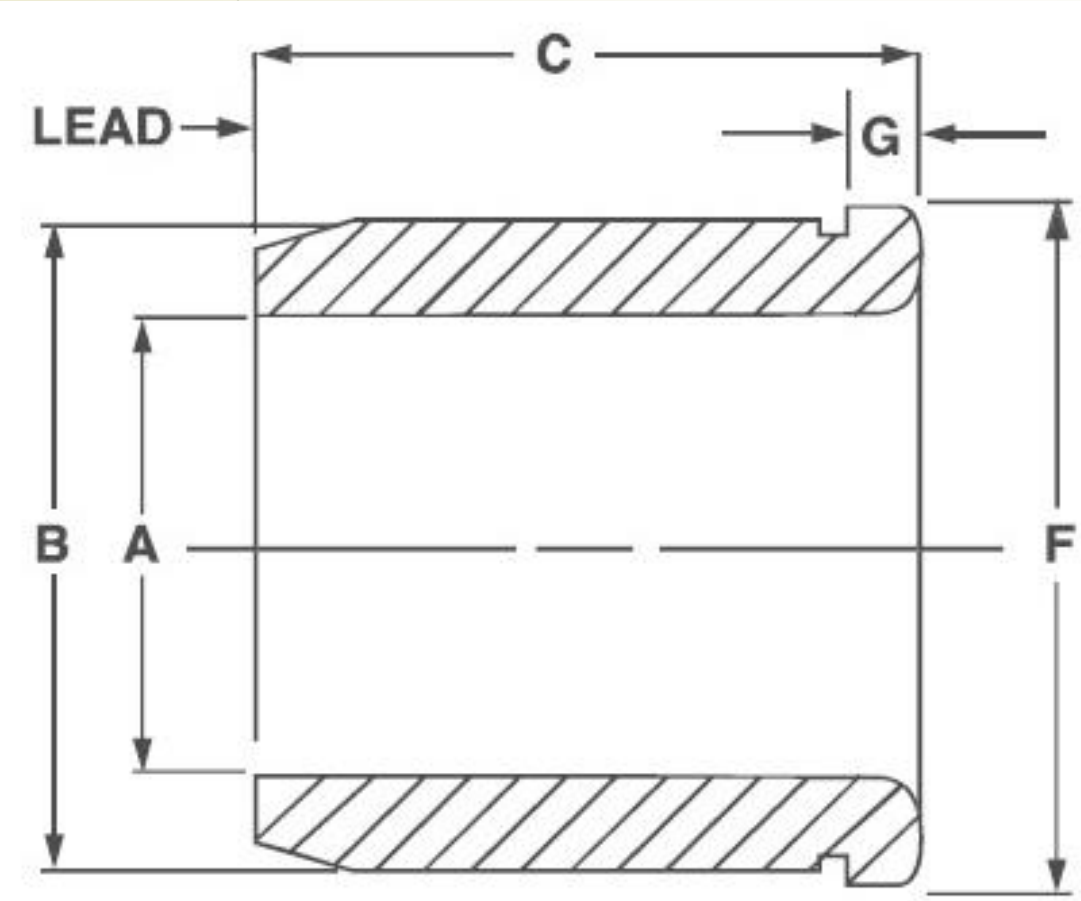


ANSI -Type H & HM (Metric)
Headed Press Fit Drill jig Bush

