



BALL BEARING COMPONENTS

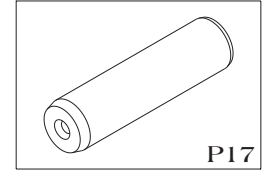


Note: MDL "D" Style Ball Bearing Components are designed to be interchangeable with ball bearing components from "Danyl/IEM" of the same size and type.

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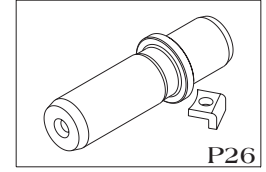
Straight Ball Bearing Guide Posts

.....04-05



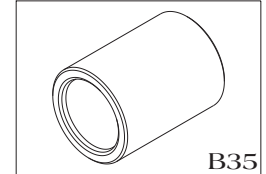
Demountable Ball Bearing Guide Posts

.....06-07



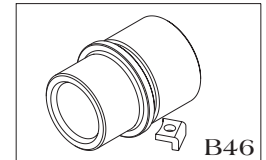
Straight Sleeve Ball Bearing Bushings

.....08



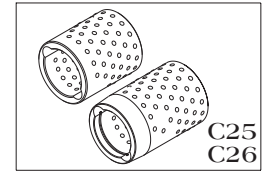
Demountable Ball Bearing Bushings

.....09



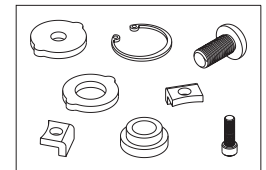
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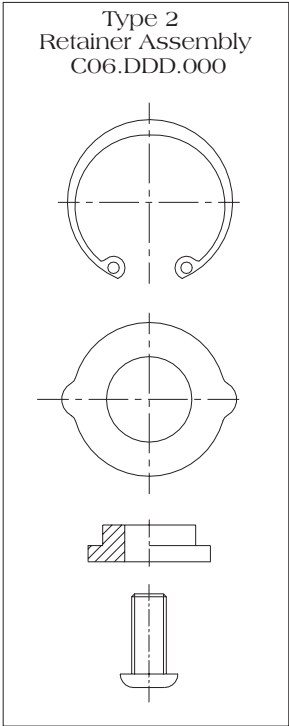
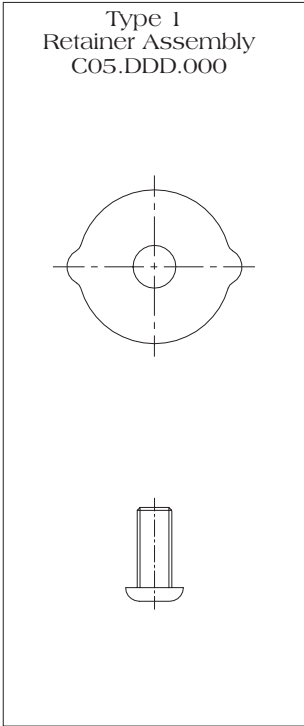
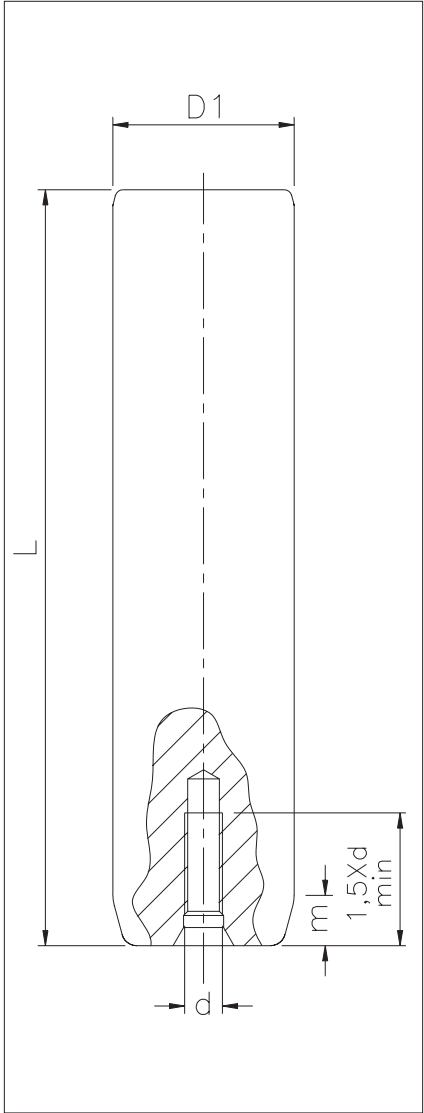
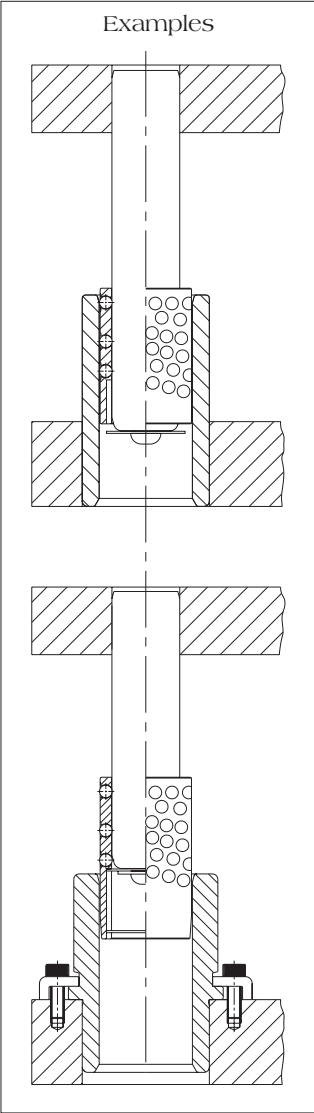
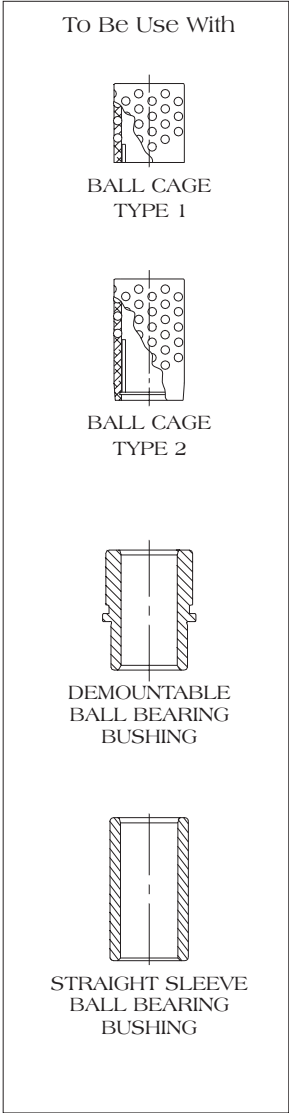
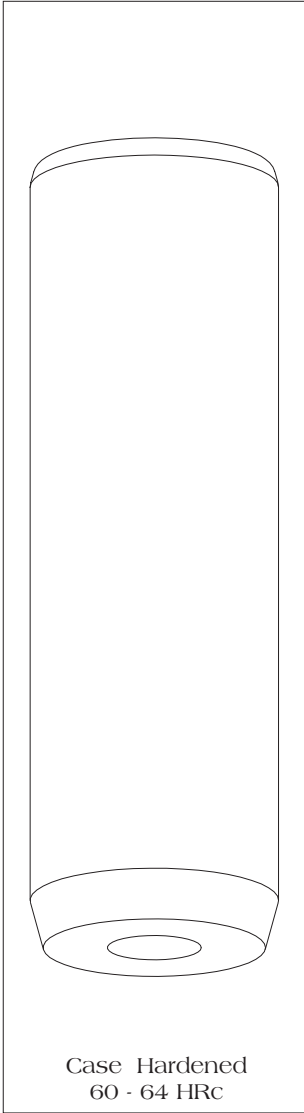
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Type 1 Selection Data and Chart

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MDL Straight Ball Bearing Guide Posts feature bearing quality alloy steel, case hardened, precision ground with a smooth surface finishing that assures free-rolling of cage balls and extend life of components.

All MDL Straight Ball Bearing Guide Posts are drilled and tapped at the bottom end, which is used for mounting the Ball Cage Retainer Assembly.

MDL Straight Ball Bearing Guide Posts are supplied with Type 2 Retainer Assembly.
If Type 1 Retainer Assembly is required, please advice.

MDL recommends that Straight Ball Bearing Guide Posts should be pressed at least 1.5 x its nominal Diameter (D1) into Punch Holder. Never less than 1.0 x Diameter.

To select Guide Post Length, see page 14.

CAUTION:

Tool design with Ball Bearing Components for a certain press stroke should never be used in a press with bigger stroke.

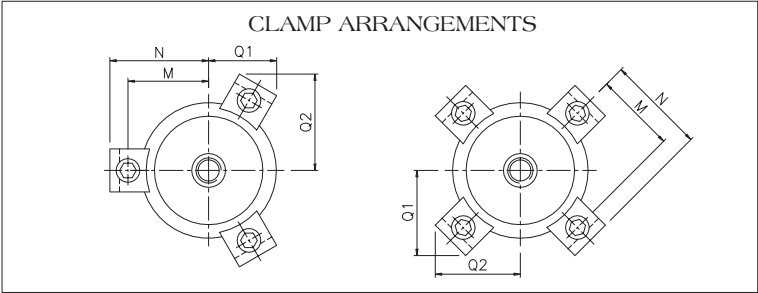
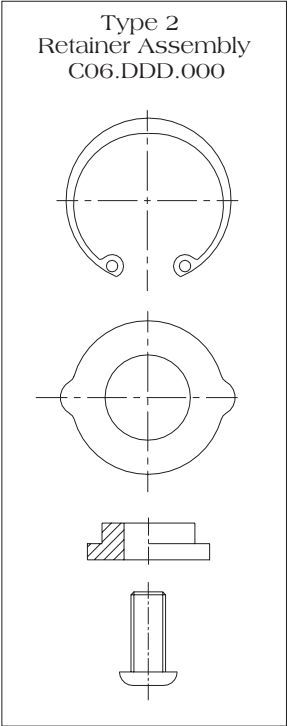
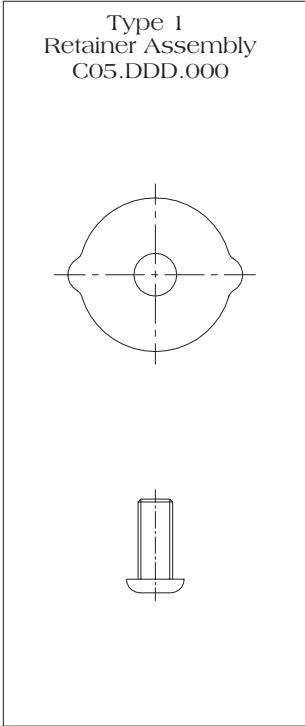
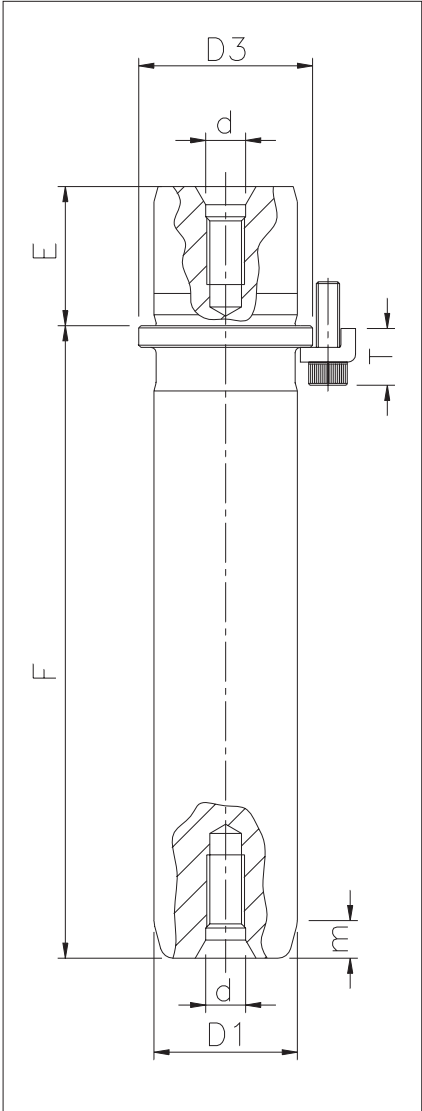
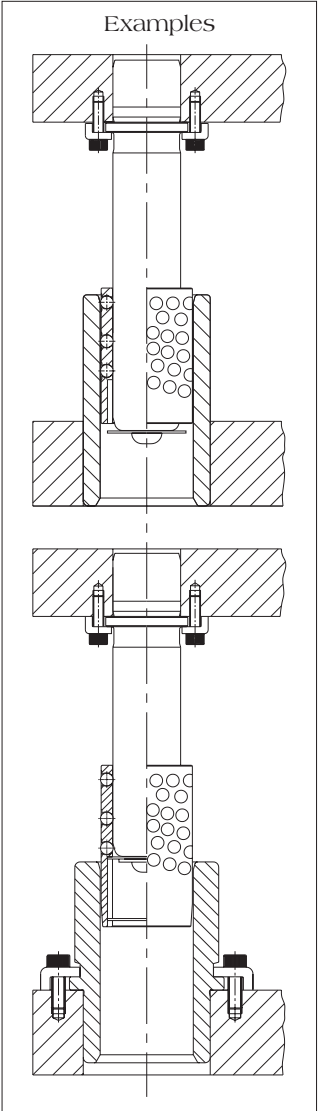
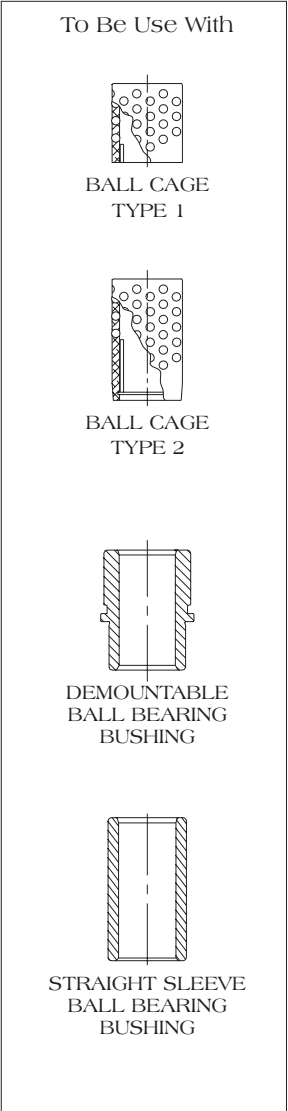
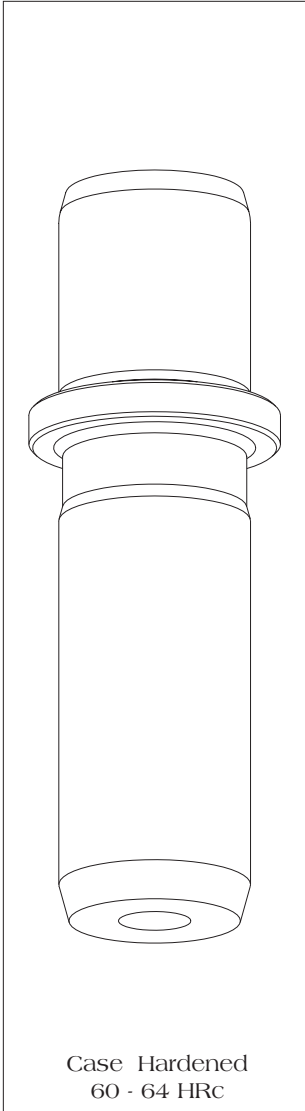
It may be used in a press with smaller stroke.



