

READY

THE INNOVATOR OF OUR INDUSTRY®

# Selective Fit® Pins and Bushings Precision Guiding for Dies

Innovation, Quality, and a Full Line, both Inch and Metric



Protected by U.S. and International Patents

## Guide Pins and Bushings - We offer the full range, inch & metric



- Our Plain Bearing line offers you three types of guide pins (straight, demountable and double diameter) and two kinds of bushings (demountable steel and our unique, patented Sintered Bronze Bushing.) All of these components are color-coded for Selective Fit™ and are fully interchangeable with one another.
- Our Ball Bearing line employs the same three guide pins plus two styles of ball bushings (straight sleeve and demountable). Unlike our competitors, our design is interchangeable with all major ball bearing brands on the market. Finally, you have at your disposal a “one size fits all” ball bearing line.
- We manufacture and stock the world’s largest inventory of Danly style metric guiding. Why? Because in North America we are READY Technology, outside North America we are Danly International\*, and we manufacture and sell Danly die sets and guiding through our ten plants and offices in Europe and in the Far East. Now we’re making our extensive line of metric components available to our U.S. customers.

*\***Make no mistake:** Neither Ready Technology or Danly International or any of the Danly companies outside North America is affiliated in any way with Danly Die Set or Connell Limited Partnership*

# READY Plain and Ball Bearing Components

In the following pages, you will see a number of innovative ideas designed to increase the performance of your stamping tools, reduce your inventory costs, simplify die assembly and maintenance, and maximize available die space.

Here are some of the highlights:

- Each Ready pin serves a dual function - it can operate as a plain bearing pin or a ball bearing guide pillar. This saves you the cost of a dual inventory.
- Ready's Selective Fit™ system matches each pin to the correct bushing to achieve the proper fit. Each part is color-coded (white, blue, or yellow), so as long as the color spot on the pin matches that of the bushing, the running clearance in each pin/bushing pair in your tool will be identical.

Since the clearance grows in proportion with the pin diameter, Selective Fit™ automatically gives you the proper running fit for your application.

- You now have a choice of clamping methods with our demountable pins. You can secure the flange with traditional toe clamps and screws, or you can hold the pin in place with a stop washer mounted in the underside of the die shoe. By eliminating the toe clamps you gain extra die space.
- Another innovation which saves space is Ready's patented Ring System. In effect you can now use our ball bearing sleeve bushing like a demountable bushing. Since the sleeve bushing and Ring System clamps have a smaller footprint than a traditional demountable bushing you save on die space. Please refer to page 11 for details.

## INCH Plain Bearing Components

<i>Precision Guide Pins.....</i>	<i>6</i>
<i>Demountable Pins.....</i>	<i>6</i>
<i>Demountable Sintered Bronze Bushings.....</i>	<i>7</i>
<i>Demountable Steel Bushings.....</i>	<i>7</i>
<i>Double Diameter Pins.....</i>	<i>8</i>

## INCH Ball Bearing Components

<i>Precision Guide Pins.....</i>	<i>12</i>
<i>Ball Bearing Cages.....</i>	<i>12</i>
<i>Straight Sleeve Bushings.....</i>	<i>13</i>
<i>Demountable Bushings.....</i>	<i>13</i>
<i>Demountable Pins.....</i>	<i>14</i>

<i>Selecting the Proper Operating Conditions.....</i>	<i>16</i>
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<i>Selecting the Correct Components.....</i>	<i>18</i>
• Guide Pins	
• Sleeve Bushings	
• Cages	

<i>Selection Chart.....</i>	<i>19</i>
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# READY Plain Bearing Components

## 3 types of pins, 2 types of bushings



### Precision Guide Pins (-825)

Our Precision Guide Pins are designed to be used with either plain bearing or ball bearing bushings.

Vacuum degassed, ball bearing quality steel is induction hardened to 60 - 64 Rc, then core tempered for toughness. This produces an optimum combination of wear resistance for long operating life and shock resistance for safety.

### Demountable Pins (-835)

Our Demountable Pins are designed for use in either plain bearing or ball bearing applications. Like our precision press fit pins, they are case hardened to 60 - 64 Rc, then core tempered for toughness.

They can be assembled to the same die set plate hundreds of times without distorting the hole center distances or damaging the holes themselves. So they not only simplify die building and maintenance, but they ensure maximum accuracy as well.

Ready demountable pins can be held in place either with toe clamps and screws, or with a retainer plug. This second option increases the die space available.

**Bore Sizes for Plain Bearing Pins and Bushings**

Pin Diameter	-825, -835 Bore Diameter	-55 Bore Diameter	-2x5, -6x5 Bore Diameter
3/4"	--	0.7506 0.7500	1.2506 1.2500
1"	0.9991 0.9985	1.0006 1.0000	1.5006 1.5000
1 1/4"	1.2489 1.2482	1.2506 1.2500	1.7506 1.7500
1 1/2"	1.4989 1.4982	1.5006 1.5000	2.0007 2.0000
1 3/4"	1.7489 1.7482	1.7506 1.7500	2.2507 2.2500
2"	1.9989 1.9982	2.0007 2.0000	2.5007 2.5000
2 1/2"	2.4986 2.4979	2.5007 2.5000	3.2509 3.2500
3"	2.9986 2.9974	3.0007 3.0000	3.7509 3.7500

### Double Diameter Pins (-55)

Our double diameter pins are also designed for use with ball bearing as well as plain bearing bushings. They are case hardened to 60-64 Rc for wear resistance, then core tempered for toughness. A tapped hole is provided at the end of the pin for the ball cage assembly.

The press fit diameter is interchangeable with familiar brands of plain bearing and ball bearing pins, so Ready double diameter pins may be used for die maintenance as well as for new tooling.

### Demountable Sintered Bronze Bushings (-235, -245, -285)

Our Sintered Bronze Bushings set a new standard of performance for stamping die guide bushings. A layer of bronze is sintered to the inside diameter of a steel bushing, creating a mechanical bond at the bronze/steel interface stronger than that of traditional plated bushings. Please refer to the following page for details.

### Demountable Steel Bushings (-645)

Our Steel Bushings are manufactured to the same high level of precision as our Sintered Bronze Bushings. If operated at moderate speeds and side loads with good lubrication, they are an economic substitute for sintered bronze bushings. These two types of bushings are fully interchangeable.

# Our patented Sintered Bronze Bushings offer many advantages over plated bronze bushings.

- **Thicker Bronze:** The sintered bronze in our bushings is substantially thicker than the plating technology it replaces.
- **Porous Surface:** Holds the lubrication oil where you need it most, to resist wear. Sintered bronze is porous bronze, up to 40% porosity.
- **Stronger Bond:** Our patented process forms a unique fusion bond so the bronze and substrate become one. See the 1000x magnification in the adjacent panel.
- **Wear Resistance:** The combination of increased thickness, porosity and stronger bonding means our bushing is your best choice for high speed and eccentric loading. The longest life possible under extreme conditions.

Bronze plating is not a simple process. If the bushing is dirty or there are contaminants in the plating solution, the bronze will not adhere properly and will peel away from the surface. The fourth batch of bushings, for example, will be less likely to be defect-free than the first batch placed in a tank with fresh plating solution.

The second problem with plating is that the thickness of the bronze layer depends on the plating time. A thick bronze layer is simply too costly to produce, and on large diameter bushings in particular, problems arise when the thin plating wears away and the underlying steel comes in contact with the guide pin.