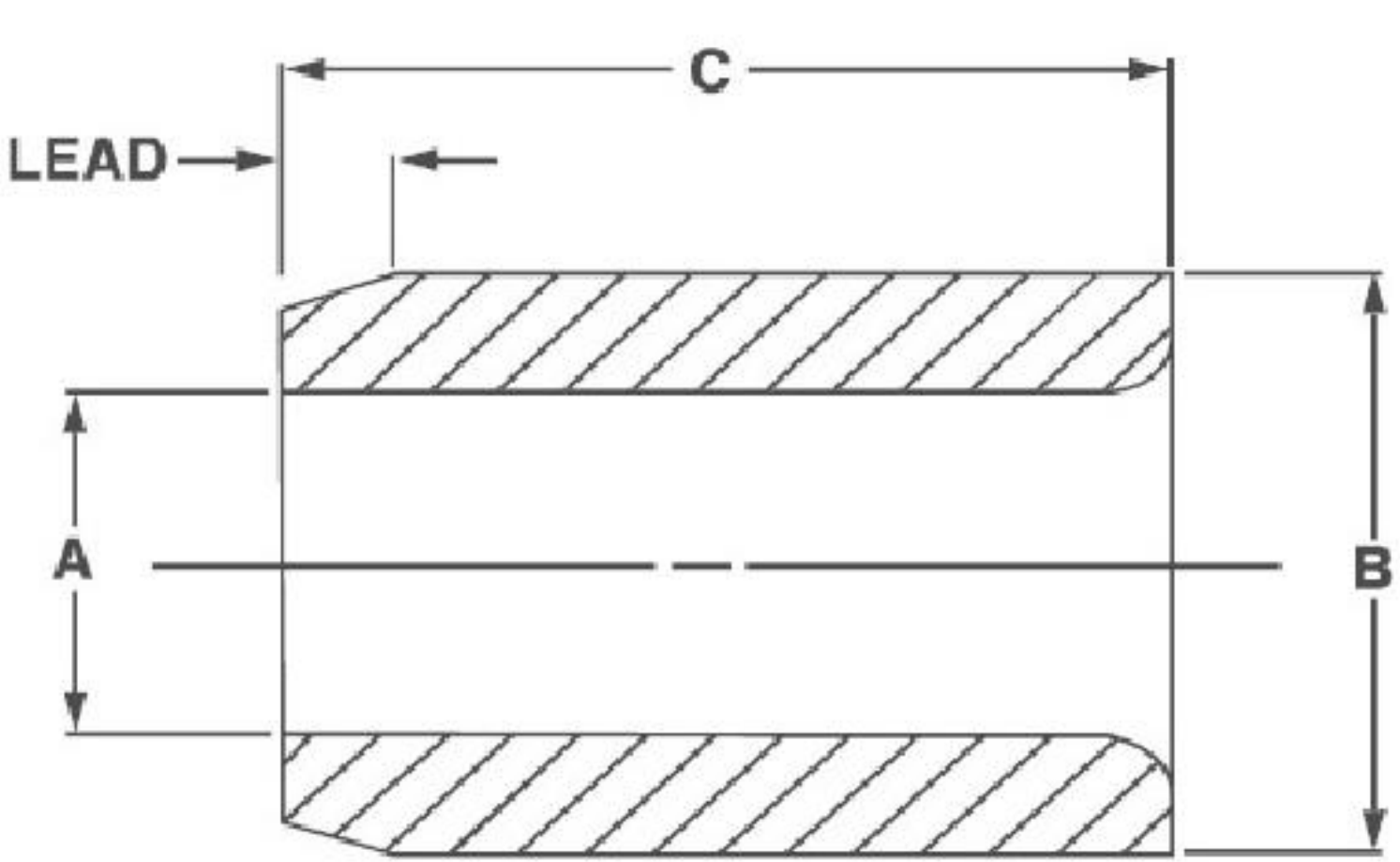




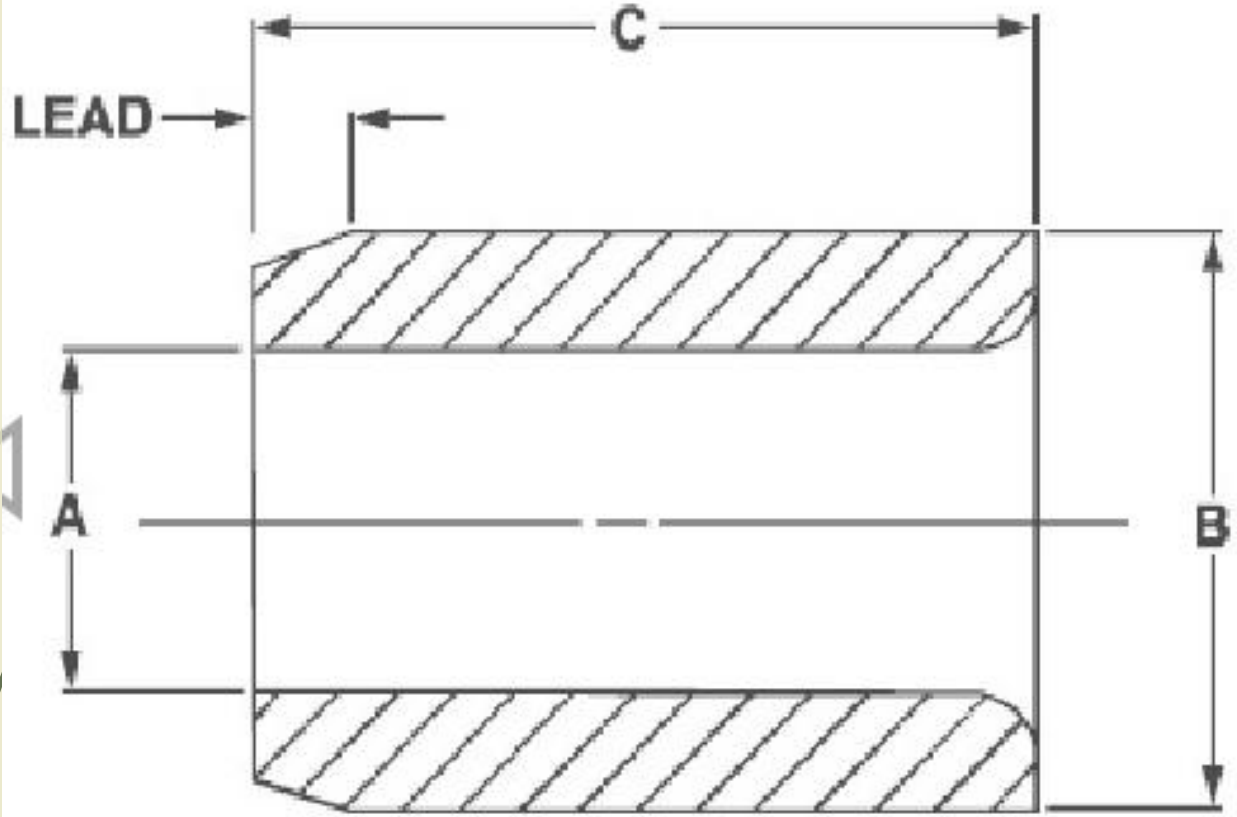
ANSI - TYPE SF Slip-Fixed Renewable