Straight Ball Bearing Guide Post

P17.DDD.LLL

D _i	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
L	CATALOG NUMBER						
3.25	P17.008.013						
3.75	P17.008.015						
4.25	P17.008.017	P17.010.017	P17.012.017				
4.50	P17.008.018						
4.75	P17.008.019	P17.010.019					
5.00	P17.008.020		P17.012.020	P17.014.020			
5.25	P17.008.021	P17.010.021					
5.50	P17.008.022	P17.010.022					
5.75	P17.008.023	P17.010.023	P17.012.023	P17.014.023	P17.016.023		
6.00	P17.008.024	P17.010.024	P17.012.024				
6.50	P17.008.026	P17.010.026	P17.012.026	P17.014.026	P17.016.026		
7.00	P17.008.028	P17.010.028	P17.012.028	P17.014.028			
7.25					P17.016.029		
7.50	P17.008.030	P17.010.030	P17.012.030	P17.014.030	P17.016.030		
7.75					P17.016.031		
8.00	P17.008.032	P17.010.032	P17.012.032	P17.014.032	P17.016.032	P17.020.032	
8.50	P17.008.034	P17.010.034	P17.012.034	P17.014.034	P17.016.034		P17.024.034
8.75						P17.020.035	
9.00	P17.008.036	P17.010.036	P17.012.036	P17.014.036	P17.016.036		
9.25							P17.024.037
9.50			P17.012.038	P17.014.038	P17.016.038	P17.020.038	
10.00		P17.010.040	P17.012.040	P17.014.040	P17.016.040	P17.020.040	P17.024.040
10.50			P17.012.042	P17.014.042	P17.016.042		
11.00		P17.010.044	P17.012.044	P17.014.044	P17.016.044	P17.020.044	P17.024.044
11.50			P17.012.046	P17.014.046	P17.016.046		
12.00		P17.010.048	P17.012.048	P17.014.048	P17.016.048	P17.020.048	P17.024.048
12.50			P17.012.050	P17.014.050	P17.016.050		
13.00			P17.012.052	P17.014.052	P17.016.052	P17.020.052	P17.024.052
14.00			P17.012.056	P17.014.056	P17.016.056	P17.020.056	P17.024.056
15.00				P17.014.060	P17.016.060		
16.00					P17.016.064		
17.00				P17.014.068	P17.016.068	P17.020.068	P17.024.068
18.00					P17.016.072	P17.020.072	
20.00						P17.020.080	P17.024.080
d	1/4 NC	5/16 NC	3/8 NC		1/2 NC	5/8 NC	
m	0.22						



MDL Demountable Ball Bearing Guide Posts feature bearing quality alloy steel, case hardened, precision ground with a smooth surface finishing that assures free rolling of cage balls and extended life components.

All MDL Demountable Ball Bearing Guide Posts are drilled and tapped at both ends. The bottom end tap is used for mounting the Ball Cage Retainer Assembly.

MDL Demountable Ball Bearing Guide Posts are supplied with Type 2 Retainer Assembly, Clamps and Screws. If Type 1 Retainer Assembly is required, please advice.

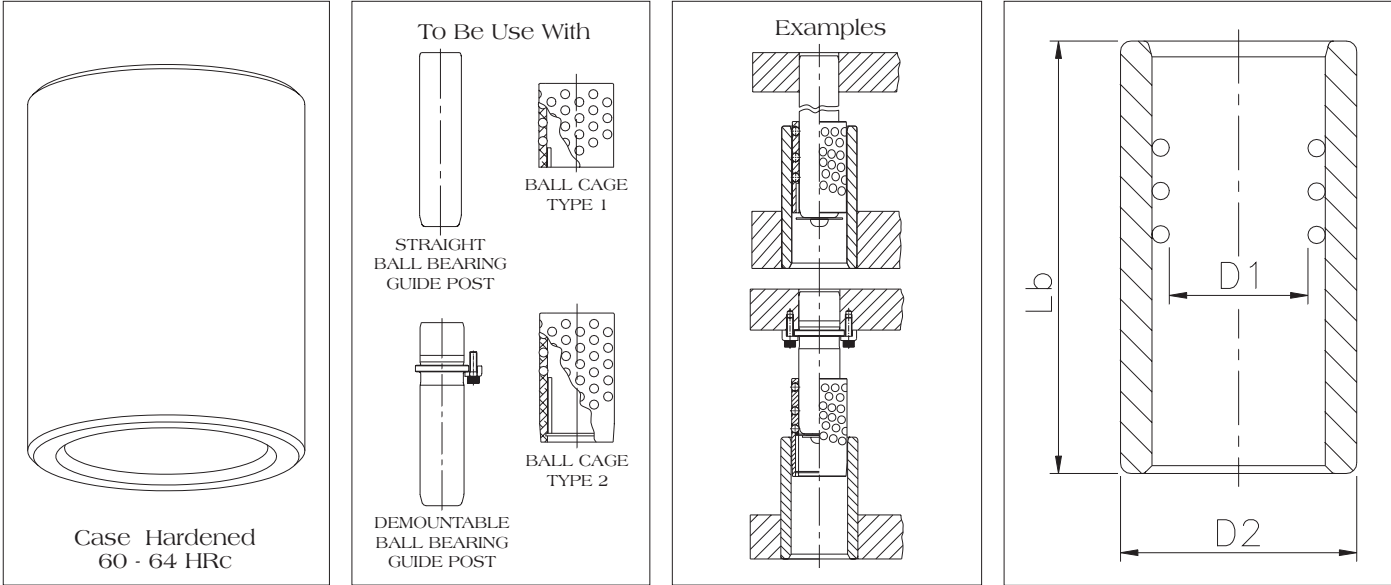
To select Guide Post Length, see page 14.



Demountable Ball Bearing Guide Post

P26.DDD.FFF

D _i	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
F	CATALOG NUMBER						
2.50	P26.008.010						
2.75	P26.008.011						
3.00	P26.008.012						
3.25	P26.008.013	P26.010.013	P26.012.013				
3.50	P26.008.014	P26.010.014	P26.012.014				
3.75	P26.008.015	P26.010.015	P26.012.015	P26.014.015			
4.00	P26.008.016	P26.010.016	P26.012.016	P26.014.016			
4.25	P26.008.017	P26.010.017	P26.012.017	P26.014.017	P26.016.017		
4.50	P26.008.018	P26.010.018	P26.012.018	P26.014.018	P26.016.018		
4.75	P26.008.019	P26.010.019		P26.014.019	P26.016.019		
5.00			P26.012.020		P26.016.020		
5.25	P26.008.021	P26.010.021		P26.014.021	P26.016.021		
5.50			P26.012.022		P26.016.022		
5.75	P26.008.023	P26.010.023		P26.014.023	P26.016.023		
6.00			P26.012.24		P26.016.024	P26.020.024	P26.024.024
6.25	P26.008.025	P26.010.025		P26.014.025			
6.50			P26.012.026		P26.016.026	P26.020.026	P26.024.026
6.75	P26.008.027	P26.010.027		P26.014.027			
7.00			P26.012.028		P26.016.028	P26.020.028	
7.25	P26.008.029	P26.010.029		P26.014.029			
7.50			P26.012.030		P26.016.030		P26.024.030
7.75	P26.008.031	P26.010.031		P26.014.031			
8.00			P26.012.032		P26.016.032	P26.020.032	
8.25				P26.014.033			
8.50			P26.012.034		P26.016.034		P26.024.034
8.75		P26.010.035		P26.014.035			
9.00			P26.012.036		P26.016.036	P26.020.036	
9.25				P26.014.037			
9.50			P26.012.038		P26.016.038		P26.024.038
9.75		P26.010.039		P26.014.039			
10.00			P26.012.040		P26.016.040	P26.020.040	
10.25				P26.014.041			
10.50			P26.012.042		P26.016.042		P26.024.042
10.75		P26.010.043		P26.014.043			
11.00			P26.012.044		P26.016.044	P26.020.044	
11.25				P26.014.045			
11.50			P26.012.046				P26.024.046
12.00					P26.016.048	P26.020.048	
12.25				P26.014.049			
12.50			P26.012.050				
13.00					P26.016.052		
13.25				P26.014.053			
14.00					P26.016.056		
14.25				P26.014.057			
14.50							P26.024.058
15.00					P26.016.060	P26.020.060	
15.25				P26.014.061			
16.00					P26.016.064		
17.50							P26.024.070
18.00						P26.020.072	
D ₃	1 5/16	1 9/16	1 7/8	2 1/4	2 1/2	3 1/32	3 1/2
E	1.1875		1.4375	1.6875	1.9375		2.4375
d	1/4 NC	5/16 NC	3/8 NC		1/2 NC	5/8 NC	
m	0.2756						
M	13/16	63/64	1 1/8	1 19/64	1 27/64	1 43/64	1 59/64
N	1.1436	1.4247	1.5622	1.7309	1.8540	2.1009	2.3484
Q ₁	0.8210	0.9660	1.0363	1.4251	1.5135	1.6903	1.8671
Q ₂	1.1090	1.3602	1.4820				
T	0.606	0.708					
CLAMPS	B01.006.000	B01.008.000					
SCREWS	A25.008.006 (1/4-20 X 3/4)	A25.010.006 (5/16-18 X 3/4)					
Qty	3			4			



D ₁	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
Lb	CATALOG NUMBER						
2.50	B35.008.010						
3.00	B35.008.012	B35.010.012	B35.012.012				
3.50	B35.008.014	B35.010.014		B35.014.014			
3.75			B35.012.015				
4.00	B35.008.016	B35.010.016			B35.016.016		
4.25				B35.014.017			
4.50	B35.008.018	B35.010.018	B35.012.018				
4.75					B35.016.019		
5.00	B35.008.020	B35.010.020	B35.012.020	B35.014.020			
5.50			B35.012.022	B35.014.022	B35.016.022		
6.00		B35.010.024	B35.012.024	B35.014.024		B35.020.024	B35.024.024
6.25					B35.016.025		
6.75						B35.020.027	B35.024.027
7.00			B35.012.028	B35.014.028	B35.016.028		
7.50						B35.020.030	B35.024.030
8.00			B35.012.032	B35.014.032	B35.016.032		
8.50						B35.020.034	B35.024.034
9.00				B35.014.036	B35.016.036		
9.50						B35.020.038	B35.024.038
10.00					B35.016.040		
10.50						B35.020.042	B35.024.042
D ₂	1 7/8	2 1/8	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4

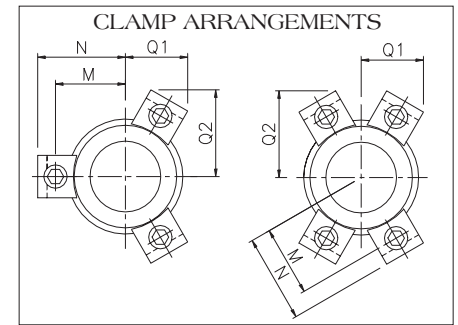
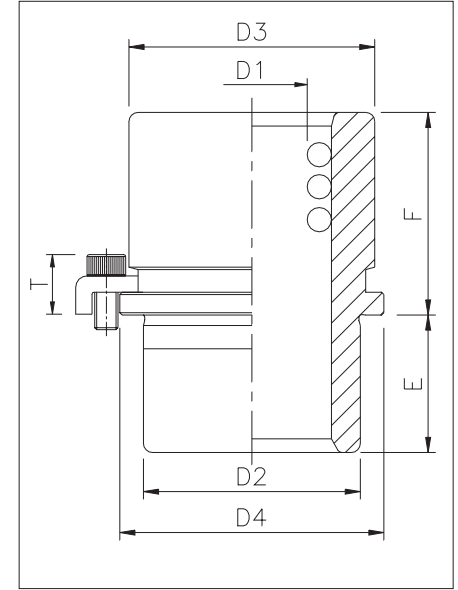
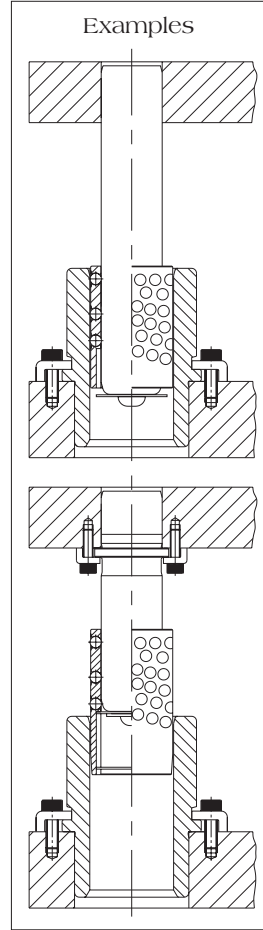
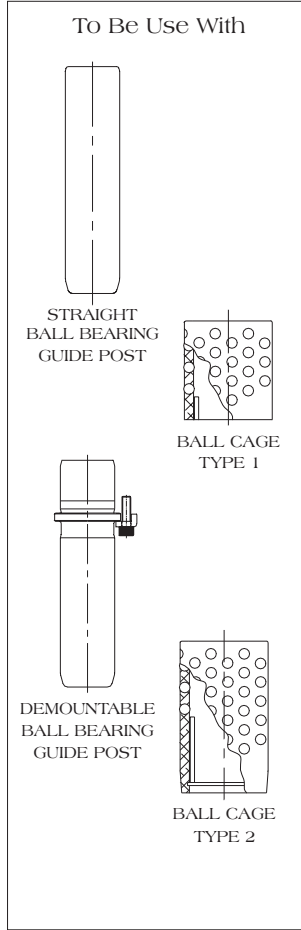
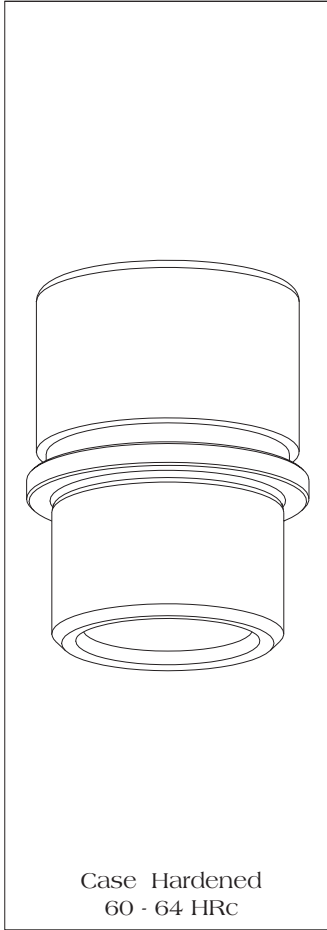
MDL Straight Sleeve Ball Bearing Bushings should not be press-fit since close-in may occur. If properly installed, no honing is necessary.

MDL recommends that Straight Sleeve Ball Bearing Bushings should be installed using Loctite 603.