READY's Sintered Bronze Bushings solve both problems. Using a patented manufacturing process, a layer of bronze is sintered to the inside diameter of the steel bushing, creating a strong, reliable mechanical bond. The thickness of the bronze layer is not limited by time or cost con-

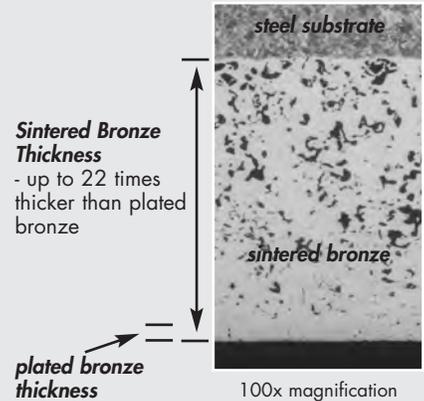
straints, so it is thicker than plated bronze, and it increases proportionally with the bushing diameter.

You can test the bond strengths yourself. Cut through the diameter of a plated bushing and you stand a good chance to see peeling. Do the same with our sintered bushing and you will see that the bronze-steel bond is unaffected. If you need to shorten the inserted diameter to fit our bushing into a thin stripper plate, you can do so without harming it.

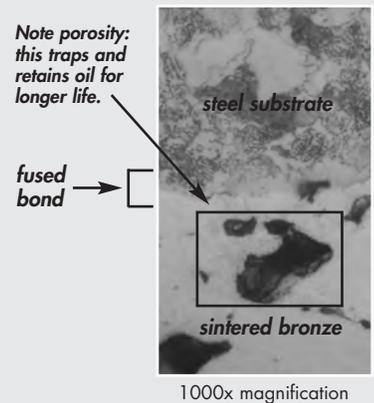
There is a third advantage to our sintered bushings. Because sintered bronze is porous, it holds the lubrication oil in place and helps to maintain an unbroken lubrication layer, which improves wear resistance. The bronze pores act as small oil reservoirs, so our Sintered Bronze Bushings are more forgiving if maintenance has been overlooked. However, for best results, we recommend regular, periodic lubrication with a high viscosity oil.

## Take A Closer Look ...

Actual magnified views of bushing cross sections.



This view reveals the greater bronze thickness and the porosity of our Sintered Bronze Bushing.



This view reveals the fusion bonding of the thick sintered bronze layer to the steel substrate.

## Compare The Thickness ...

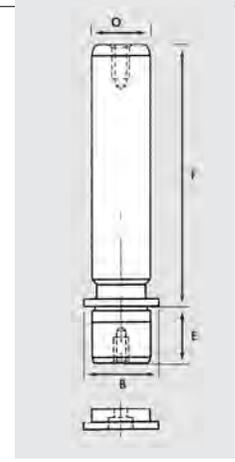
Nominal Diameter O Nom.	Plated Bronze Layer Thickness	READY Sintered Bronze Layer Thickness
1"	0.002"	0.027"
1 1/4"	0.002"	0.030"
1 1/2"	0.002"	0.033"
1 3/4"	0.002"	0.034"
2"	0.002"	0.037"
2 1/2"	0.002"	0.041"
3"	0.002"	0.044"

**Precision Pin Selection Guide (-825)**

Nominal Pin Diameter O	Length L	Catalog Number	Nominal Pin Diameter O	Length L	Catalog Number
1"	3 1/4	5-0813-825	1 3/4"	5	5-1420-825
	3 3/4	5-0815-825		5 3/4	5-1423-825
	4 1/4	5-0817-825		6 1/2	5-1426-825
	4 1/2	5-0818-825		7	5-1428-825
	4 3/4	5-0819-825		7 1/2	5-1430-825
	5	5-0820-825		8	5-1432-825
	5 1/4	5-0821-825		8 1/2	5-1434-825
	5 1/2	5-0822-825		9	5-1436-825
	5 3/4	5-0823-825		9 1/2	5-1438-825
	6	5-0824-825		10	5-1440-825
	6 1/2	5-0826-825		10 1/2	5-1442-825
	7	5-0828-825		11	5-1444-825
	7 1/2	5-0830-825		11 1/2	5-1446-825
	8	5-0832-825		12	5-1448-825
	8 1/2	5-0834-825		12 1/2	5-1450-825
	9	5-0836-825		13	5-1452-825
	1 1/4"	4 1/4		5-1017-825	2"
4 3/4		5-1019-825	15	5-1460-825	
5 1/4		5-1021-825	17	5-1468-825	
5 1/2		5-1022-825	5 3/4	5-1623-825	
5 3/4		5-1023-825	6 1/2	5-1626-825	
6		5-1024-825	7 1/4	5-1629-825	
6 1/2		5-1026-825	7 1/2	5-1630-825	
7		5-1028-825	7 3/4	5-1631-825	
7 1/2		5-1030-825	8	5-1632-825	
8		5-1032-825	8 1/2	5-1634-825	
8 1/2		5-1034-825	9	5-1636-825	
9		5-1036-825	9 1/2	5-1638-825	
10	5-1040-825	10	5-1640-825		
11	5-1044-825	10 1/2	5-1642-825		
12	5-1048-825	11	5-1644-825		
1 1/2"	4 1/4	5-1217-825	2 1/2"	11 1/2	5-1646-825
	5	5-1220-825		12	5-1648-825
	5 3/4	5-1223-825		12 1/2	5-1650-825
	6	5-1224-825		13	5-1652-825
	6 1/2	5-1226-825		14	5-1656-825
	7	5-1228-825		15	5-1660-825
	7 1/2	5-1230-825		16	5-1664-825
	8	5-1232-825		17	5-1668-825
	8 1/2	5-1234-825		18	5-1672-825
	9	5-1236-825		8	5-2032-825
	9 1/2	5-1238-825		8 3/4	5-2035-825
	10	5-1240-825		9 1/2	5-2038-825
	10 1/2	5-1242-825		10	5-2040-825
	11	5-1244-825		11	5-2044-825
	11 1/2	5-1246-825		12	5-2048-825
	12	5-1248-825		13	5-2052-825
	12 1/2	5-1250-825		14	5-2056-825
	13	5-1252-825		17	5-2068-825
14	5-1256-825	18	5-2072-825		
3"			20	5-2080-825	
			8	5-2432-825	
			9	5-2436-825	
			10	5-2440-825	
			11	5-2444-825	
			12	5-2448-825	
			13	5-2452-825	
			14	5-2456-825	
		17	5-2468-825		
		20	5-2480-825		