Combination Drill Jig Bush



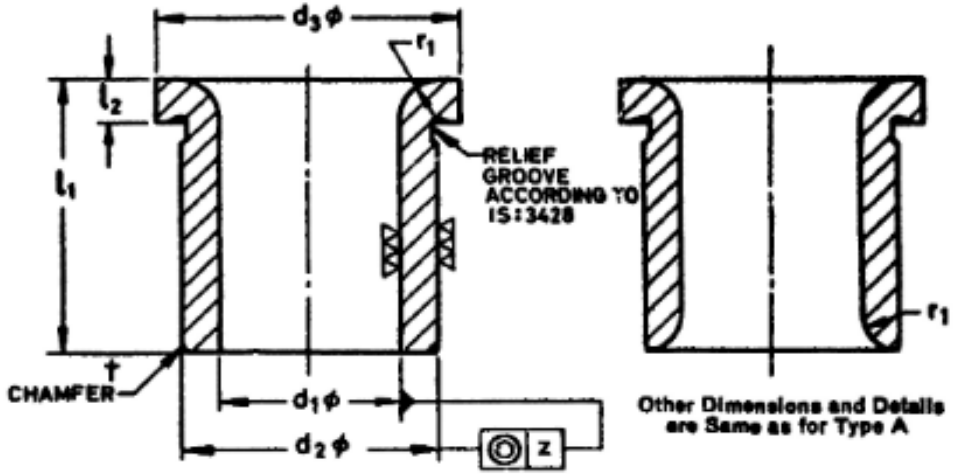
ANSI TYPE-HL Headed Liner Drill Jig Bush