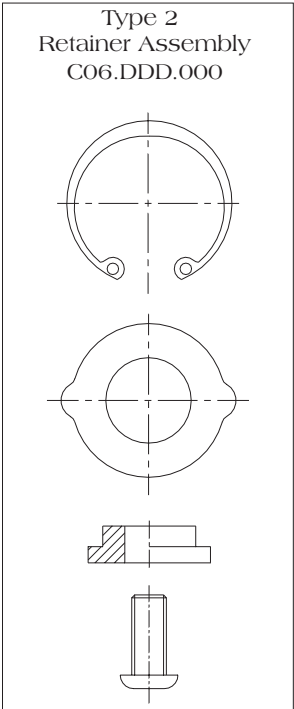
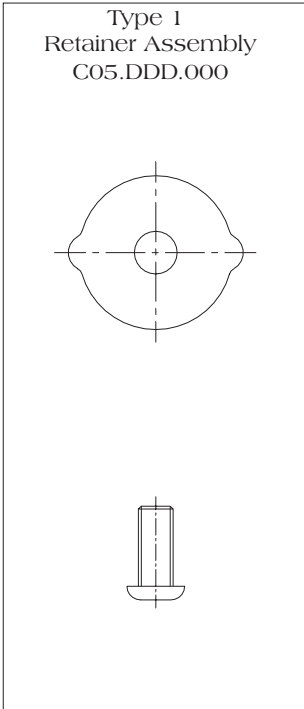
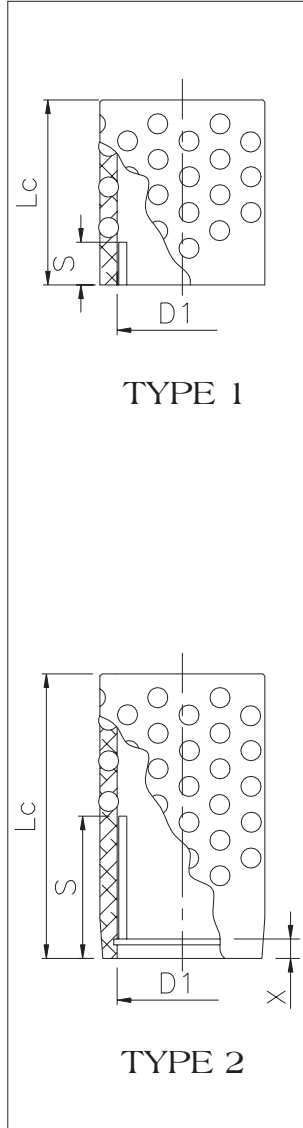
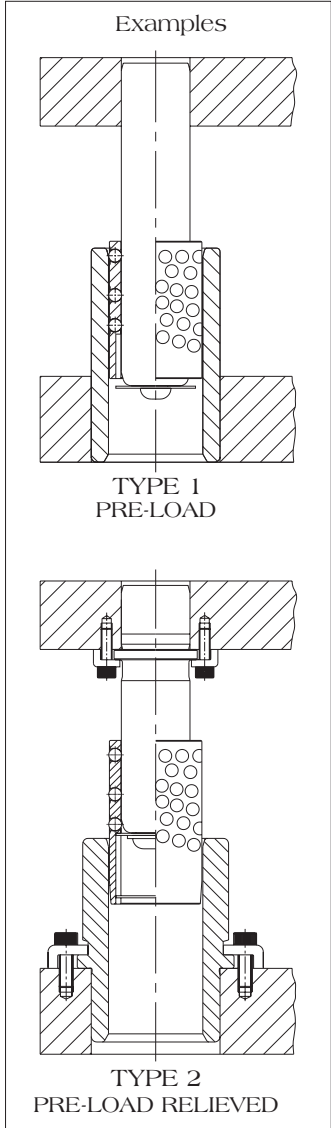
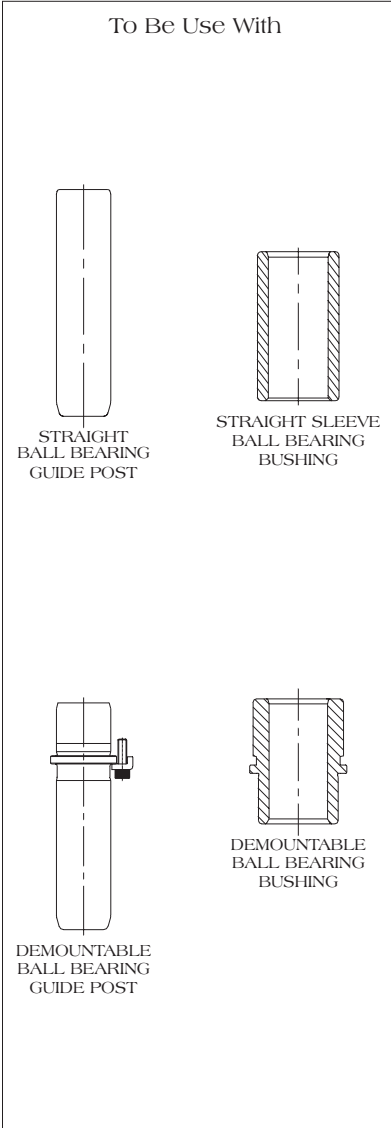
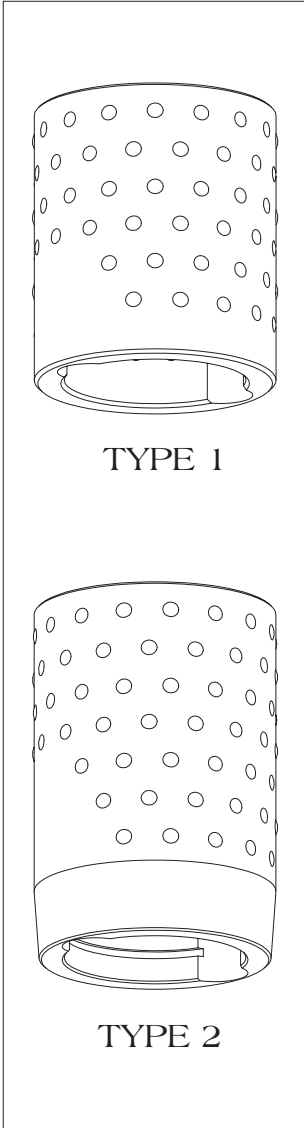
For selection of appropriate Sleeve or Demountable Ball Bearing Bushing length, see page 15 when using with Cage type 1, or page 17 when using Cage type 2.

Assembly Instructions:

1. Press Guide Posts into Punch Holder Plate. End of Guide Posts with drill and tapped hole should not be pressed in. For Demountable Ball Bearing Guide Posts use Clamps and Screws supplied.
2. Be sure Guide Posts are perpendicular to the surface of the Punch Holder (0.001 in 6 inches).
3. Mount Ball Bearing Cages on the Guide Posts using Retainer Assembly supplied.
4. Place Die Shoe on a flat surface. For Big Die Sets we recommend using two horses to keep the bores accessible on both ends.
5. Place on Die Shoe two parallels having height as close as possible Minimum Shut Height.
6. Degrease Sleeve and Die Shoe Bore using appropriate solvent and wipe carefully.
7. Apply a thin layer of Loctite 603 on the Bores and Sleeves.
8. Position the Sleeve into Bore.
9. Bring the Punch Holder into position until it rests on the two parallels.
10. Check that the Sleeves are in the right position.
11. Allow the required time to harden: 4 hours at 72°F. Do not use Die Set during hardening process.



D ₁	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
F	CATALOG NUMBER						
1.25	B46.008.005						
1.50			B46.012.006				
1.75	B46.008.007	B46.010.007		B46.014.007			
2.00					B46.016.008		
2.25	B46.008.009	B46.010.009	B46.012.009				
2.50				B46.014.010			
2.75	B46.008.011	B46.010.011			B46.016.011		
3.00			B46.012.012				
3.25				B46.014.013			
3.50			B46.012.014		B46.016.014		
4.00						B46.020.016	B46.024.016
4.25					B46.016.017		
4.75						B46.020.019	B46.024.019
5.00					B46.016.020		
5.50						B46.020.022	B46.024.022
D ₂	1 7/8	2 1/8	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4
D ₃	2 1/8	2 3/8	2 7/8	3 1/8	3 5/8	4 1/8	4 3/4
D ₄	2.283	2.533	3.033	3.283	3.783	4.283	4.908
E	1.1875		1.4375	1.6875	1.9375		
M	1.3396	1.4657	1.7198	1.8439	2.0961	2.3573	2.6753
N	1.7462	1.8722	2.1264	2.2505	2.5026	2.7639	3.0818
Q ₁	1.1439	1.2070	1.3340	1.3961	1.5222	1.6528	1.8117
Q ₂	1.6686	1.7778	1.9979	2.1053	2.3237	2.5499	2.8253
T	0.708						
CLAMPS	B01.008.001						
SCREWS	A25.010.006 (5/16-18 X 3/4)						
Qty	3			4			



MDL Ball Bearing Cages are manufactured from aluminum alloy heat treated tubing with tough and wear-resistant properties. Balls are made of bearing quality alloy steel through hardened and thoroughly inspected.

Operating Conditions:

Type 1:

In this condition at the top end of the stroke, the Guide Post does not leave the top end of the Bushing and the entire Cage remains under pre-load. At the bottom end of the stroke, the lower end of the Guide Post and the Retainer Assembly can leave the lower end of the Cage.

On type 1 condition, the Cage remains under full pre-load contact with the Guide Post and the Bushing during the entire length of the stroke.

Type 2:

In this condition at the upper end of the stroke, the Guide Post may leave the top end of the Bushing. When this happens the Cage starts to travel with the Guide Post. At the bottom end of stroke, the Guide Post and the Retainer Assembly cannot leave the lower end of the Cage due to a Snap Ring.

On type 2 condition, the Cage remains under pre-load with the Guide Post and the Bushing only when the lower end of the Guide Post goes below the top end of the Bushing.

To select Ball Bearing Cages length, see page 15 when using with Cage type 1, or page 17 when using with Cage type 2.

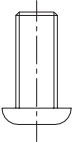
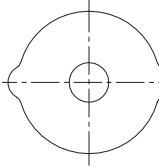
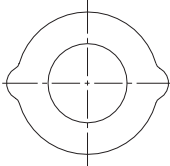

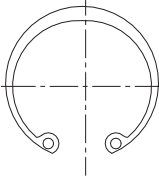


Ball Bearing Cages
Type 1 & 2

C25.DDD.LcLcLc
C26.DDD.LcLcLc

D _i		1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
L _c	S	CATALOG NUMBER TYPE 1						
1.50	0.4375	C25.008.006	C25.010.006					
2.00	0.6875	C25.008.008	C25.010.008	C25.012.008				
2.50	0.9375			C25.012.010	C25.014.010			
3.00	1.1875				C25.014.012	C25.016.012		
3.50	1.4375					C25.016.014		
4.00	1.6875						C25.020.016	C25.024.016
L _c	S	CATALOG NUMBER TYPE 2						
2.00	1.0625	C26.008.008						
2.50	1.3125	C26.008.010						
2.75	1.4375		C26.010.011	C26.012.011				
3.00	1.5625	C26.008.012						
3.25	1.6875		C26.010.013		C26.014.013			
	1.8125	C26.008.013						
3.50	1.8125			C26.012.014				
	2.0625	C26.008.014						
3.75	1.9375		C26.010.015			C26.016.015		
	2.3125	C26.008.015						
4.00	2.0625				C26.014.016			
	2.1875		C26.010.016					
4.25	2.1875			C26.012.017				
	2.4375		C26.010.017					
4.50	2.3125					C26.016.018		
	2.4375			C26.012.018				
4.75	2.4375				C26.014.019			
	2.9375		C26.010.019					
5.00	2.9375			C26.012.020				
5.25	2.6875					C26.016.021		
	2.9375				C26.014.021			
5.50	3.4375			C26.012.022				
5.625	3.0625					C26.016.023		
5.75	3.0000						C26.020.023	C26.024.023
	3.4375				C26.014.023			
6.00	3.4375					C26.016.024		
	3.9375			C26.012.024				
6.25	3.9375				C26.014.025			
6.50	3.3750						C26.020.026	C26.024.026
	3.9375					C26.016.026		
6.75	4.4375				C26.014.027			
7.00	4.4375					C26.016.028		
7.25	3.7500						C26.020.029	C26.024.029
7.50	4.9375					C26.016.030		
7.75	4.2500						C26.020.031	C26.024.031
8.25	4.7500						C26.020.033	C26.024.033
8.75	5.2500						C26.020.035	C26.024.035
X		0.1875		0.2500			0.3750	

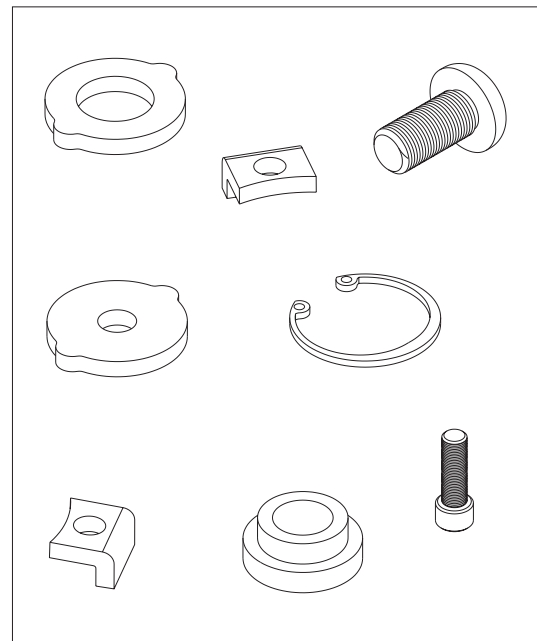
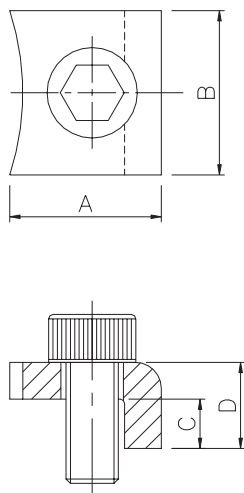
Retainer Assembly

POST DIA.						Type 1 Retainer Assembly (Screw and Washer)	Type 2 Retainer Assembly (Screw, Washer, Bushing and Snap Ring)
	Screw ANSI B 18.3	Retaining Washer type 1	Retaining Washer type 2	Bushing type 2	Snap Ring		

USED WITH ASSEMBLY TYPE

	1 & 2	1	2	2	2		
1	A26.008.006 <small>(1/4-20 X 3/4)</small>	C05.008.001	C06.008.001	C02.025.002	C06.008.003	C05.008.000	C06.008.000
1 1/4	A26.010.007 <small>(5/16-18 X 7/8)</small>	C05.010.001	C06.010.001	C02.032.002	C06.010.003	C05.010.000	C06.010.000
1 1/2	A26.012.008 <small>(3/8-16 X 1)</small>	C05.012.001	C06.012.001	C02.040.002	C06.012.003	C05.012.000	C06.012.000
1 3/4		C05.014.001	C06.014.001		C06.014.003	C05.014.000	C06.014.000
2	A26.016.010 <small>(1/2-13 X 1 1/4)</small>	C05.016.001	C06.016.001	C02.050.002	C06.016.003	C05.016.000	C06.016.000
2 1/2	A26.020.012 <small>(5/8-11 X 1 1/2)</small>	C05.020.001	C06.020.001	C02.063.002	C06.020.003	C05.020.000	C06.020.000
3		C05.024.001	C06.024.001		C06.024.003	C05.024.000	C06.024.000

Clamps

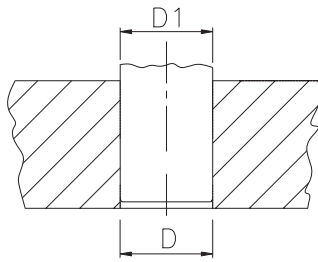


Cat. N°	B01.006.000	B01.008.000	
A	0.610	0.779	
B	0.625	0.625	
C	0.192	0.192	
D	0.342	0.374	
SCREWS	A25.008.006 <small>(1/4-20 X 3/4)</small>	A25.010.006 <small>(5/16-18 X 3/4)</small>	

Lubrication Recommendation

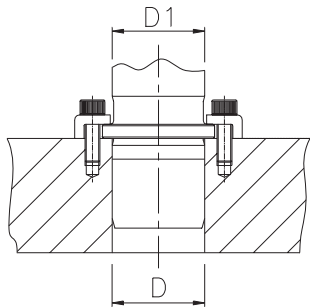
MDL Ball Bearing Components under normal operating conditions should be lubricated using mineral oil of viscosity 290/340 SSU @ 100°F once every eight hour shift.

This lubricant may be applied by spray or clean brush.