**Demountable Pin Selection Guide (-835)**

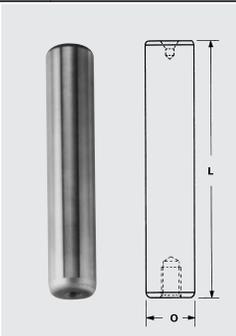
Nominal Pin Diameter O	Flange B	Length E	Length F	Catalog Number	Nominal Pin Diameter O	Flange B	Length E	Length F	Catalog Number
1"	1.31	7/8"	4	5-0816-835	2"	2.50	1 15/16"	5	5-1620-835
			4 1/2	5-0818-835				5 1/2	5-1622-835
			5	5-0820-835				6	5-1624-835
			5 1/2	5-0822-835				6 1/2	5-1626-835
			6	5-0824-835				7	5-1628-835
			6 1/2	5-0826-835				7 1/2	5-1630-835
			7	5-0828-835				8	5-1632-835
			7 1/2	5-0830-835				8 1/2	5-1634-835
			8	5-0832-835				9	5-1636-835
			8 1/2	5-0834-835				9 1/2	5-1638-835
9	5-0836-835	10	5-1640-835						
1 1/4"	1.56	1 3/16"	4	5-1016-835				2 1/2"	3.00
			4 1/2	5-1018-835	5 1/2	5-2022-835			
			5	5-1020-835	6	5-2024-835			
			5 1/2	5-1022-835	6 1/2	5-2026-835			
			6	5-1024-835	7	5-2028-835			
			6 1/2	5-1026-835	7 1/2	5-2030-835			
			7	5-1028-835	8	5-2032-835			
			7 1/2	5-1030-835	8 1/2	5-2034-835			
			8	5-1032-835	9	5-2036-835			
			8 1/2	5-1034-835	9 1/2	5-2038-835			
9	5-1036-835	10	5-2040-835						
1 1/2"	1.87	1 7/16"	5	5-1220-835	3"	3.50	2 3/16"		
			5 1/2	5-1222-835				7	5-2428-835
			6	5-1224-835				8	5-2432-835
			6 1/2	5-1226-835				9	5-2436-835
			7	5-1228-835				10	5-2440-835
			7 1/2	5-1230-835				11	5-2444-835
			8	5-1232-835				12	5-2448-835
			8 1/2	5-1234-835				14	5-2456-835
			9	5-1236-835				16	5-2464-835
			9 1/2	5-1238-835				5	5-1420-835
10	5-1240-835	5 1/2	5-1422-835						
11	5-1244-835	6	5-1424-835						
5 1/2	5-1426-835	6 1/2	5-1428-835						
6	5-1430-835	7	5-1432-835						
6 1/2	5-1434-835	7 1/2	5-1436-835						
7	5-1438-835	8	5-1440-835						
7 1/2	5-1442-835	8 1/2	5-1444-835						
8	5-1448-835	9	5-1436-835						
8 1/2	5-1438-835	9 1/2	5-1438-835						
9	5-1436-835	10	5-1440-835						
9 1/2	5-1438-835	11	5-1444-835						
10	5-1440-835	12	5-1448-835						



**Guide Pin Tap Sizes Recommended Seating Torque**

Nominal Pin Diameter O	Tap Size	Lbs. - Feet
1 - 1 1/4"	5/16 - 18 N.C.	26
1 1/2 - 1 3/4 - 2"	3/8 - 16 N.C.	47
2 1/2" - 3"	1/2 - 13 N.C.	112

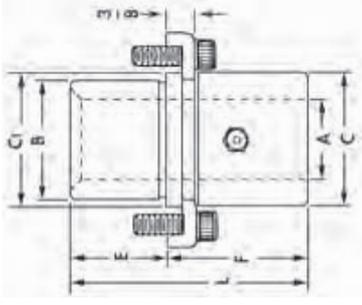
For Demountable Pin Tap Sizes, see page 9.



**New Expanded Line of Steel Sintered Bushing Sizes!**

**Demountable Sintered Steel Bushings (-235, -245, -285)**

**Demountable Steel Bushings (-635, -645, -565)**



**Short Shoulder**



Inside Diameter A	Nom. Dec.							Sintered Bronze Catalog Number	Steel Catalog Number
3/4"	0.750	1 1/8	1.17	1.27	11/16	3/4	1.43	6-06-235	6-06-635
1"	1.000	1 1/2	1.72	1.84	15/16	13/16	1 3/4	6-08-235	6-08-635
1 1/4"	1.250	1 3/4	1.95	2.09	1 1/8	13/16	1 15/16	6-10-235	6-10-635
1 1/2"	1.500	2	2.19	2.35	1 3/16	13/16	2	6-12-235	6-12-635
1 3/4"	1.750	2 1/4	2.50	2.66	1 3/8	1	2 3/8	6-14-235	6-14-635
2"	2.000	2 1/2	2.91	2.95	1 5/8	1	2 5/8	6-16-235	6-16-635
2 1/2"	2.500	3 1/4	3.66	3.66	1 7/8	1	2 7/8	6-20-235	6-20-635
3"	3.000	3 3/4	4.19	4.28	1 7/8	1	2 7/8	6-24-235	6-24-635

**Standard**



Inside Diameter A	Nom. Dec.							Sintered Bronze Catalog Number	Steel Catalog Number
3/4"	0.750	1 1/8	1.17	1.26	11/16	1 3/4	2.44	6-06-245	6-06-645
1"	1.000	1 1/2	1.72	1.84	15/16	1 3/4	2 11/16	6-08-245	6-08-645
1 1/4"	1.250	1 3/4	1.95	2.09	1 1/8	2	3 1/8	6-10-245	6-10-645
1 1/2"	1.500	2	2.19	2.35	1 3/16	2	3 3/16	6-12-245	6-12-645
1 3/4"	1.750	2 1/4	2.50	2.66	1 3/8	2	3 3/8	6-14-245	6-14-645
2"	2.000	2 1/2	2.91	2.95	1 5/8	2	3 5/8	6-16-245	6-16-645
2 1/2"	2.500	3 1/4	3.66	3.66	1 7/8	2 1/2	4 3/8	6-20-245	6-20-645
3"	3.000	3 3/4	4.19	4.28	1 7/8	2 1/2	4 3/8	6-24-245	6-24-645

**Extra Long Shoulder Bushings**



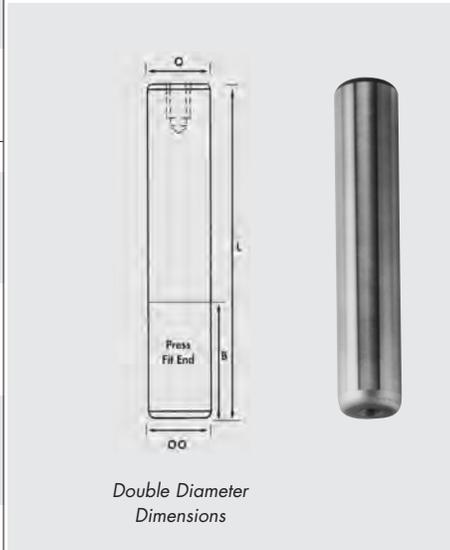
Inside Diameter A	Nom. Dec.							Sintered Bronze Catalog Number	Steel Catalog Number
1"	1.000	1 1/2	1.72	1.84	15/16	3	3 15/16	6-08-285	6-08-565
1 1/4"	1.250	1 3/4	1.95	2.09	1 1/8	3	4 1/8	6-10-285	6-10-565
1 1/2"	1.500	2	2.19	2.35	1 3/16	3	4 3/16	6-12-285	6-12-565
1 3/4"	1.750	2 1/4	2.50	2.66	1 3/8	3	4 3/8	6-14-285	6-14-565
2"	2.000	2 1/2	2.91	2.95	1 5/8	3	4 5/8	6-16-285	6-16-565
2 1/2"	2.500	3 1/4	3.66	3.66	1 7/8	3	4 7/8	6-20-285	6-20-565
3"	3.000	3 3/4	4.19	4.28	1 7/8	3	4 7/8	6-24-285	6-24-565