ANSI- TYPE P Headless
Drill Jig Bushings



ANSI -PM(Metric) Headless
Press Fit Drill Jig Bushings



TYPE A BORE ROUNDED ON TOP ONLY

Other Dimensions and Details are Same as for Type A

TYPE B BORE ROUNDED ON BOTH ENDS

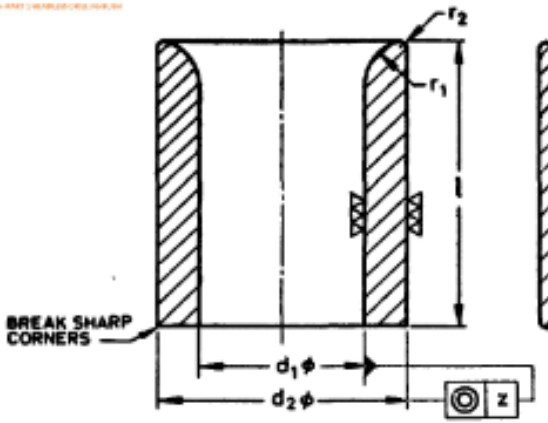
All dimensions in millimetres

d_1* F7		l_1		l_2	d_1 n6	d_3	r_1	z
Over	Up to	Short	Long					
—	1	6	9	2	3	5	1·2	0·01
1	1·8				4	7		
1·8	2·6				5	8		
2·6	3·3	8	12	2·5	6	10	1·6	
3·3	4				7	11		
4	5				8	12	2	
5	6	10	16	3	10	14		0·02
6	8				12	16		
8	10	12	20	4	15	19	2·5	
10	12				18	22		
12	15	16	28	4	22	26	4	
15	18				28	30		
18	22	20	36	5	30	35	6	0·04
22	26				35	40		
26	30				42	47		
30	35	25	45	5	48	55	8	
35	42				55	62		
42	48	30	56	6	62	69		
48	55				70	77		
55	63	35	72	6	78	85		

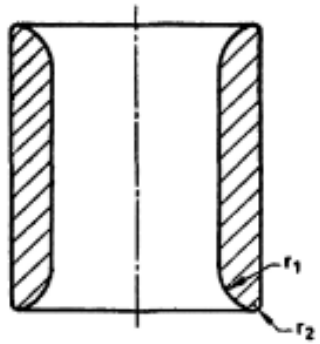
Note — Dimensional deviation for untoleranced dimensions: Medium class according to IS : 2102-1969

*See also 3.

†Suitable chamber to guide in the bushes.



TYPE C BORE ROUNDED ON TOP ONLY



Other Dimensions and Details are Same as for Type A

TYPE D BORE ROUNDED ON BOTH ENDS

All dimensions in millimetres.

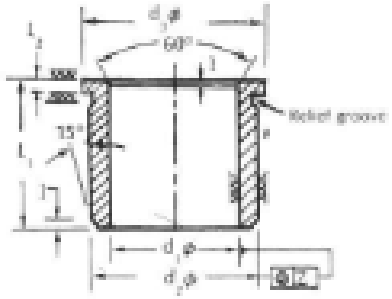
d_1* F7		l		d_2 n6	r_1	r_2	z
Over	Up to	Short	Long				
—	1	6	9	3	1·2	0·2	0·005
1	1·8			4			
1·8	2·6			5		0·3	
2·6	3·3	8	12	6	1·5		
3·3	4			7		0·4	
4	5			8	2		
5	6	10	16	10			
6	8			12		0·6	0·01
8	10	12	20	15	2·5	0·8	
10	12			18			
12	15	16	26	22	4		
15	18			26			
18	22	20	36	30	6	1	0·02
22	26			35			
26	30			42			
30	35	25	45	48	8	1·6	
35	42			55			
42	48	30	56	62			
48	55			70			
55	63	35	72	78			

Note — Dimensional deviation for untoleranced dimensions:
Medium class according to IS : 2102-1969

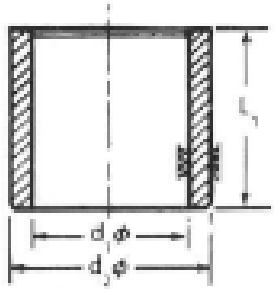
*See also 3.