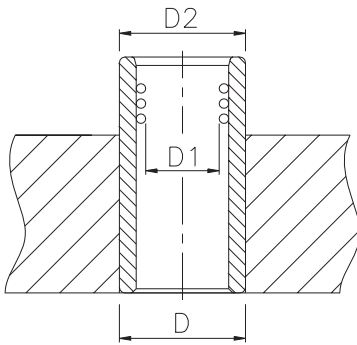
STRAIGHT BALL BEARING GUIDE POST P17

D ₁	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
D	$\frac{0.9988}{0.9980}$	$\frac{1.2488}{1.2480}$	$\frac{1.4983}{1.4975}$	$\frac{1.7483}{1.7475}$	$\frac{1.9983}{1.9975}$	$\frac{2.4978}{2.4970}$	$\frac{2.9978}{2.9970}$



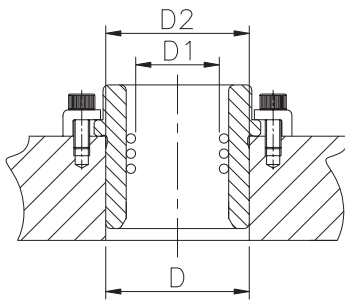
DEMOUNTABLE BALL BEARING GUIDE POST P26

D ₁	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
D	$\frac{0.9988}{0.9980}$	$\frac{1.2488}{1.2480}$	$\frac{1.4983}{1.4975}$	$\frac{1.7483}{1.7475}$	$\frac{1.9983}{1.9975}$	$\frac{2.4978}{2.4970}$	$\frac{2.9978}{2.9970}$



STRAIGHT SLEEVE BALL BEARING BUSHING B35

D ₁	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
D ₂	1 7/8	2 1/8	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4
D	$\frac{1.8755}{1.8748}$	$\frac{2.1255}{2.1248}$	$\frac{2.5005}{2.4998}$	$\frac{2.7505}{2.7498}$	$\frac{3.2505}{3.2498}$	$\frac{3.7505}{3.7498}$	$\frac{4.2505}{4.2498}$

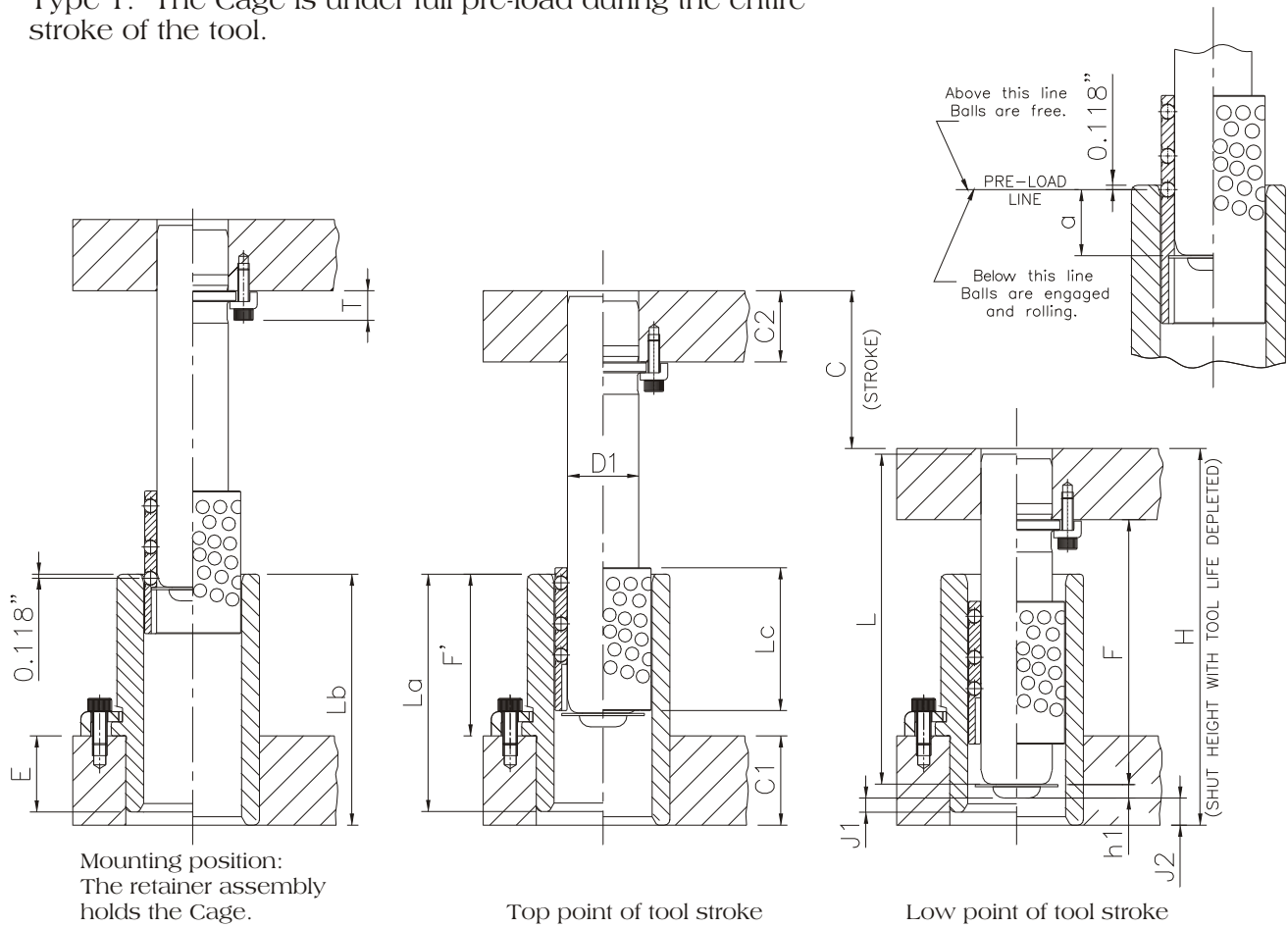


DEMOUNTABLE BALL BEARING BUSHING B46

D ₁	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
D ₂	1 7/8	2 1/8	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4
D	$\frac{1.8755}{1.8748}$	$\frac{2.1255}{2.1248}$	$\frac{2.5005}{2.4998}$	$\frac{2.7505}{2.7498}$	$\frac{3.2505}{3.2498}$	$\frac{3.7505}{3.7498}$	$\frac{4.2505}{4.2498}$

Bores for MDL Ball Bearing Guide Posts and Bushings should be precision bored, smooth and free from toll marks to provide proper bearing area.

Type 1: The Cage is under full pre-load during the entire stroke of the tool.



Calculations for Guide Post Length (L for Straight, F for Demountable)

Straight Sleeve Bushing		Demountable Bushing							
Straight Guide Post	Demountable Guide Post	Straight Guide Post	Demountable Guide Post						
$L = H - h - J_2$	$F \leq H - h - J_2 - C_2$	$L = H - J_1 - h - C_1 + E$	$F \leq H - J_1 - h - C_1 + E - C_2$						
CAUTION: $H > C_2 + L_b$	CAUTION: $H > C_2 + L_b + T$	CAUTION: $H > C_1 + C_2 + F'$	CAUTION: $H > C_1 + C_2 + F' + T$						
NB: $h = h_1$ (for type 1); $h = h_2$ (for type 2);		for E see page 9;		for T see page 7;		J1 = J2 = 0.16			
For Straight Guide Post, if calculated length (L) is not available: Select the immediately longer Guide Post and cut it or select the immediately shorter Guide Post and press it on the Punch Holder of Die Set until exact length is obtained. For Demountable Guide Post, if calculated length (F) is not available: Select the immediately shorter one. NB: Demountable Guide Post should never be cut.		D1	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
		a	0.62	0.56	0.54	0.50	0.54	0.49	0.46
		h1	0.23	0.26	0.30	0.30	0.36	0.43	0.43
		h2	0.43	0.46	0.50	0.50	0.56	0.63	0.63

Selection of Ball Bearing (Straight or Demountable) and Cages for type 1 is based on Guide Post diameter and stroke of tool using chart of page 15:

1. Select desired Guide Post diameter "D1".
2. Select required stroke of tool "C" (don't forget to add grinding allowance of tool to press stroke).
3. Move down the stroke column until you reach the color area corresponding to the Guide Post diameter used. Up to 2" diameter, each color corresponds to one Ball Bearing Cage length available. Choose the Ball Bearing Cage that best suites your tool. Long Cages provide longer life.
4. Move horizontally to select the length of Ball Bearing Bushings (Straight or Demountable). Maximum length of Ball Bearing Bushings is limited by space available between the plates of the Die Set (don't forget to consider "T" for Demountable Ball Bearing Guide Post and die grinding allowance). To check interference, use formula above label as "CAUTION".

NB: Demountable Ball Bearing Bushings $L_a = E + F$

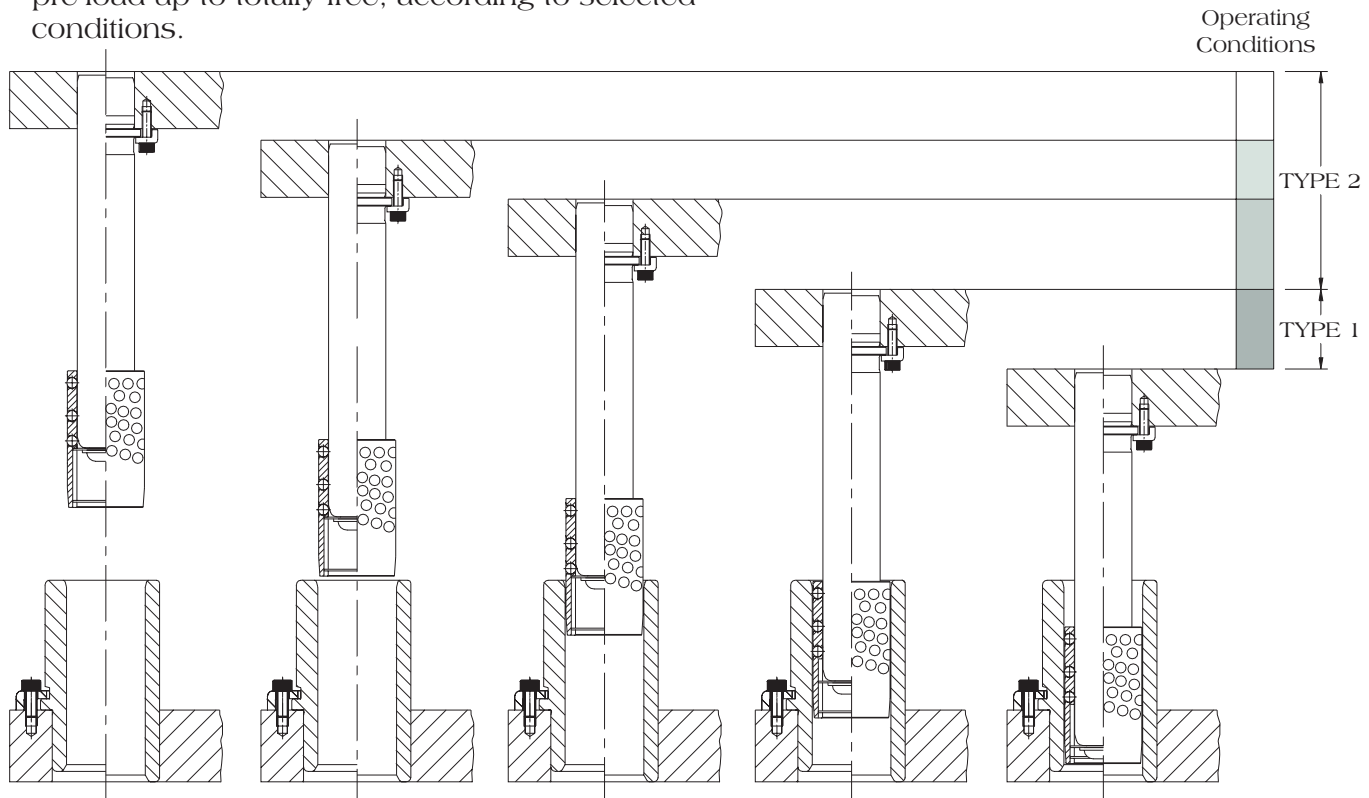


Type 1 Bushing & Ball Cage Selection Chart

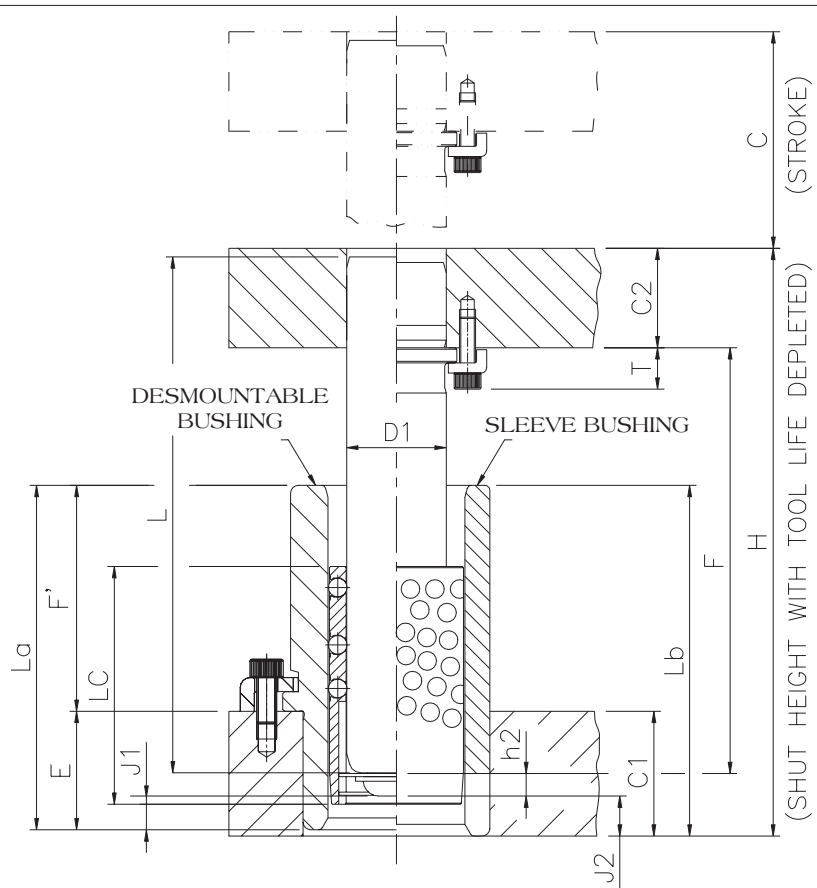


POST DIA.	BALL BEARING BUSHING		BALL CAGE (PG 11)	STROKE "C" INCLUDING DIE GRINDING ALLOWANCE													Maximum Die Grind Allowance
	DEMOUNTABLE (PG 9)	STRAIGHT SLEEVE (PG 8)		0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	
D ₁	F	L _b	L _c														
1	1.25	3.00	1.50														0.3750
	2.25	3.50															
	2.75	4.00															
	4.50																
	5.00	2.00															
1 1/4	1.75	3.00	1.50														0.3750
	2.25	3.50															
	2.75	4.00															
	4.50																
	5.00	2.00															
6.00	2.00														0.4375		
1 1/2	2.25															3.75	2.00
	3.00															4.50	
	3.50															5.00	
	5.50																
	6.00	2.50															
7.00	2.50														0.5000		
1 3/4	2.50															4.25	2.50
	3.25															5.00	
	5.50																
	6.00																
	7.00																
8.00	3.00														0.5625		
2	2.75															4.75	3.00
	3.50															5.50	
	4.25															6.25	
	5.00															7.00	
	8.00																
9.00																	
10.00	3.50														0.6250		
2 1/2	4.00															6.00	4.00
	4.75															6.75	
	5.50															7.50	
	8.50																
	9.50																
10.50																	
3	4.00	6.00	4.00														0.6250
	4.75	6.75															
	5.50	7.50															
	8.50																
	9.50																
10.50																	

Type 2: The cage pre-load can vary from partial pre-load up to totally free, according to selected conditions.