## Double Diameter Pins

### Double Diameter Pin Selection Guide (-55)

Nominal Pin Diameter O	Length B	Length L	Catalog Number	Nominal Pin Diameter O	Length B	Length L	Catalog Number		
3/4"	1 1/8"	4	5-0616-55	1 3/4"	2 1/4"	6	5-1424-55		
		4 1/2	5-0618-55			6 1/2	5-1426-55		
		5	5-0620-55			7	5-1428-55		
		5 1/2	5-0622-55			7 1/2	5-1430-55		
		6	5-0624-55			8	5-1432-55		
		6 1/2	5-0626-55			8 1/2	5-1434-55		
		7	5-0628-55			9	5-1436-55		
		7 1/2	5-0630-55			9 1/2	5-1438-55		
8	5-0632-55	10	5-1440-55						
1"	1 1/2"	4	5-0816-55			11	5-1444-55		
		4 1/2	5-0818-55			12	5-1448-55		
		5	5-0820-55			13	5-1452-55		
		5 1/2	5-0822-55			14	5-1456-55		
		6	5-0824-55			15	5-1460-55		
		6 1/2	5-0826-55			17	5-1468-55		
		7	5-0828-55			2"	2 1/2"	6	5-1624-55
		7 1/2	5-0830-55					6 1/2	5-1626-55
		8	5-0832-55	7	5-1628-55				
		8 1/2	5-0834-55	7 1/2	5-1630-55				
9	5-0836-55	8	5-1632-55						
9 1/2	5-0838-55	8 1/2	5-1634-55						
10	5-0840-55	9	5-1636-55						
1 1/4"	1 3/4"	4	5-1016-55	9 1/2	5-1638-55				
		4 1/2	5-1018-55	10	5-1640-55				
		5	5-1020-55	11	5-1644-55				
		5 1/2	5-1022-55	12	5-1648-55				
		6	5-1024-55	13	5-1652-55				
		6 1/2	5-1026-55	14	5-1656-55				
		7	5-1028-55	15	5-1660-55				
		7 1/2	5-1030-55	17	5-1668-55				
		8	5-1032-55	2 1/2"	3 1/2"	8	5-2032-55		
		8 1/2	5-1034-55			8 1/2	5-2034-55		
		9	5-1036-55			9	5-2036-55		
		9 1/2	5-1038-55			10	5-2040-55		
		10	5-1040-55			11	5-2044-55		
		11	5-1044-55			12	5-2048-55		
12	5-1048-55	13	5-2052-55						
14	5-1056-55	14	5-2056-55						
1 1/2"	2"	4 1/2	5-1218-55			15	5-2060-55		
		5	5-1220-55			17	5-2068-55		
		5 1/2	5-1222-55	19	5-2076-55				
		6	5-1224-55	3"	4"	9	5-2436-55		
		6 1/2	5-1226-55			10	5-2440-55		
		7	5-1228-55			11	5-2444-55		
		7 1/2	5-1230-55			12	5-2448-55		
		8	5-1232-55			13	5-2452-55		
		8 1/2	5-1234-55			14	5-2456-55		
		9	5-1236-55			15	5-2460-55		
		9 1/2	5-1238-55			17	5-2468-55		
		10	5-1240-55			19	5-2476-55		
		11	5-1244-55						
		12	5-1248-55						
14	5-1256-55								

- Ideal for retro-fits to improve productivity and decrease costly maintenance.
- Proven quality and dependability in dies for years.
- Readily available.
- Oversize press fit end for die shoe and nominal size end for bushing.
- Interchangeable with familiar brands.



Double Diameter Pin Dimensions

Pin Diameter	OO +0 -0.0005	Length of Press Fit B
3/4"	0.752	1 1/8"
1"	1.002	1 1/2"
1 1/4"	1.2525	1 3/4"
1 1/2"	1.5025	2"
1 3/4"	1.7525	2 1/4"
2"	2.0025	2 1/2"
2 1/2"	2.503	3 1/2"
3"	3.003	4"

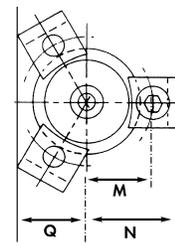
Guide Pin Tap Sizes

Recommended Seating Torque

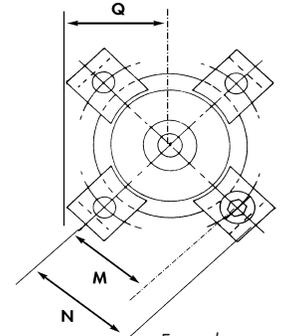
Nominal Pin Diameter O	Tap Size	Lbs. - Feet
1 - 1 1/4"	5/16 - 18 N.C.	26
1 1/2 - 1 3/4 - 2"	3/8 - 16 N.C.	47
2 1/2" - 3"	1/2 - 13 N.C.	112

## Demountable Pin Clamp Data

Diameter O	Pillar Clamp Data						
	Radius		Q	Qty per Pillar	Catalog Number	Socket Head Cap Screws	
	M	N				S	T
1"	13/16	1 1/8	7/8	3	6-90-1	1/4 - 20 x 3/4	5/8
1 1/4"	63/64	1 7/16	1	3	6-93-1	5/16 - 18 x 7/8	3/4
1 1/2"	1 1/8	1 9/16	1 1/16	3			
1 3/4"	1 19/64	1 3/4	1 3/8				
2"	1 27/64	1 7/8	1 9/16	4	6-93-1	5/16 - 18 x 7/8	3/4
2 1/2"	1 43/64	2 1/8	1 3/4				
3"	1 59/64	2 3/8	1 15/16				

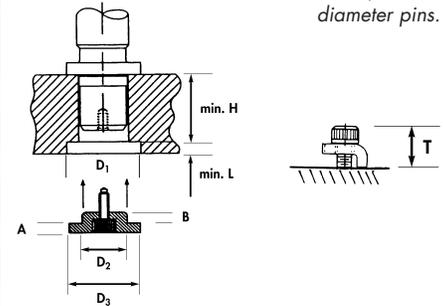


Three clamps equally spaced for 1" - 1 1/2" diameter pins.



Four clamps equally spaced for 1 3/4" - 3" diameter pins.

Pin Diameter O	Pillar Retaining Plug Data								
	D1	min.	min.	A	B	D2	D3	Catalog Number	Screw
		L	H						
1"	1.50	.25	1.25	.20	.36	.99	1.49	6-08-35	3/8 - 16
1 1/4"	1.75	.25	1.75	.20	.55	1.24	1.74	6-10-35	1/2 - 13
1 1/2"	2.00	.25	2.00	.20	.55	1.49	1.99	6-12-35	1/2 - 13
1 3/4"	2.25	.25	2.45	.20	.73	1.74	2.24	6-14-35	5/8 - 11
2"	2.50	.25	2.70	.20	.73	1.99	2.49	6-16-35	5/8 - 11
2 1/2"	3.00	.25	2.70	.20	.73	2.49	2.99	6-20-35	5/8 - 11
3"	3.50	.25	3.15	.20	.93	2.99	3.49	6-24-35	3/4 - 10



## Demountable Bushing Clamp Data

**Clamp Arrangement Selection Data**

**L - R Feed**

**F - B Feed**

**Round Dies**

NOTE: If not specified, clamp arrangement L-R will be furnished. Clamp arrangement F-B is furnished on center pin sets.

**Clamp Numbers:**  
6-90-1, 6-93-1, 6-95-1

We ship the appropriate number of clamps and SHCS with each demountable bushing ordered.