Liner Jig Bushes

Type 'A' Headed Liner Bush



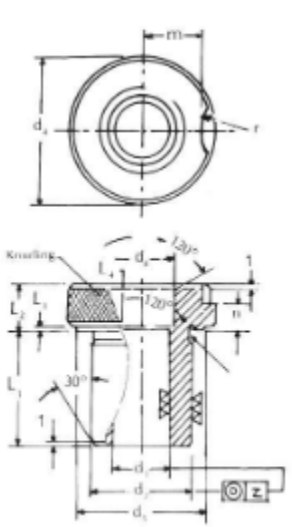
Type 'B' Headless Liner Bush



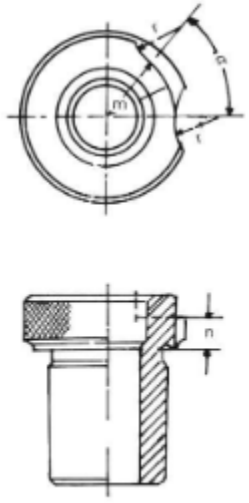
d_1 H7	d_2 m6	d_3	L_1 Short	L_1 Long	L_2	Z
8	12	15	8	12.5	2	0.01
10	15	18	10	16		
15	20	24	12.5	20	2.5	
22	28	32	16	25		0.02
28	36	40	20	32	3	
35	46	50				
46	56	60	25	40	4	0.03
58	70	74				

Renewable Drill Jig Bushes

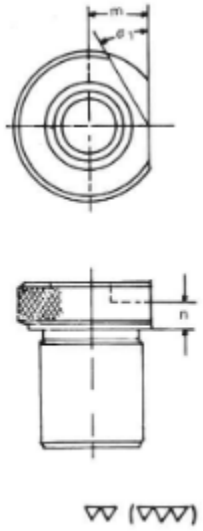
Type 'A' Fixed Renewable Bush



Type 'B' Slip Renewable Bush



Type 'C' Slip Renewable Bush

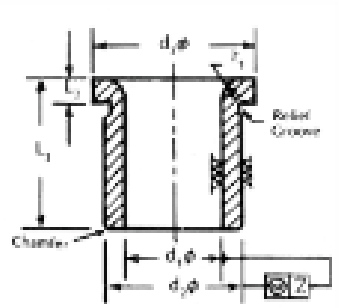


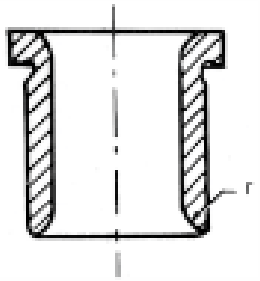
all dimensions in mm

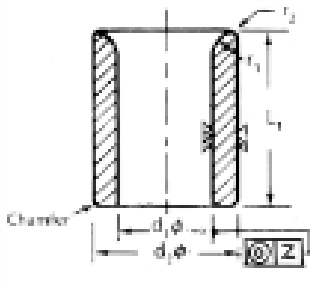
d_1 G7		d_2	d_4	d_5	d_6	f_1	L_1			L_2	L_3	L_4		m	n	r	z_1	α	α	Locking
over	upto	h6					Short	Medium	Long			For l_1 medium	for l_1 long							Screw
-	2.65	8	15	12	3	0.5	8	12.5	0	8	1	4.5	-	5	4.5	7	0.02	65°	40°	M5 x 5
2.65	4.75	10	18	15	5		10	16	25			6	15	6.5						
4.75	8.5	15	24	20	9	0.8	12.5	20	32	10	1	8	20	9	5.5	9	0.03	50°	30°	M6 x 6
8.5	14.0	22	32	28	14.5		16	25	40			9	24	13						
14.0	19.0	28	40	36	20	1.2	20	32	50	12	1.5	12	30	17	7			30°		M6 x 7.5
19.0	25.0	35	50	46	26									22						
25.0	33.5	46	60	50	35	1.6	25	40	63	16	2	15	38	26	9.5	11.5	0.04	20°	20°	M8 x 10
33.5	45.0	58	74	70	47									33						

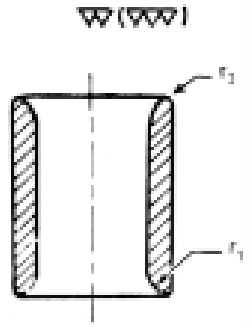
Drill Jig Bushes IS 666 : 1972

TYPE 'A' Bore Rounded On Top Only	Type 'D' Bore Rounded Both Ends	Type 'C' Bore Rounded On Top Only	Type 'D' Bore Rounded Both Ends










از توجه شما عزیزان
سپاسگزارم