Guide Post Length calculation see page 14.



Selection of Ball Bearing Bushings (Straight or Demountable) and Cages for Type 2 is based on Guide Post diameter and stroke of tool using chart of page 17:

1. Select desired Guide Post diameter "D1".
2. Select required stroke of tool "C" (don't forget to add grinding allowance of tool to press stroke).
3. Move down the stroke column until you reach the color of desired operating condition.
4. Move horizontally to the left to select the length of Ball Bearing Bushing (Straight or Demountable) and Cage.

On Type 2, each Ball Bearing Cage length corresponds to one Ball Bearing Bushing length.

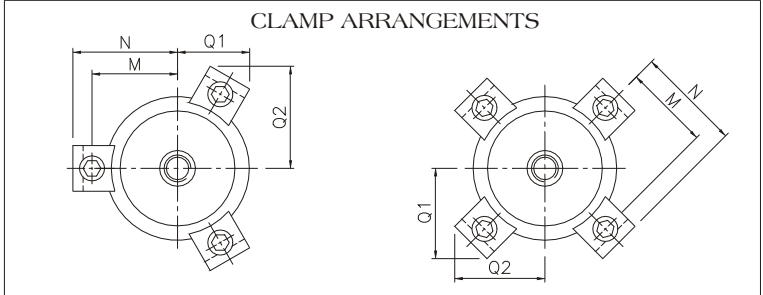
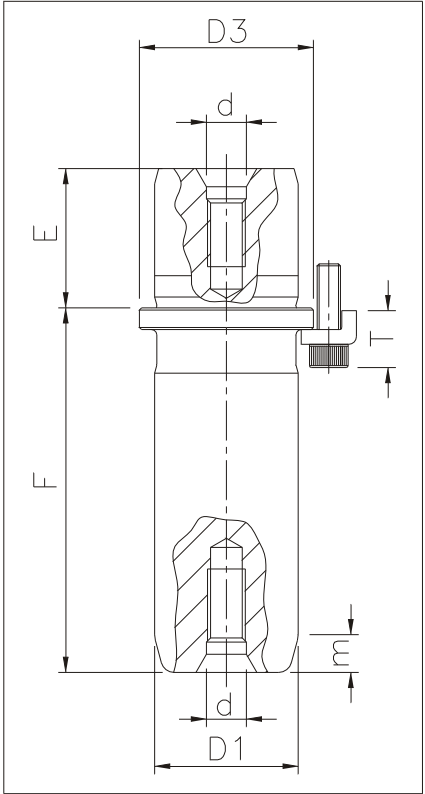
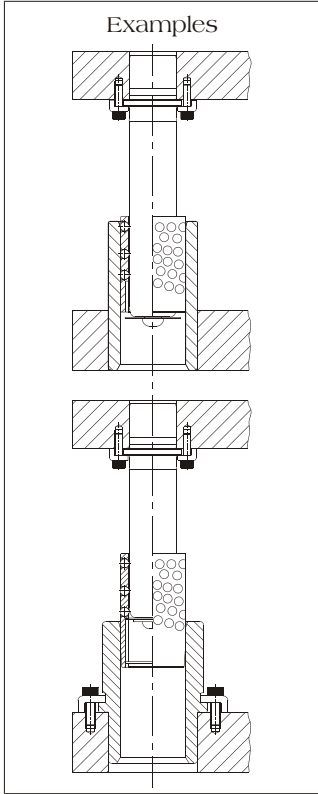
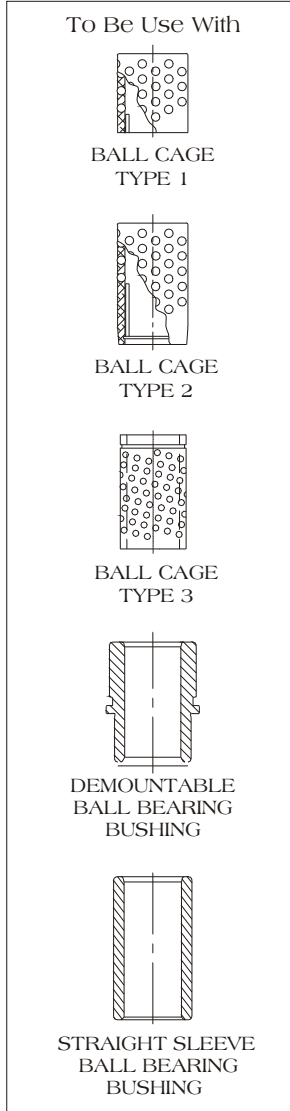
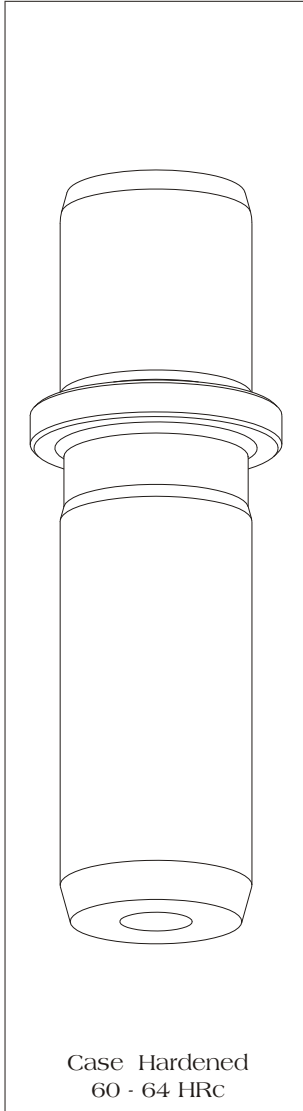
Caution: Length of Ball Bearing Bushing is limited by space available between the plates of the Die Set (don't forget to consider "T" for Demountable Guide Post). To check interference, use formula on page 14 labeled as "CAUTION".



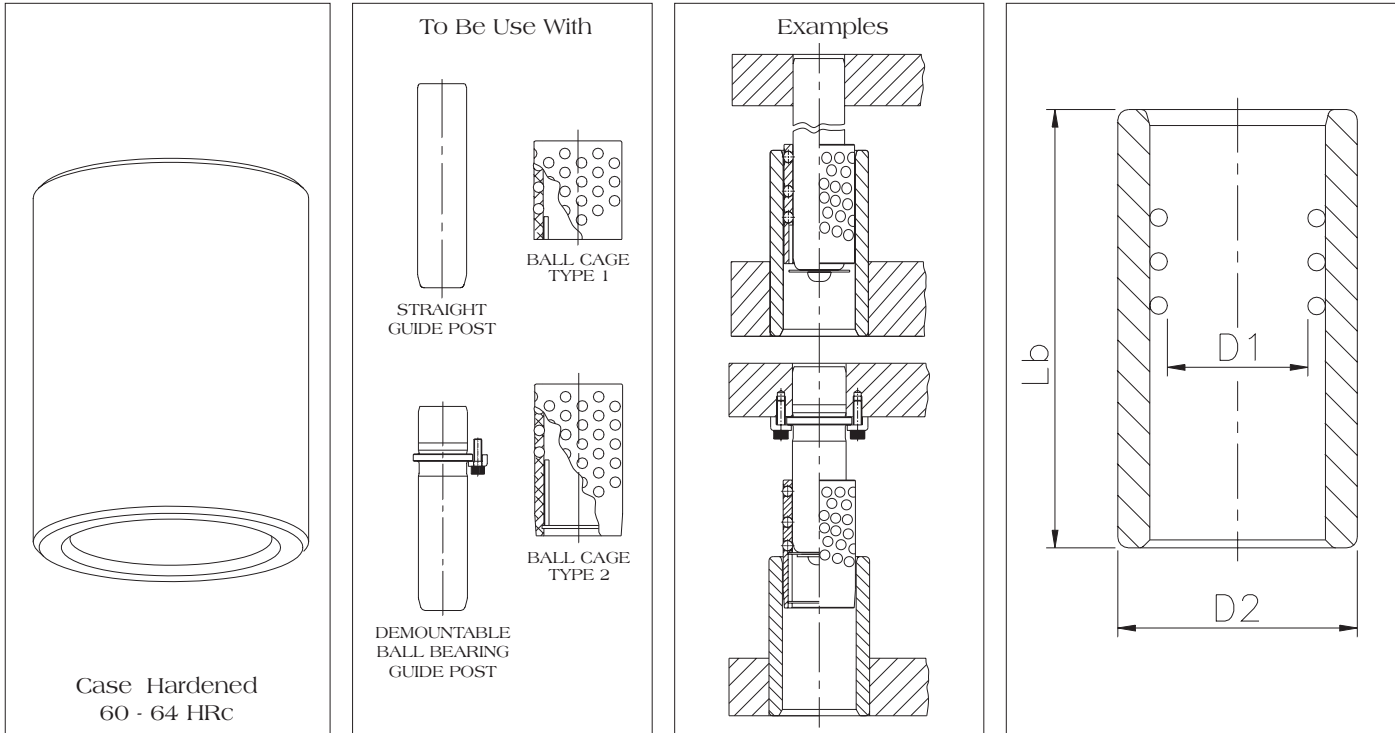
Type 2 Bushing & Ball Cage Selection Chart



POST DIA.	BALL BEARING BUSHING		BALL CAGE (PG 11)	STROKE "C" INCLUDING DIE GRINDING ALLOWANCE												
	DEMOUNTABLE (PG 9)	STRAIGHT SLEEVE (PG 8)		0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	7.00
	F	L _b		L _c												
1	1.25	2.50	2.00													
	1.75	3.00	2.50													
	2.25	3.50	3.00													
	2.75	4.00	3.25													
		4.50	3.50													
		5.00	3.75													
1 1/4	1.75	3.00	2.75													
	2.25	3.50	3.25													
	2.75	4.00	3.75													
		4.50	4.00													
		5.00	4.25													
		6.00	4.75													
1 1/2	1.50	3.00	2.75													
	2.25	3.75	3.50													
	3.00	4.50	4.25													
	3.50	5.00	4.50													
		6.00	5.00													
		7.00	5.50													
	8.00	6.00														
1 3/4	1.75	3.50	3.25													
	2.50	4.50	4.00													
	3.25	5.00	4.75													
		6.00	5.25													
		7.00	5.75													
		8.00	6.25													
	9.00	6.75														
2	2.00	4.00	3.75													
	2.75	4.75	4.50													
	3.50	5.50	5.25													
	4.50	6.25	5.625													
	5.00	7.00	6.00													
		8.00	6.50													
		9.00	7.00													
	10.00	7.50														
2 1/2	4.00	6.00	5.75													
	4.75	6.75	6.50													
	5.50	7.50	7.25													
		8.50	7.75													
		9.50	8.25													
		10.50	8.75													
3	4.00	6.00	5.75													
	4.75	6.75	6.50													
	5.50	7.50	7.25													
		8.50	7.75													
		9.50	8.25													
		10.50	8.75													



D ₁	25	32	40	50	63	80
F	CATALOG NUMBER					
80	P21.025.080					
90	P21.025.090					
100	P21.025.100	P21.032.100	P21.040.100			
110	P21.025.110	P21.032.110	P21.040.110	P21.050.110		
125	P21.025.125	P21.032.125	P21.040.125	P21.050.125	P21.063.125	P21.080.125
140	P21.025.140	P21.032.140	P21.040.140	P21.050.140	P21.063.140	P21.080.140
160	P21.025.160	P21.032.160	P21.040.160	P21.050.160	P21.063.160	P21.080.160
180	P21.025.180	P21.032.180	P21.040.180	P21.050.180	P21.063.180	P21.080.180
200	P21.025.200	P21.032.200	P21.040.200	P21.050.200	P21.063.200	P21.080.200
220		P21.032.220	P21.040.220	P21.050.220	P21.063.220	P21.080.220
250		P21.032.250	P21.040.250	P21.050.250	P21.063.250	P21.080.250
280		P21.032.280	P21.040.280	P21.050.280	P21.063.280	P21.080.280
315				P21.050.315	P21.063.315	P21.080.315
355				P21.050.355	P21.063.355	P21.080.355
400				P21.050.400	P21.063.400	P21.080.400
500						P21.080.500
D ₃	32	40	50	63	76	93
E	25	32	40	45	50	60
d	M6	M8	M10	M12	M16	M20
m	9,6	10,1	10,6	11,3	12,1	13,3
M	20,3	24,0	30,0	36,5	42,5	51,0
N	28,7	32,3	41,1	47,5	53,4	61,8
Q ₁	20,7	22,5	27,0			
Q ₂	27,9	31,3	38,9	38,7	43,0	49,0
T	15,1			18,1		
CLAMPS	B01.006.000			B01.008.000		
SCREWS	A05.006.016 (M6 X 16)			A05.008.020 (M8 X 20)		
Qty	3			4		



D ₁	25	32	40	50	63	80
L _b	CATALOG NUMBER					
65	B30.025.065					
80	B30.025.080	B30.032.080	B30.040.080			
95	B30.025.095	B30.032.095	B30.040.095			
110	B30.025.110	B30.032.110	B30.040.110	B30.050.110		
130	B30.025.130	B30.032.130	B30.040.130	B30.050.130		
150		B30.032.150	B30.040.150	B30.050.150	B30.063.150	B30.080.150
170		B30.032.170	B30.040.170	B30.050.170	B30.063.170	B30.080.170
190			B30.040.190	B30.050.190	B30.063.190	B30.080.190
215			B30.040.215	B30.050.215	B30.063.215	B30.080.215
240				B30.050.240	B30.063.240	B30.080.240
265				B30.050.265	B30.063.265	B30.080.265
D ₂	45	54	65	81	95	112

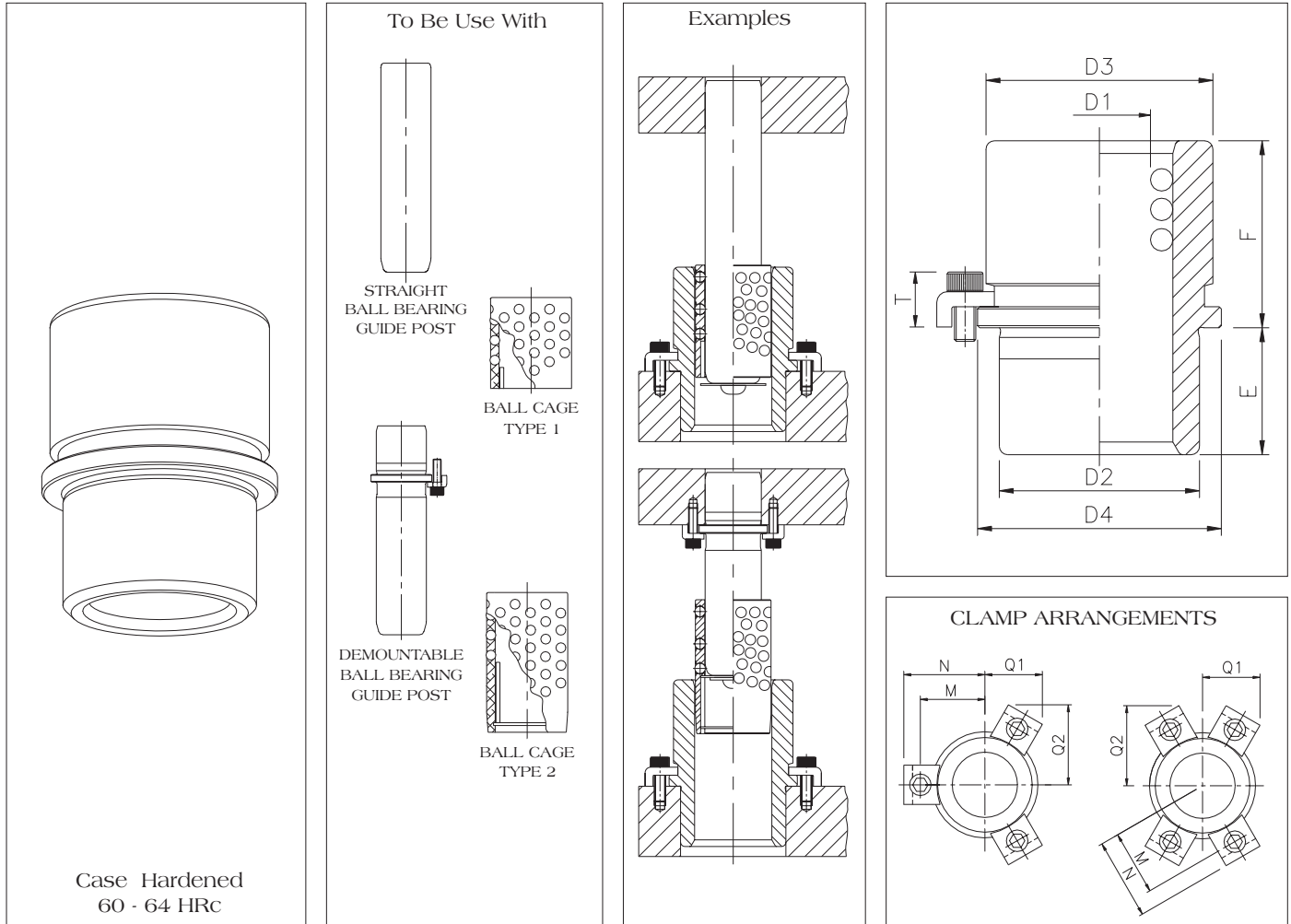
MDL Straight Sleeve Ball Bearing Bushings should not be press-fit since close-in may occur. If properly installed, no honing is necessary.