APPLICATION	Nominal Diameter Bush. ID Pin OD	Clamp Data											
		Location				Size				Clamp No.	Per Unit	Screw Size	T
		M	N	L	K	A	B	C	D				
Bushings, Demountable Shoulder and Short Shoulder	3/4"	25/32	1 1/64	90°	45°	15/32	1/2	.125	7/32	6-95-1	2	1/4 - 20 x 5/8	15/32
	1"	1 1/16	1 3/8	90°	45°	5/8	5/8	.193	11/32	6-90-1	2	1/4 - 20 x 3/4	39/64
	1 1/4"	1 7/32	1 17/32	120°	45°	25/32	5/8	.250	7/16	6-93-1	3	5/16 - 18 x 3/4	3/4
	1 1/2"	1 3/8	1 11/16										
	1 3/4"	1 1/2	1 13/16	35°	10°	25/32	5/8	.250	7/16	6-93-1	4	5/16 - 18 x 3/4	3/4
	2"	1 45/64	2 1/64										
	2 1/2"	2 5/64	2 25/64										
3"	2 5/16	2 5/8	45°	0°									

## **Ball Bearing Cages**

### **Operating Conditions**

For optimum performance guide pins should be mounted in the punch holder. This allows the ball cage to reposition itself, if preload is relieved on each press stroke. Complete assemblies (guide pin, ball cage and bushing) should be ordered to insure proper fit.

### **Recommended Lubrication**

We recommend lubricating the ball bushing assembly once each 8 hour shift. Use a refined mineral oil with a viscosity of 290/340 SSU at 100° F, combining "EP" additives and rust inhibitors, such as Mobil Compound AA or Mobil Gear 626.

## **Installation Instructions for Sleeve Bushings Using Bushing Mount**

1. Degrease bushing OD and die shoe bore with alcohol, acetone or other volatile solvent and wipe dry.
2. Apply Bushing Mount sparingly to both surfaces.
3. Wring bushing into die shoe.
4. Allow 4-hour cure at 72°F. To accelerate cure, heat with heat-lamp. Do not disturb bushing until cure is complete.
5. Honing is not required after installation.

## **Precision Guide Pins (-825) Demountable Pins (-835), and Double Diameter Pins (-55)**

You can use any of our guide pins in ball bearing applications because each of the 3 styles is designed for dual purpose in both friction solid guiding and ball bearing guiding.

Vacuum degassed, ball bearing quality steel is induction hardened to 60-64 Rc, then core tempered for toughness. This produces an optimum combination of wear resistance for long

operating life and shock resistance for safety.

The guide pin retains the ball cage by means of a washer assembly. The cage is free to rotate 360°, so scoring and tracking on the guide pin surface are eliminated or reduced.

Our guide pins are interchangeable with all the major brands.

## **Ball Bearing Cages (-8225)**

Our Ball Cages use AFBMA Grade 10 precision ball bearings, accurate to within .0001". These ball bearing have been chosen for their high hardness and excellent resistance to wear and deformation. They are retained securely in place by a hardened aluminum alloy cage, heat treated for toughness and wear resistance.

Each ball bearing is held in place with 360° staking. This is a safer design than two or four point staking.

Failure tests show that a 360° staked ball requires a substantially higher force to become dislodged.

Ready Ball Cages are free to rotate within the ball bushing assembly, so wear on the guide pin and bushing is reduced. The ball bearings are arranged in a double spiral pattern, so that each ball bearing travels along its own unique path. Tracking is reduced and operating life is enhanced.

## **Demountable Ball Bearing Bushings (-855) and Straight Sleeve Bushings (-865)**

We offer two types of ball bearing bushings. Our Demountable Ball Bearing Bushings are flange mounted and held in place with toe clamps and screws. They are interchangeable with familiar brands of demountable ball bushings.

Our Straight Sleeve bushings offer something quite new. All sleeve bushings 1 1/2" in diameter and larger incorporate our patented Ring System clamping groove, which provides several benefits. Please refer to the following page for details.

If you prefer, however, you can secure our sleeve bushings in the traditional

manner with Bushing Mount. Up to eleven tons of force are required to dislodge the bushing once the Bushing Mount has properly cured. Please follow the assembly procedure outlined in the side panel on this page. Bushing Mount compound is available upon request.

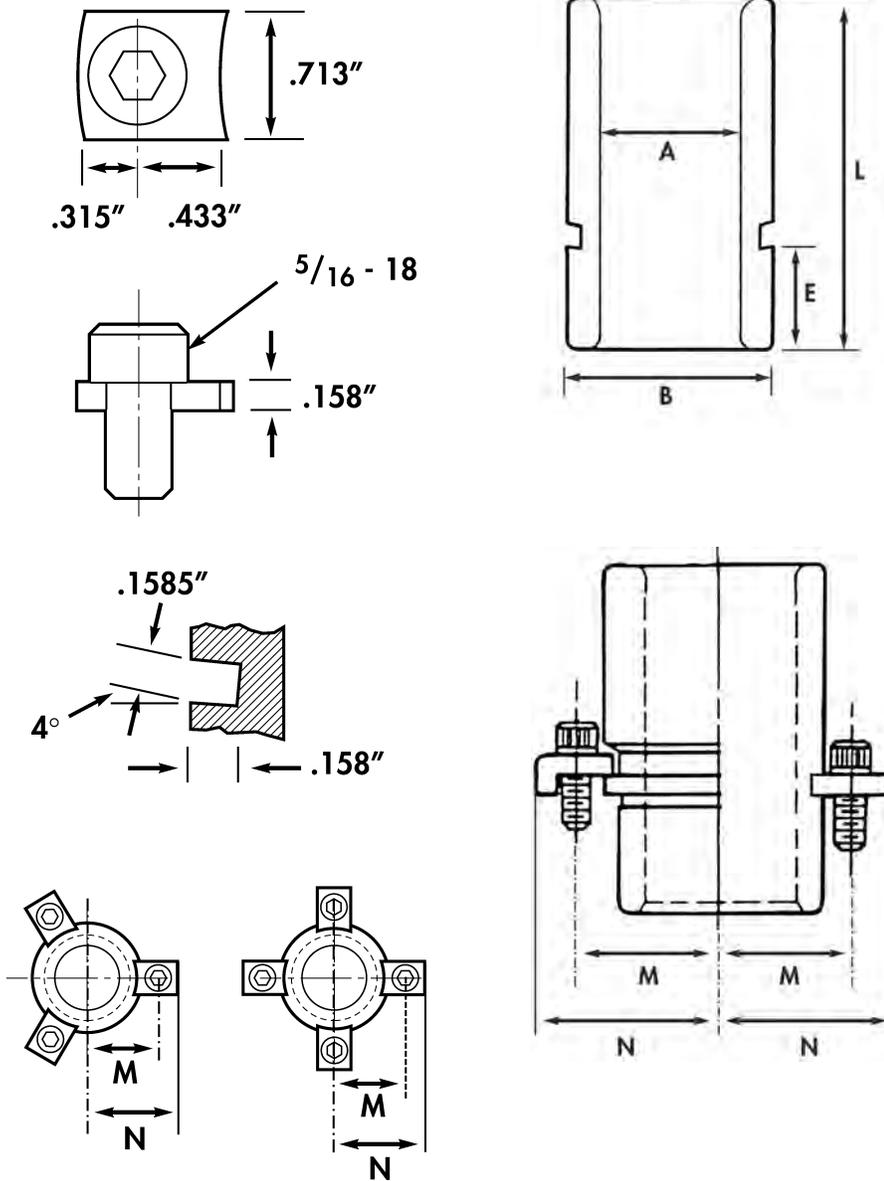
Our ball bearing bushings are interchangeable with most major brands; for brands with a smaller register fit than ours, we have left the OD of our straight sleeve bushing soft, enabling you to turn down the OD to match. See your READY representative for details.

# The Ring System - Our Straight Sleeve Bushing Has Just Become Demountable

Our patented Ring System consists of a slightly curved clamp which fits into a 4° angled groove. As the clamping screw is tightened the clamp wedges against the slot, holding the bushing securely in place.