MDL recommends that Straight Sleeve Ball Bearing Bushings should be installed using Loctite 603.

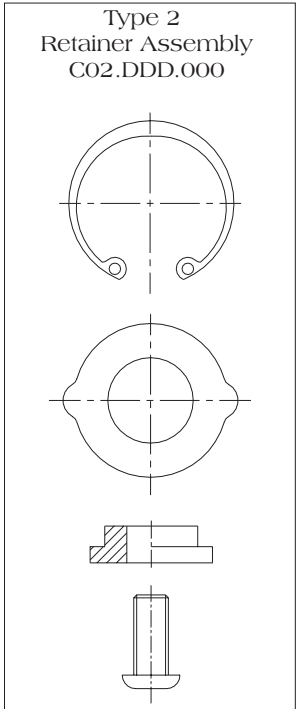
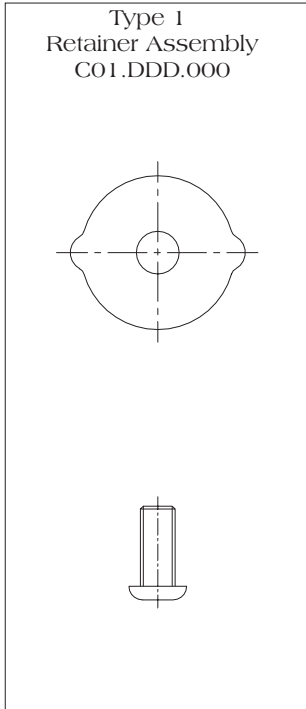
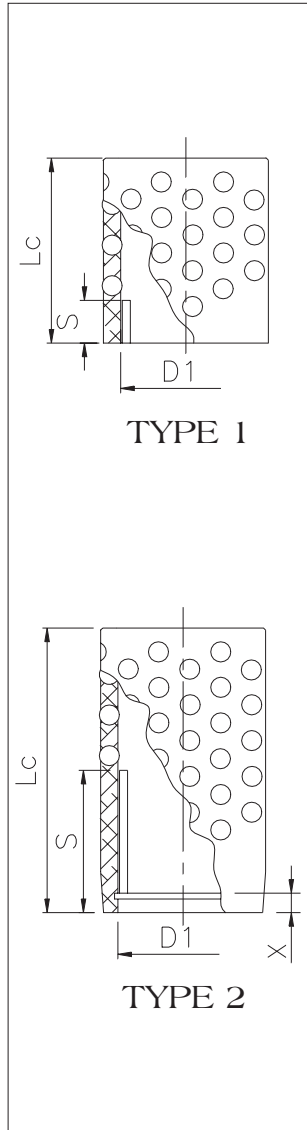
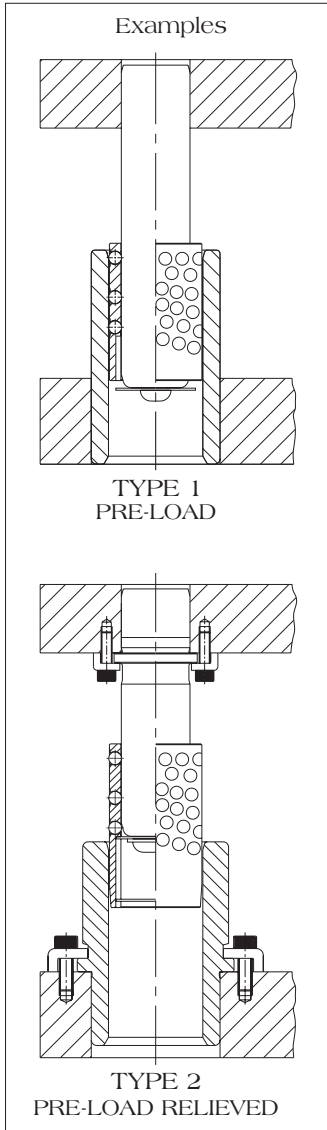
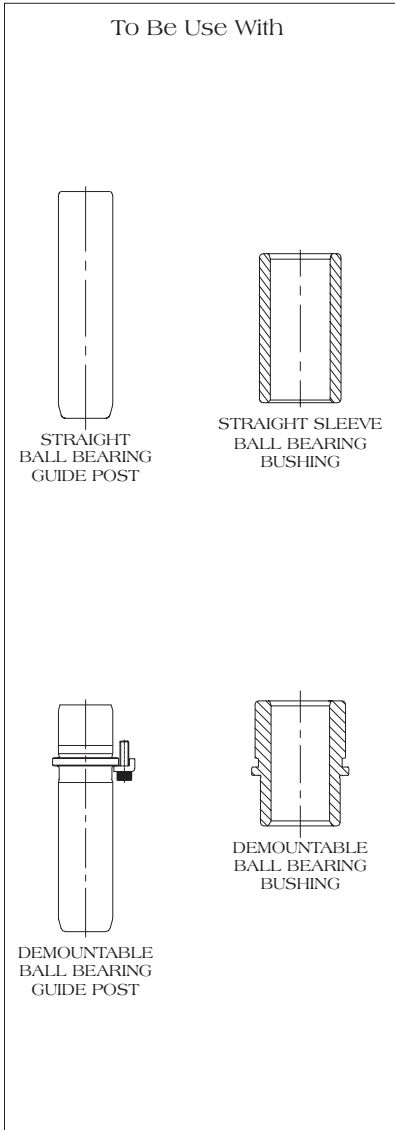
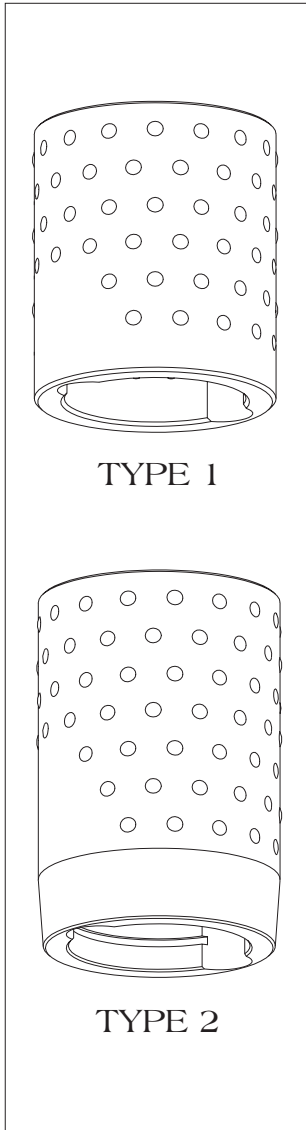
For selection of appropriate Sleeve or Demountable Ball Bearing Bushing length, see page 29 when using with Cage type 1, or page 31 when using Cage type 2.

Assembly Instructions:

1. Press Guide Posts into Punch Holder Plate. End of Guide Posts with drill and tapped hole should not be pressed in. For Demountable Ball Bearing Guide Posts use Clamps and Screws supplied.
2. Be sure Guide Posts are perpendicular to the surface of the Punch Holder (0.025 in 150 mm).
3. Mount Ball Bearing Cages on the Guide Posts using Retainer Assembly supplied.
4. Place Die Shoe on a flat surface. For Big Die Sets we recommend using two horses to keep the bores accessible on both ends.
5. Place on Die Shoe two parallels having height as close as possible Minimum Shut Height.
6. Degrease Sleeve and Die Shoe Bore using appropriate solvent and wipe carefully.
7. Apply a thin layer of Loctite 603 on the Bores and Sleeves.
8. Position the Sleeve into Bore.
9. Bring the Punch Holder into position until it rests on the two parallels.
10. Check that the Sleeves are in the right position.
11. Allow the required time to harden: 4 hours at 22°C. Do not use Die Set during hardening process.



D ₁	25	32	40	50	63	80
F	CATALOG NUMBER					
35	B41.025.035					
50	B41.025.050	B41.032.050	B41.040.050			
65	B41.025.065	B41.032.065	B41.040.065	B41.050.065		
80		B41.032.080	B41.040.080	B41.050.080		
100			B41.040.100	B41.050.100	B41.063.100	B41.080.100
120				B41.050.120	B41.063.120	B41.080.120
140					B41.063.140	B41.080.140
D ₂	45	54	65	81	95	112
D ₃	49	58	70	88	103	120
D ₄	54	63	75	93	108	125
E		30			50	
M	31	37	43	52	60	68
N	39,1	48,0	53,9	62,8	70,8	78,7
Q ₁	26,0	30,5	33,5	38,0	42,0	46,0
Q ₂	37,1	44,9	50,1	57,9	64,9	71,8
T	15,1			18,1		
CLAMPS	B01.006.000			B01.008.000		
SCREWS	A05.006.016 <small>(M6 X 16)</small>			A05.008.020 <small>(M8 X 20)</small>		
Qty	3			4		



MDL Ball Bearing Cages are manufactured from aluminum alloy heat treated tubing with tough and wear-resistant properties. Balls are made of bearing quality alloy steel through hardened and thoroughly inspected.

Operating Conditions:

Type 1:

In this condition at the top end of the stroke, the Guide Post does not leave the top end of the Bushing and the entire Cage remains under pre-load. At the bottom end of the stroke, the lower end of the Guide Post and the Retainer Assembly can leave the lower end of the Cage.

On type 1 condition, the Cage remains under full pre-load contact with the Guide Post and the Bushing during the entire length of the stroke.

Type 2:

In this condition at the upper end of the stroke, the Guide Post may leave the top end of the Bushing. When this happens the Cage starts to travel with the Guide Post. At the bottom end of stroke, the Guide Post and the Retainer Assembly cannot leave the lower end of the Cage due to a Snap Ring.

On type 2 condition, the Cage remains under pre-load with the Guide Post and the Bushing only when the lower end of the Guide Post goes below the top end of the Bushing.

To select Ball Bearing Cages length, see page 29 when using with Cage type 1, or page 31 when using with Cage type 2.



Ball Bearing Cages
Type 1 & 2

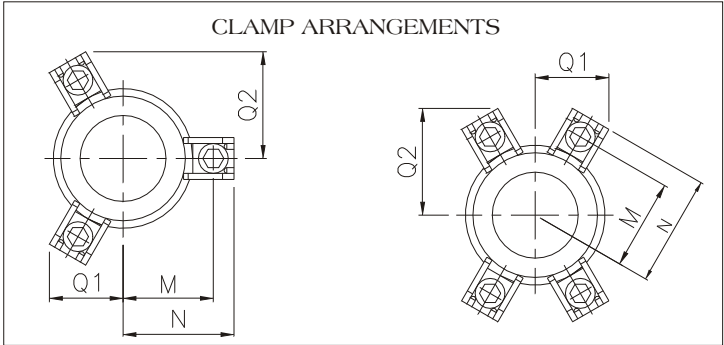
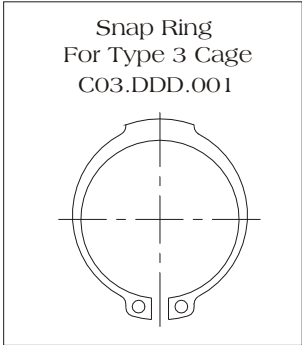
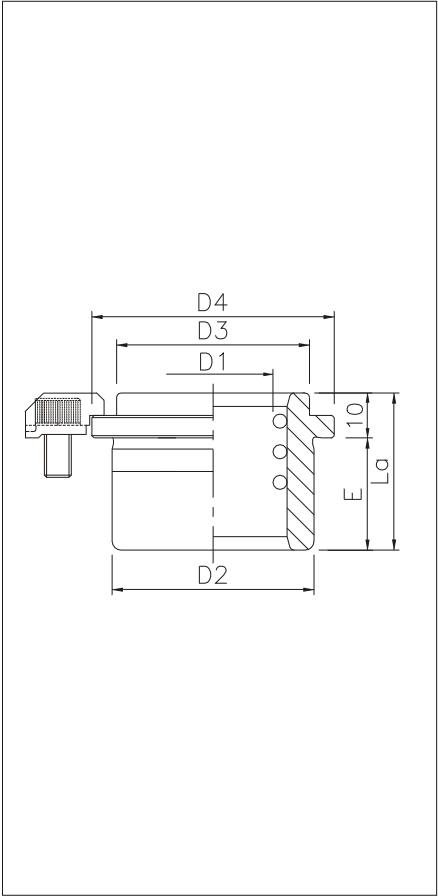
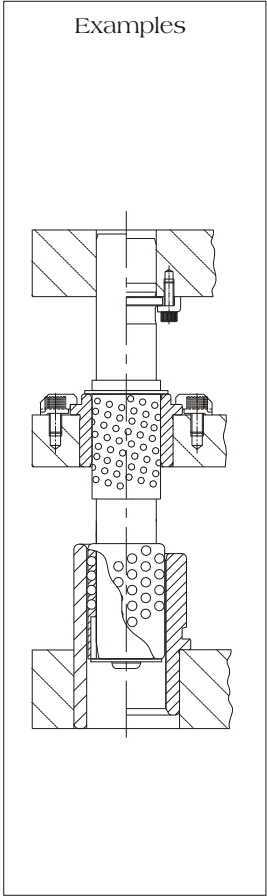
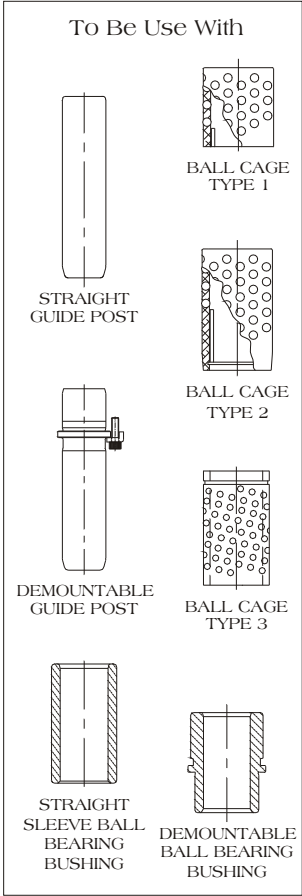
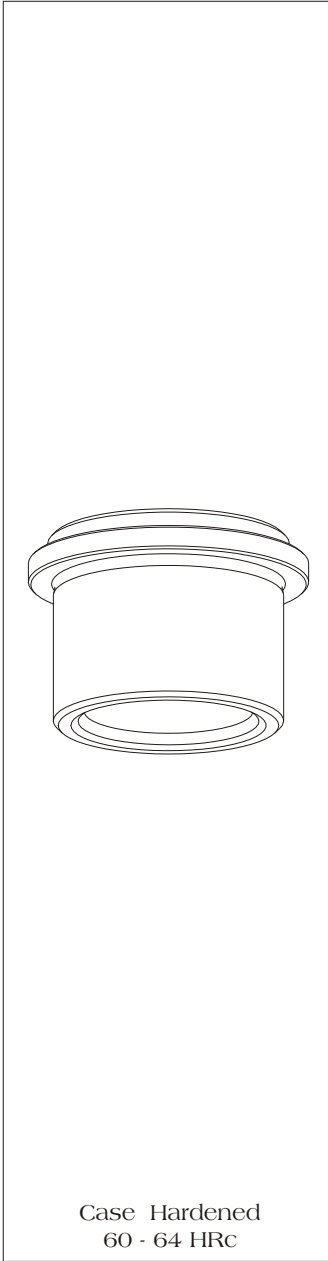
C11.DDD.LcLcLc
C12.DDD.LcLcLc

D ₁		25	32	40	50	63	80
L _c	S	CATALOG NUMBER TYPE 1					
36	11.5	C11.025.036	C11.032.036				
48	17.5	C11.025.048	C11.032.048	C11.040.048			
60	23.5			C11.040.060			
70	28.5				C11.050.070		
84	35.5				C11.050.084		
98	42.5					C11.063.098	C11.080.098
L _c	S	CATALOG NUMBER TYPE 2					
55	27	C12.025.055					
70	35	C12.025.070	C12.032.070				
	36			C12.040.070			
85	43						
90	42	C12.025.090		C12.040.085			
	43		C12.032.090				
100	50	C12.025.100					
105			C12.032.105				
	51			C12.040.105	C12.050.105		
110	60	C12.025.110					
115			C12.032.115				
120	61				C12.050.120		
125	70		C12.032.125				
	71			C12.040.125			
135	80		C12.032.135				
	81			C12.040.135			
140	71				C12.050.140		
145	72					C12.063.145	C12.080.145
	91			C12.040.145			
150	81				C12.050.150		
155	103			C12.040.155			
160	91				C12.050.160		
165	82					C12.063.165	C12.080.165
170	103				C12.050.170		
180	92					C12.063.180	C12.080.180
185	116				C12.050.185		
190	105					C12.063.190	C12.080.190
195	128				C12.050.195		
205	117					C12.063.205	C12.080.205
215	130					C12.063.215	C12.080.215
X		4.2		5.8	7.0		8.5

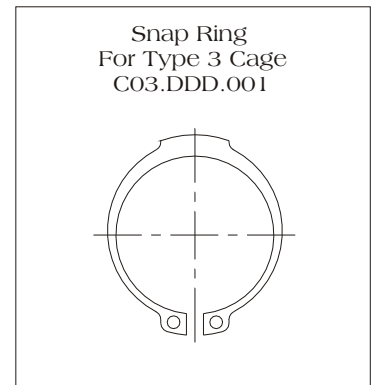
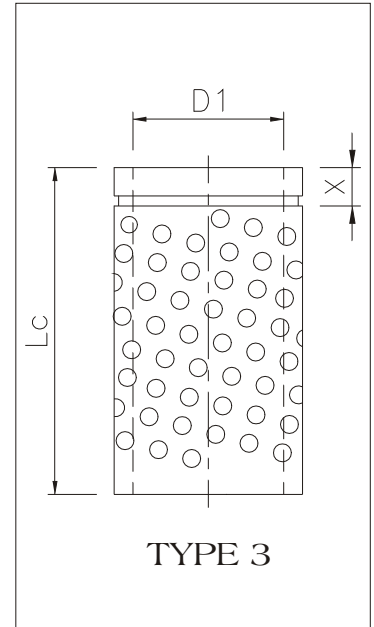
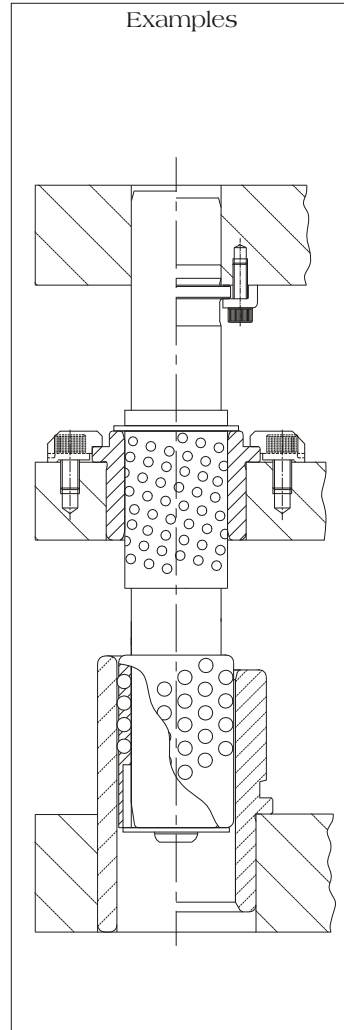
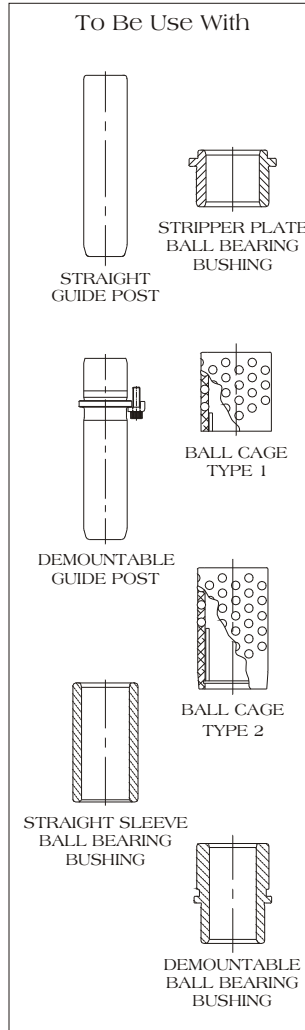
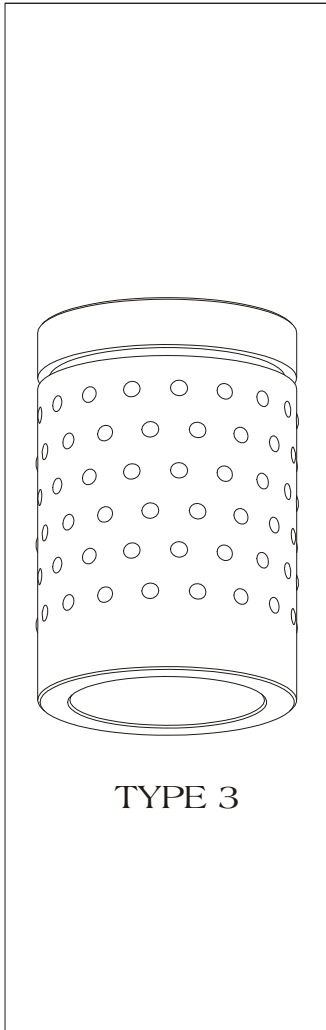
CAUTION:

Tool design with Ball Bearing Components for a certain press stroke should never be used in a press with bigger stroke.

It may be used in a press with smaller stroke.



D_1	25	32	40	50
E	CATALOG NUMBER			
20	B43.025.030	B43.032.030		
25	B43.025.035	B43.032.035		
29		B43.032.039	B43.040.039	
32		B43.032.042	B43.040.042	
36			B43.040.046	B43.050.046
44			B43.040.054	B43.050.054
D_2	45	54	65	81
D_3	43	50	64	79
D_4	54	63	75	93
M	33,5	38,0	44,0	53,0
N	42,1	46,5	52,4	61,4
Q_1	27,0	29,3	32,3	36,8
Q_2	39,6	43,4	48,6	56,4
CLAMPS	B02.006.000			
SCREWS	A05.006.012 (M6 X 12)			
Qty	3		4	



D ₁	25	32	40	50	63	80
Lc	CATALOG NUMBER					
40	C13.025.040	C13.032.040				
52	C13.025.052	C13.032.052	C13.040.052			
63	C13.025.063	C13.032.063	C13.040.063	C13.050.063		
80	C13.025.080	C13.032.080	C13.040.080	C13.050.080		
100		C13.032.100	C13.040.100	C13.050.100	C13.063.100	
125			C13.040.125	C13.050.125	C13.063.125	C13.080.125
140						C13.080.140
X	4,2	4,9	5,7	6,7		

Selection of Stripper Plate Ball Bearing Cage is based on Guide Post diameter, stroke of Stripper Plate (C) in relation to Plate where Guide Post is attached and length of Stripper Plate Ball Bearing Bushing used, according to the following formula:

$$Lc \geq \frac{C}{2} + E + 10 + X$$

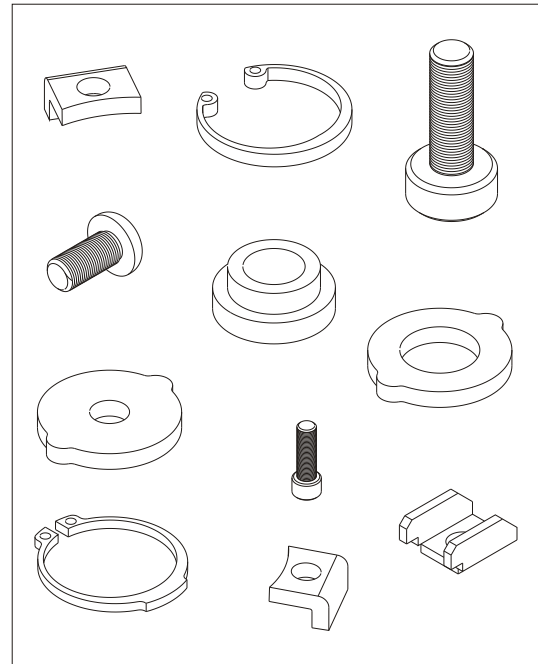
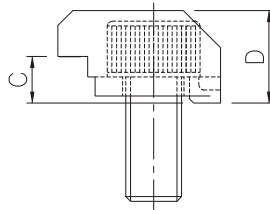
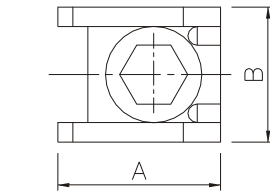
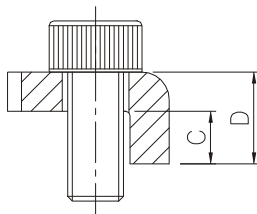
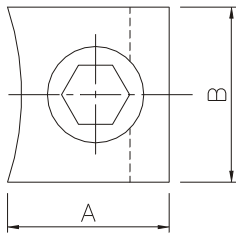
Retainer Assembly

POST DIA.							Type 1 Retainer Assembly (Screw and Washer)	Type 2 Retainer Assembly (Screw, Washer, Bushing and Snap Ring)
	A06 A07	Retaining Washer Type 1	Retaining Washer Type 2	Bushing Type 2	Snap Ring Type 2	Snap Ring Type 3		

USED WITH ASSEMBLY TYPE

	1&2	1	2	2	2	3		
25	A06.006.020 (M6 X 20)	C01.025.001	C02.025.001	C02.025.002	C02.025.003	C03.025.001	C01.025.000	C02.025.000
32	A06.008.020 (M8 X 20)	C01.032.001	C02.032.001	C02.032.002	C02.032.003	C03.032.001	C01.032.000	C02.032.000
40	A06.010.025 (M10 X 25)	C01.040.001	C02.040.001	C02.040.002	C02.040.003	C03.040.001	C01.040.000	C02.040.000
50	A06.012.030 (M12 X 30)	C01.050.001	C02.050.001	C02.050.002	C02.050.003	C03.050.001	C01.050.000	C02.050.000
63	A07.016.035 (M16 X 35)	C01.063.001	C02.063.001	C02.063.002	C02.063.003	-	C01.063.000	C02.063.000
80	A07.020.040 (M20 X 40)	C01.080.001	C02.080.001	C02.080.002	C02.080.003	-	C01.080.000	C02.080.000

Clamps

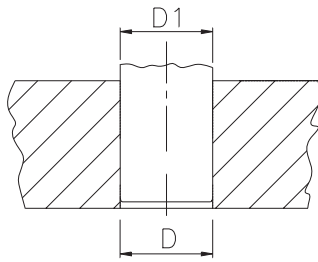


Lubrication Recommendation

MDL Ball Bearing Components, under normal operating conditions, should be lubricated using mineral oil of viscosity 66,0/75,0 cSt at 40°C once every eight hours shift.

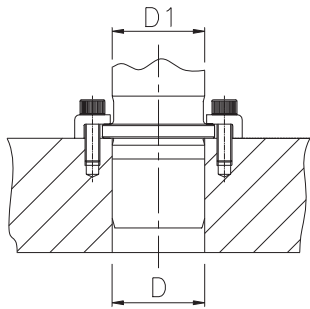
This lubricant may be applied by spray or clean brush.

Cat. N°	B01.006.000	B01.008.000	B02.006.000
A	15,5	19,8	18,3
B	15,9	15,9	14,5
C	4,9	4,9	5,0
D	8,7	9,5	10,0
SCREWS	A05.006.016 (M6 X 16)	A05.008.020 (M8 X 20)	A05.006.012 (M6 X 12)



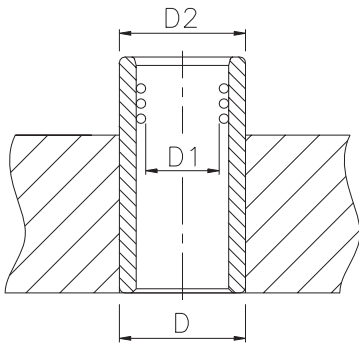
STRAIGHT GUIDE POST P10

D ₁	25	32	40	50	63	80
D	$\frac{24,976}{24,963}$	$\frac{31,971}{31,955}$	$\frac{39,971}{39,955}$	$\frac{49,971}{49,955}$	$\frac{62,965}{62,946}$	$\frac{79,963}{79,944}$



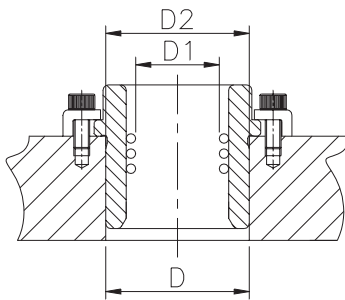
DEMOUNTABLE GUIDE POST P21

D ₁	25	32	40	50	63	80
D	$\frac{24,976}{24,963}$	$\frac{31,971}{31,955}$	$\frac{39,971}{39,955}$	$\frac{49,971}{49,955}$	$\frac{62,965}{62,946}$	$\frac{79,963}{79,944}$



STRAIGHT SLEEVE BALL BEARING BUSHING B30

D ₁	25	32	40	50	63	80
D ₂	45	54	65	81	95	112
D	$\frac{45,000}{45,016}$	$\frac{54,000}{54,019}$	$\frac{65,000}{65,019}$	$\frac{81,000}{81,022}$	$\frac{95,000}{95,022}$	$\frac{112,000}{112,022}$