This design produces real benefits. Since the Ring System makes the sleeve bushing easy to assemble and disassemble, die building and maintenance are simplified. Ring System bushings are less costly to produce than demountable bushings, so you save on purchase cost.

In addition, Ring System bushings give you more die space. You can see in the table below that the Ring System sleeve bushing takes up less space than a demountable ball bearing bushing of traditional design.

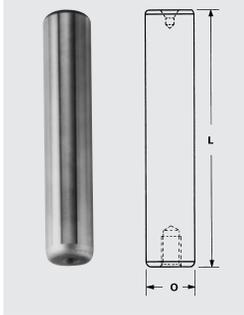


Clamp Data

Pin Diameter	Demountable Bushing					Ring System Sleeve Bushing				
	M	N	Clamps per Bushing	Clamp	Screw	M	N	Clamps per Bushing	Clamp	Screw
1"	1.313	1.688	3			-	-	-		
1 1/4"	1.438	1.813	3			-	-	-		
1 1/2"	1.688	2.063	4			1.513	1.846	4		5/16 - 18
1 3/4"	1.813	2.188	4	6-93-1	X	1.657	1.972	4	6-B2-1	X
2"	2.063	2.438	4			1.909	2.224	4		3/4 lg
2 1/2"	2.313	2.688	4			2.161	2.476	4		
3"	2.625	3.000	4			-	-	-		

**Precision Pin Selection Guide (-825)**

Nominal Pin Diameter O	Length L	Catalog Number	Nominal Pin Diameter O	Length L	Catalog Number	
1"	3 1/4	5-0813-825	1 3/4"	5	5-1420-825	
	3 3/4	5-0815-825		5 3/4	5-1423-825	
	4 1/4	5-0817-825		6 1/2	5-1426-825	
	4 1/2	5-0818-825		7	5-1428-825	
	4 3/4	5-0819-825		7 1/2	5-1430-825	
	5	5-0820-825		8	5-1432-825	
	5 1/4	5-0821-825		8 1/2	5-1434-825	
	5 1/2	5-0822-825		9	5-1436-825	
	5 3/4	5-0823-825		9 1/2	5-1438-825	
	6	5-0824-825		10	5-1440-825	
	6 1/2	5-0826-825		10 1/2	5-1442-825	
	7	5-0828-825		11	5-1444-825	
	7 1/2	5-0830-825		11 1/2	5-1446-825	
	8	5-0832-825		12	5-1448-825	
	8 1/2	5-0834-825		12 1/2	5-1450-825	
	9	5-0836-825		13	5-1452-825	
				14	5-1456-825	
				15	5-1460-825	
		17	5-1468-825			
1 1/4"	4 1/4	5-1017-825	2"	5 3/4	5-1623-825	
	4 3/4	5-1019-825		6 1/2	5-1626-825	
	5 1/4	5-1021-825		7 1/4	5-1629-825	
	5 1/2	5-1022-825		7 1/2	5-1630-825	
	5 3/4	5-1023-825		7 3/4	5-1631-825	
	6	5-1024-825		8	5-1632-825	
	6 1/2	5-1026-825		8 1/2	5-1634-825	
	7	5-1028-825		9	5-1636-825	
	7 1/2	5-1030-825		9 1/2	5-1638-825	
	8	5-1032-825		10	5-1640-825	
	8 1/2	5-1034-825		10 1/2	5-1642-825	
	9	5-1036-825		11	5-1644-825	
		11 1/2	5-1646-825			
		12	5-1648-825			
		12 1/2	5-1650-825			
		13	5-1652-825			
		14	5-1656-825			
		15	5-1660-825			
		16	5-1664-825			
		17	5-1668-825			
		18	5-1672-825			
1 1/2"	4 1/4	5-1217-825	2 1/2"	8	5-2032-825	
	5	5-1220-825		8 3/4	5-2035-825	
	5 3/4	5-1223-825		9 1/2	5-2038-825	
	6	5-1224-825		10	5-2040-825	
	6 1/2	5-1226-825		11	5-2044-825	
	7	5-1228-825		12	5-2048-825	
	7 1/2	5-1230-825		13	5-2052-825	
	8	5-1232-825		14	5-2056-825	
	8 1/2	5-1234-825		17	5-2068-825	
	9	5-1236-825		18	5-2072-825	
	9 1/2	5-1238-825		20	5-2080-825	
	10	5-1240-825				
	10 1/2	5-1242-825				
	11	5-1244-825				
11 1/2	5-1246-825					
12	5-1248-825					
12 1/2	5-1250-825					
13	5-1252-825					
14	5-1256-825					
3"			3"	8	5-2432-825	
				9	5-2436-825	
				10	5-2440-825	
				11	5-2444-825	
				12	5-2448-825	
				13	5-2452-825	
				14	5-2456-825	
				17	5-2468-825	
				20	5-2480-825	



**Ball Bearing Cage Selection Guide (-8225)**

Diameter O	C	S	X	Catalog Number
1"	2	1 1/16	3/16	6-0808-8225
	2 1/2	1 5/16		6-0810-8225
	3	1 9/16		6-0812-8225
	3 1/4	1 13/16		6-0813-8225
	3 1/2	2 1/16		6-0814-8225
	3 3/4	2 5/16		6-0815-8225
1 1/4"	2 3/4	1 7/16	3/16	6-1011-8225
	3 1/4	1 11/16		6-1013-8225
	3 3/4	1 15/16		6-1015-8225
	4	2 3/16		6-1016-8225
	4 1/4	2 7/16		6-1017-8225
	4 3/4	2 15/16		6-1019-8225
1 1/2"	2 3/4	1 7/16	1/4	6-1211-8225
	3 1/2	1 13/16		6-1214-8225
	4 1/4	2 3/16		6-1217-8225
	4 1/2	2 7/16		6-1218-8225
	5	2 15/16		6-1220-8225
	5 1/2	3 7/16		6-1222-8225
	6	3 15/16	6-1224-8225	
1 3/4"	3 1/4	1 11/16	1/4	6-1413-8225
	4	2 1/16		6-1416-8225
	4 3/4	2 7/16		6-1419-8225
	5 1/4	2 15/16		6-1421-8225
	5 3/4	3 7/16		6-1423-8225
	6 1/4	3 15/16		6-1425-8225
	6 3/4	4 7/16	6-1427-8225	
2"	3 3/4	1 15/16	1/4	6-1615-8225
	4 1/2	2 5/16		6-1618-8225
	5 1/4	2 11/16		6-1621-8225
	5 5/8	3 1/16		6-1623-8225
	6	3 7/16		6-1624-8225
	6 1/2	3 15/16		6-1626-8225
	7	4 7/16	6-1628-8225	
	7 1/2	4 15/16	6-1630-8225	
2 1/2"	5 3/4	3	3/8	6-2023-8225
	6 1/2	3 3/8		6-2026-8225
	7 1/4	3 3/4		6-2029-8225
	7 3/4	4 1/4		6-2031-8225
	8 1/4	4 3/4		6-2033-8225
	8 3/4	5 1/4		6-2035-8225
3"	5 3/4	3	3/8	6-2423-8225
	6 1/2	3 3/8		6-2426-8225
	7 1/4	3 3/4		6-2429-8225



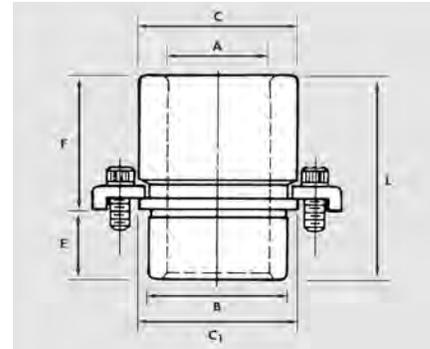
**Washer Assemblies**

Nominal Pin Diameter O	Catalog Number
1"	6-0008-822
1 1/4"	6-0010-822
1 1/2"	6-0012-822
1 3/4"	6-0014-822
2"	6-0016-822
2 1/2"	6-0020-822
3"	6-0024-822

Washer Assemblies sold separately for ball bearing applications.

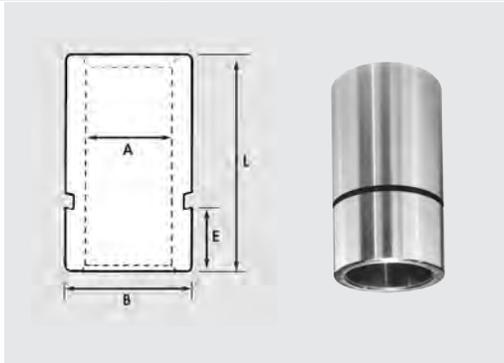
### Straight Sleeve Bushing Selection Guide (-865)

Nominal Post Diameter O	A	B	E	Length L	Catalog Number
1"	1 3/8	1 7/8	n/a	2 1/2	6-0810-865
				3	6-0812-865
				3 1/2	6-0814-865
				4	6-0816-865
				4 1/2	6-0818-865
5	6-0820-865				
1 1/4"	1 5/8	2 1/8	n/a	3	6-1012-865
				3 1/2	6-1014-865
				4	6-1016-865
				4 1/2	6-1018-865
				5	6-1020-865
6	6-1024-865				
1 1/2"	1 7/8	2 1/2	1 3/8	3	6-1212-865
				3 3/4	6-1215-865
				4 1/2	6-1218-865
				5	6-1220-865
				5 1/2	6-1222-865
				6	6-1224-865
				7	6-1228-865
8	6-1232-865				
1 3/4"	2 1/8	2 3/4	1 5/8	3 1/2	6-1414-865
				4 1/4	6-1417-865
				5	6-1420-865
				5 1/2	6-1422-865
				6	6-1424-865
				7	6-1428-865
8	6-1432-865				
9	6-1436-865				
2"	2 1/2	3 1/4	1 7/8	4	6-1616-865
				4 3/4	6-1619-865
				5 1/2	6-1622-865
				6 1/4	6-1625-865
				7	6-1628-865
				8	6-1632-865
				9	6-1636-865
10	6-1640-865				
2 1/2"	3	3 3/4	1 7/8	6	6-2024-865
				6 3/4	6-2027-865
				7 1/2	6-2030-865
				8 1/2	6-2034-865
				9 1/2	6-2038-865
10 1/2	6-2042-865				



### Demountable Bushing Selection Guide (-855)

Nominal Post Diameter O	A	B	C	C1	E	F	L	Catalog Number
1"	1 3/8	1 7/8	2 1/8	2.28	1 3/16	1 1/4	2 7/16	6-0805-855
						1 3/4	2 15/16	6-0807-855
						2 1/4	3 7/16	6-0809-855
1 1/4"	1 5/8	2 1/8	2 3/8	2.48	1 3/16	1 3/4	2 15/16	6-1007-855
						2 1/4	3 7/16	6-1009-855
						2 3/4	3 15/16	6-1011-855
1 1/2"	1 7/8	2 1/2	2 7/8	2.98	1 7/16	1 1/2	2 15/16	6-1206-855
						2 1/4	3 11/16	6-1209-855
						3	4 7/16	6-1212-855
						3 1/2	4 15/16	6-1214-855
1 3/4"	2 1/8	2 3/4	3 1/8	3.28	1 11/16	1 3/4	3 7/16	6-1407-855
						2 1/2	4 3/16	6-1410-855
						3 1/4	4 15/16	6-1413-855
2"	2 1/2	3 1/4	3 5/8	3.74	1 15/16	2	3 15/16	6-1608-855
						2 3/4	4 11/16	6-1611-855
						3 1/2	5 7/16	6-1614-855
						4 1/4	6 3/16	6-1617-855
2 1/2"	3	3 3/4	4 1/8	4.25	1 15/16	4	5 15/16	6-2016-855
						4 3/4	6 11/16	6-2019-855
						5 1/2	7 7/16	6-2022-855
3"	3 1/2	4 1/4	4 3/4	4.88	1 15/16	4	5 15/16	6-2416-855
						4 3/4	6 11/16	6-2419-855
						5 1/2	7 7/16	6-2422-855



### Bore Sizes for Ball Bearing Bushing and Pin Assembly

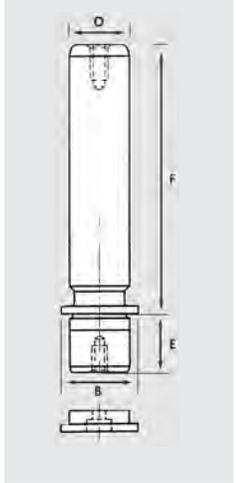
Pin Diameter	-825, -835 Bore Diameter	-55 Bore Diameter	Ball Bushing Bore Diameter	Ring System Bore Diameter
1"	0.9991	1.0006	1.8756	-
	0.9985	1.0000	1.8750	-
1 1/4"	1.2489	1.2506	2.1257	-
	1.2482	1.2500	2.1250	-
1 1/2"	1.4989	1.5006	2.5007	2.4997
	1.4982	1.5000	2.5000	2.4990
1 3/4"	1.7489	1.7506	2.7507	2.7497
	1.7482	1.7500	2.7500	2.7490
2"	1.9989	2.0007	3.2509	3.2499
	1.9982	2.0000	3.2500	3.2490
2 1/2"	2.4986	2.5007	3.7509	3.7499
	2.4979	2.5000	3.7500	3.7490
3"	2.9986	3.0007	4.2509	-
	2.9979	3.0000	4.2500	-

**Demountable Pin Selection Guide (-835)**

**Ball Bearing Cage Selection Guide (-8225)**

Nominal Pin Diameter O	Flange B	Length E	Length F	Catalog Number			
1"	1.31	7/8"	4	5-0816-835			
			4 1/2	5-0818-835			
			5	5-0820-835			
			5 1/2	5-0822-835			
			6	5-0824-835			
			6 1/2	5-0826-835			
			7	5-0828-835			
			7 1/2	5-0830-835			
			1 1/4"	1.56	1 3/16"	4	5-1016-835
						4 1/2	5-1018-835
5	5-1020-835						
5 1/2	5-1022-835						
6	5-1024-835						
6 1/2	5-1026-835						
7	5-1028-835						
7 1/2	5-1030-835						
8	5-1032-835						
8 1/2	5-1034-835						
9	5-1036-835						
9 1/2	5-1038-835						
10	5-1040-835						
1 1/2"	1.87	1 7/16"	5	5-1220-835			
			5 1/2	5-1222-835			
			6	5-1224-835			
			6 1/2	5-1226-835			
			7	5-1228-835			
			7 1/2	5-1230-835			
			8	5-1232-835			
			8 1/2	5-1234-835			
			9	5-1236-835			
			9 1/2	5-1238-835			
			10	5-1240-835			
11	5-1244-835						
1 3/4"	2.25	1 11/16"	5	5-1420-835			
			5 1/2	5-1422-835			
			6	5-1424-835			
			6 1/2	5-1426-835			
			7	5-1428-835			
			7 1/2	5-1430-835			
			8	5-1432-835			
			8 1/2	5-1434-835			
			9	5-1436-835			
			9 1/2	5-1438-835			
			10	5-1440-835			
			11	5-1444-835			
12	5-1448-835						