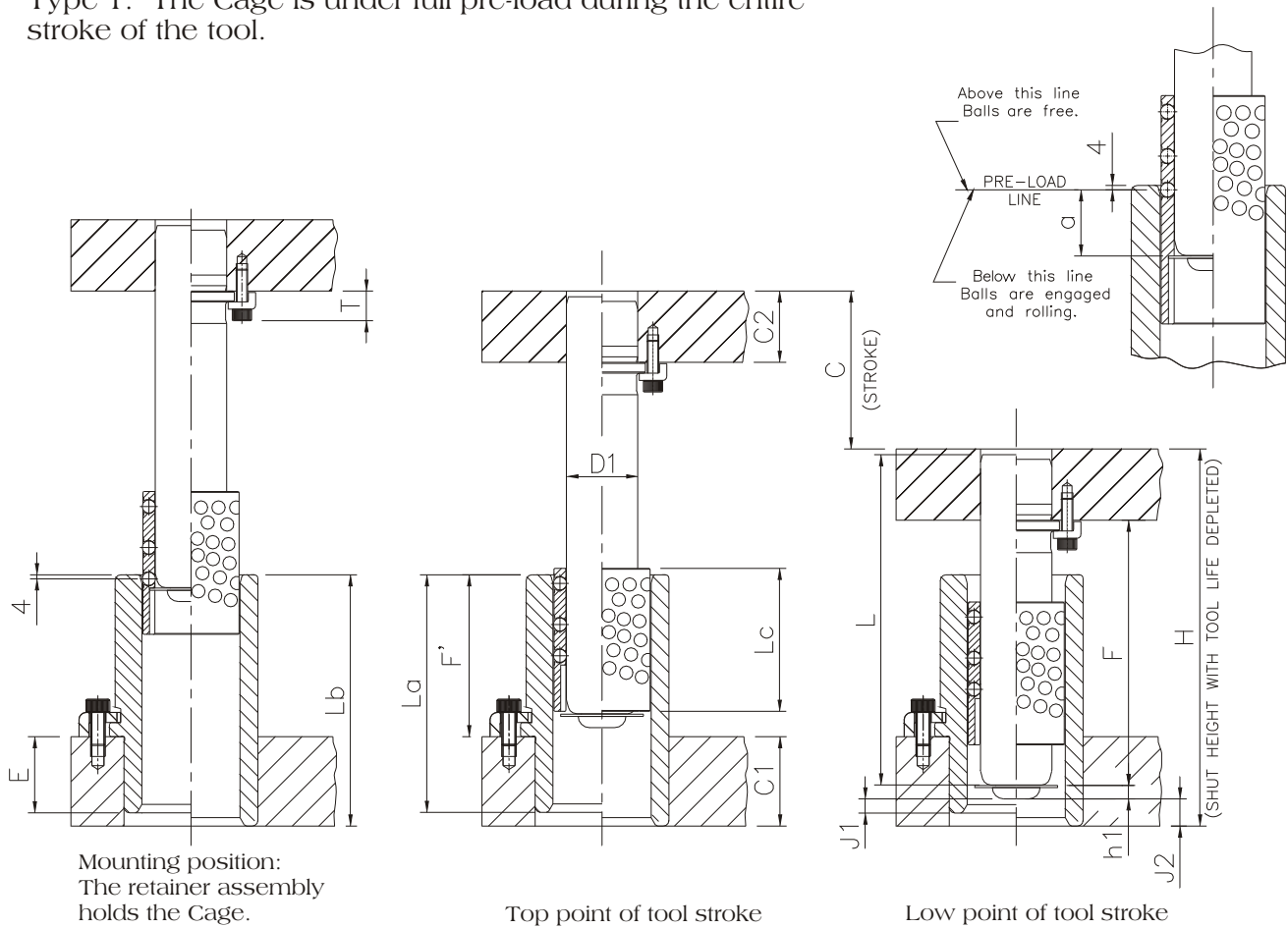


DEMOUNTABLE BALL BEARING BUSHING B41/43

D ₁	25	32	40	50	63	80
D ₂	45	54	65	81	95	112
D	$\frac{45,000}{45,016}$	$\frac{54,000}{54,019}$	$\frac{65,000}{65,019}$	$\frac{81,000}{81,022}$	$\frac{95,000}{95,022}$	$\frac{112,000}{112,022}$

Bore for MDL Ball Bearing Guide Posts and Bushings should be precision bored, smooth and free from toll marks to provide proper bearing area.

Type 1: The Cage is under full pre-load during the entire stroke of the tool.



Calculations for Guide Post Length (L for Straight, F for Demountable)

Straight Sleeve Bushing		Demountable Bushing							
Straight Guide Post	Demountable Guide Post	Straight Guide Post		Demountable Guide Post					
$L = H - h - J_2$	$F \leq H - h - J_2 - C_2$	$L = H - J_1 - h - C_1 + E$		$F \leq H - J_1 - h - C_1 + E - C_2$					
CAUTION: $H > C_2 + L_b$	CAUTION: $H > C_2 + L_b + T$	CAUTION: $H > C_1 + C_2 + F'$		CAUTION: $H > C_1 + C_2 + F' + T$					
NB: $h = h_1$ (for type 1); $h = h_2$ (for type 2);		for E see page 21;		for T see page 19;		$J_1 = J_2 = 4$			
For Straight Guide Post, if calculated length (L) is not available: Select the immediately longer Guide Post and cut it or select the immediately shorter Guide Post and press it on the Punch Holder of Die Set until exact length is obtained. For Demountable Guide Post, if calculated length (F) is not available: Select the immediately shorter one. NB: Demountable Guide Post should never be cut.		D1	25	32	40	50	63	80	
		a	14,5	14,0	14,5	15,5			
		h1	5,8	6,9	8,0	9,1	12,5	15,0	
		h2	9,3	10,4	11,5	12,6	16,0	18,5	

Selection of Ball Bearing (Straight or Demountable) and Cages for type 1 is based on Guide Post diameter and stroke of tool using chart of page 29:

1. Select desired Guide Post diameter "D1".
2. Select required stroke of tool "C" (don't forget to add grinding allowance of tool to press stroke).
3. Move down the stroke column until you reach the color area corresponding to the Guide Post diameter used. Up to 2" diameter, each color corresponds to one Ball Bearing Cage length available. Choose the Ball Bearing Cage that best suites your tool. Long Cages provide longer life.
4. Move horizontally to select the length of Ball Bearing Bushings (Straight or Demountable). Maximum length of Ball Bearing Bushings is limited by space available between the plates of the Die Set (don't forget to consider "T" for Demountable Guide Post and die grinding allowance). To check interference, use formula above label as "CAUTION".

NB: Demountable Ball Bearing Bushings $L_a = E + F$

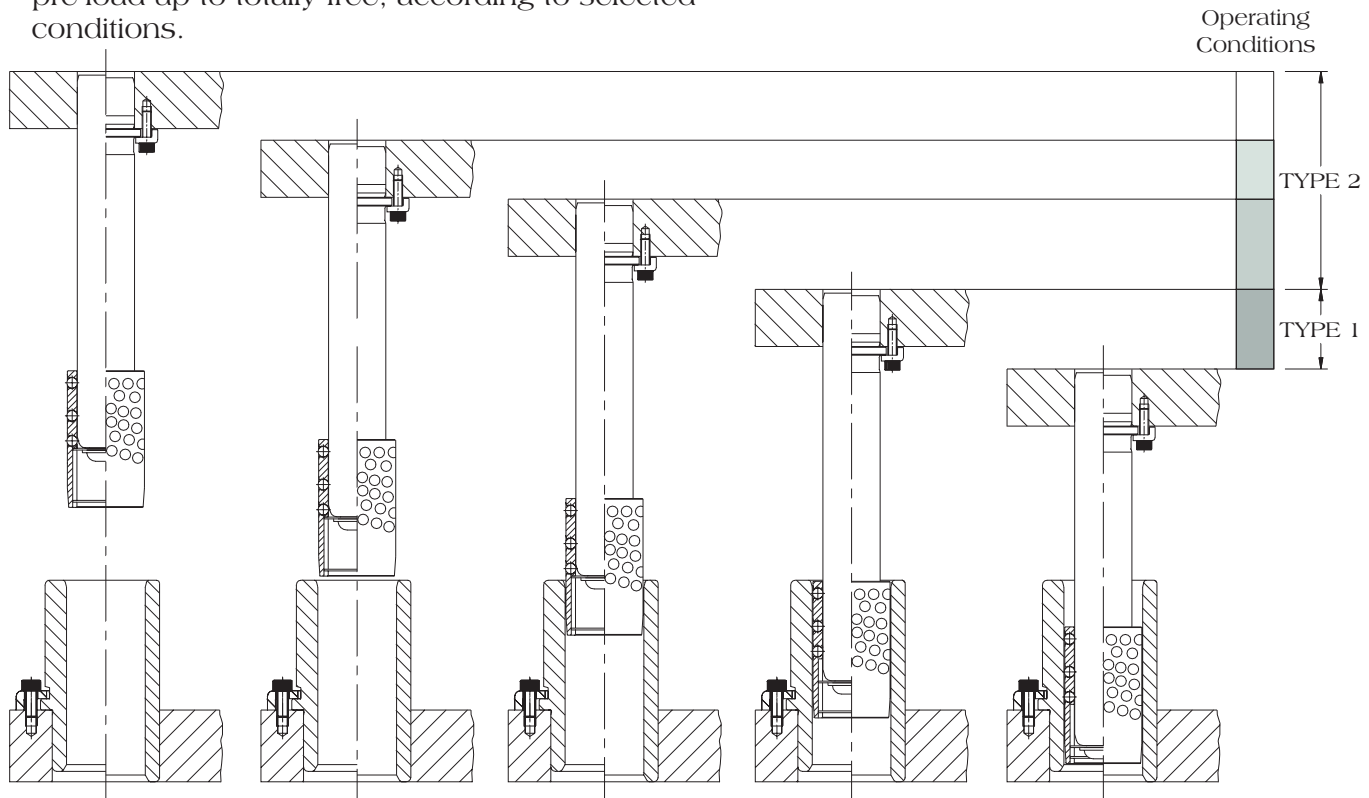


Type 1 Bushing & Ball Cage Selection Chart

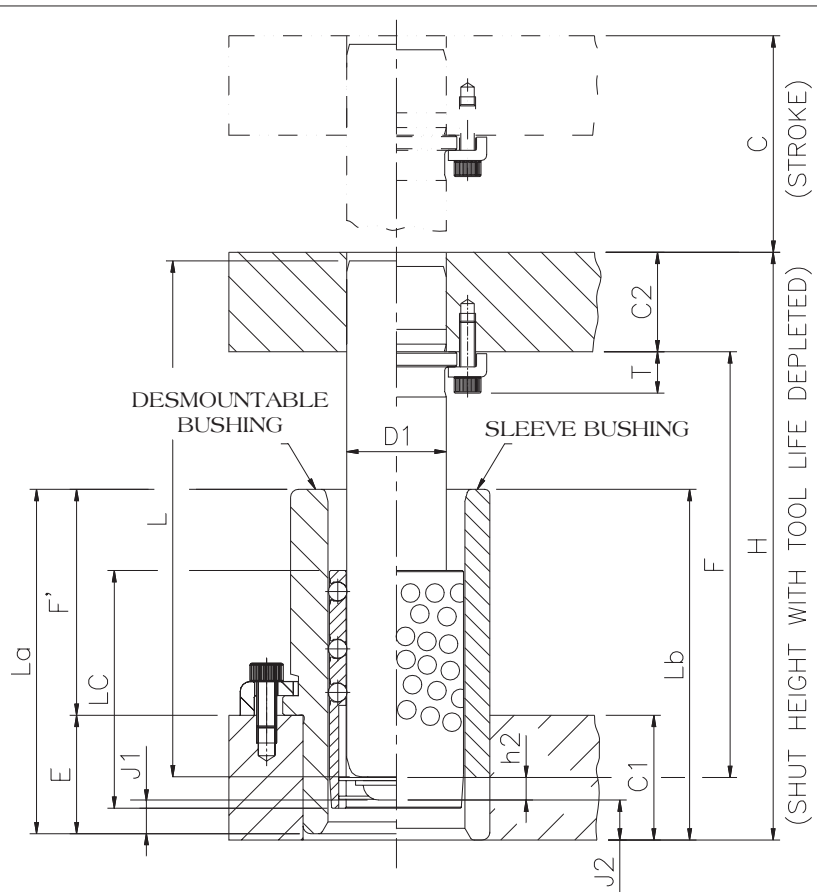


POST DIA.	BALL BEARING BUSHING		BALL CAGE (PG 23)	STROKE "C" INCLUDING DIE GRINDING ALLOWANCE				Maximum Die Grind Allowance
	DEMOUNTABLE (PG 21)	STRAIGHT SLEEVE (PG 20)		10	50	100	150	
D ₁	F	L _b	L _c					
25	35	65	36	[Shaded area]				10
	50	80						
	65	95						
		110	48	[Shaded area]				
	130							
32	50	80	36	[Shaded area]				10
	65	95						
	80	110						
		130						
		150	48	[Shaded area]				
	170							
40	50	80	48	[Shaded area]				10
	65	95						
	80	110						
	100	130						
		150						
		170	60	[Shaded area]				
	190							
	215		[Shaded area]					
50	65	110	70	[Shaded area]				10
	80	130						
	100	150						
	120	170						
		190						
		215						
		240	84	[Shaded area]				
	265							
63	100	150	98	[Shaded area]				15
	120	170						
	140	190						
		215						
		240						
	265		[Shaded area]					
80	100	150	98	[Shaded area]				15
	120	170						
	140	190						
		215						
		240						
	265		[Shaded area]					

Type 2: The cage pre-load can vary from partial pre-load up to totally free, according to selected conditions.



Guide Post Length calculation see page 28.

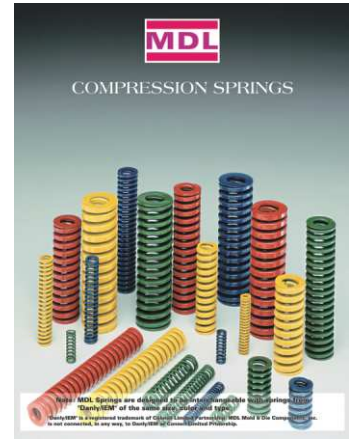
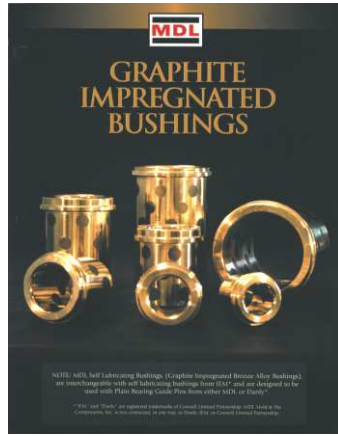
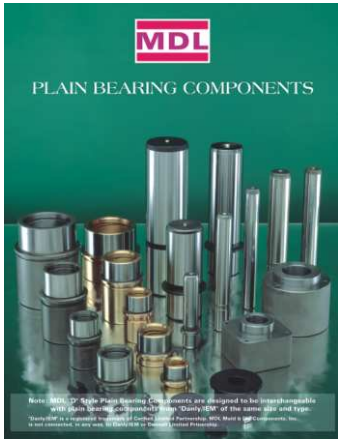


Selection of Ball Bearing Bushings (Straight or Demountable) and Cages for Type 2 is based on Guide Post diameter and stroke of tool using chart of page 31:

1. Select desired Guide Post diameter "D1".
2. Select required stroke of tool "C" (don't forget to add grinding allowance of tool to press stroke).
3. Move down the stroke column until you reach the color of desired operating condition.
4. Move horizontally to the left to select the length of Ball Bearing Bushing (Straight or Demountable) and Cage.

On Type 2, each Ball Bearing Cage length corresponds to one Ball Bearing Bushing length.

Caution: Length of Ball Bearing Bushing is limited by space available between the plates of the Die Set (don't forget to consider "T" for Demountable Guide Post). To check interference, use formula on page 28 label as "CAUTION".



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Soutz - France



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