Nominal Pin Diameter O	Flange B	Length E	Length F	Catalog Number
2"	2.50	1 15/16"	5	5-1620-835
			5 1/2	5-1622-835
			6	5-1624-835
			6 1/2	5-1626-835
			7	5-1628-835
			7 1/2	5-1630-835
			8	5-1632-835
			8 1/2	5-1634-835
			9	5-1636-835
			9 1/2	5-1638-835
			10	5-1640-835
			11	5-1644-835
12	5-1648-835			
2 1/2"	3.00	1 15/16"	5	5-2020-835
			5 1/2	5-2022-835
			6	5-2024-835
			6 1/2	5-2026-835
			7	5-2028-835
			7 1/2	5-2030-835
			8	5-2032-835
			8 1/2	5-2034-835
			9	5-2036-835
			9 1/2	5-2038-835
			10	5-2040-835
			11	5-2044-835
			12	5-2048-835
			13	5-2052-835
14	5-2056-835			
3"	3.50	2 3/16"	6	5-2424-835
			7	5-2428-835
			8	5-2432-835
			9	5-2436-835
			10	5-2440-835
			11	5-2444-835
			12	5-2448-835
			14	5-2456-835
			16	5-2464-835



Diameter O	C	S	X	Catalog Number
1"	2	1 1/16	3/16	6-0808-8225
	2 1/2	1 5/16		6-0810-8225
	3	1 9/16		6-0812-8225
	3 1/4	1 13/16		6-0813-8225
	3 1/2	2 1/16		6-0814-8225
	3 3/4	2 5/16		6-0815-8225
1 1/4"	2 3/4	1 7/16	3/16	6-1011-8225
	3 1/4	1 11/16		6-1013-8225
	3 3/4	1 15/16		6-1015-8225
	4	2 3/16		6-1016-8225
1 1/2"	4 1/4	2 7/16	1/4	6-1017-8225
	4 3/4	2 15/16		6-1019-8225
	2 3/4	1 7/16		6-1211-8225
1 1/2"	3 1/2	1 13/16	1/4	6-1214-8225
	4 1/4	2 3/16		6-1217-8225
	4 1/2	2 7/16		6-1218-8225
	5	2 15/16		6-1220-8225
	5 1/2	3 7/16		6-1222-8225
	6	3 15/16		6-1224-8225
1 3/4"	3 1/4	1 11/16	1/4	6-1413-8225
	4	2 1/16		6-1416-8225
	4 3/4	2 7/16		6-1419-8225
	5 1/4	2 15/16		6-1421-8225
	5 3/4	3 7/16		6-1423-8225
	6 1/4	3 15/16		6-1425-8225
2"	6 3/4	4 7/16	1/4	6-1427-8225
	3 3/4	1 15/16		6-1615-8225
	4 1/2	2 5/16		6-1618-8225
	5 1/4	2 11/16		6-1621-8225
	5 5/8	3 1/16		6-1623-8225
	6	3 7/16		6-1624-8225
2 1/2"	6 1/2	3 15/16	3/8	6-1626-8225
	7	4 7/16		6-1628-8225
	7 1/2	4 15/16		6-1630-8225
	5 3/4	3		6-2023-8225
	6 1/2	3 3/8		6-2026-8225
	7 1/4	3 3/4		6-2029-8225
2 1/2"	7 3/4	4 1/4	3/8	6-2031-8225
	8 1/4	4 3/4		6-2033-8225
	8 3/4	5 1/4		6-2035-8225
	5 3/4	3		6-2423-8225
3"	6 1/2	3 3/8	3/8	6-2426-8225
	7 1/4	3 3/4		6-2429-8225



**Washer Assemblies**

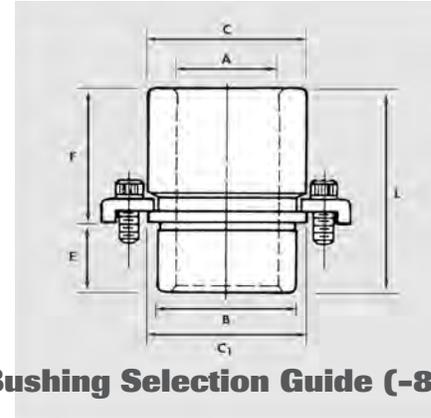
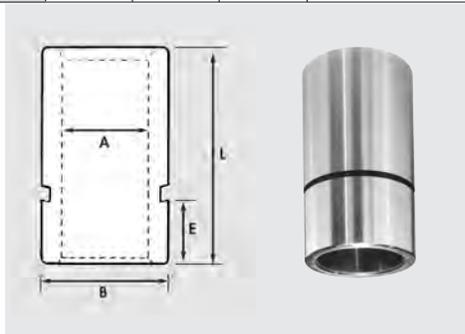
Nominal Pin Diameter O	Catalog Number
1"	6-0008-822
1 1/4"	6-0010-822
1 1/2"	6-0012-822
1 3/4"	6-0014-822
2"	6-0016-822
2 1/2"	6-0020-822
3"	6-0024-822

Washer Assemblies sold separately for ball bearing applications.



### Straight Sleeve Bushing Selection Guide (-865)

Nominal Post Diameter O	A	B	E	Length L	Catalog Number
1"	1 3/8	1 7/8	n/a	2 1/2	6-0810-865
				3	6-0812-865
				3 1/2	6-0814-865
				4	6-0816-865
				4 1/2	6-0818-865
5	6-0820-865				
1 1/4"	1 5/8	2 1/8	n/a	3	6-1012-865
				3 1/2	6-1014-865
				4	6-1016-865
				4 1/2	6-1018-865
				5	6-1020-865
6	6-1024-865				
1 1/2"	1 7/8	2 1/2	1 3/8	3	6-1212-865
				3 3/4	6-1215-865
				4 1/2	6-1218-865
				5	6-1220-865
				5 1/2	6-1222-865
				6	6-1224-865
				7	6-1228-865
8	6-1232-865				
1 3/4"	2 1/8	2 3/4	1 5/8	3 1/2	6-1414-865
				4 1/4	6-1417-865
				5	6-1420-865
				5 1/2	6-1422-865
				6	6-1424-865
7	6-1428-865				
8	6-1432-865				
9	6-1436-865				
2"	2 1/2	3 1/4	1 7/8	4	6-1616-865
				4 3/4	6-1619-865
				5 1/2	6-1622-865
				6 1/4	6-1625-865
				7	6-1628-865
				8	6-1632-865
9	6-1636-865				
10	6-1640-865				
2 1/2"	3	3 3/4	1 7/8	6	6-2024-865
				6 3/4	6-2027-865
				7 1/2	6-2030-865
				8 1/2	6-2034-865
				9 1/2	6-2038-865
10 1/2	6-2042-865				



### Demountable Bushing Selection Guide (-855)

Nominal Post Diameter O	A	B	C	C1	E	F	L	Catalog Number
1"	1 3/8	1 7/8	2 1/8	2.28	1 3/16	1 1/4	2 7/16	6-0805-855
						1 3/4	2 15/16	6-0807-855
						2 1/4	3 7/16	6-0809-855
1 1/4"	1 5/8	2 1/8	2 3/8	2.48	1 3/16	1 3/4	2 15/16	6-1007-855
						2 1/4	3 7/16	6-1009-855
						2 3/4	3 15/16	6-1011-855
1 1/2"	1 7/8	2 1/2	2 7/8	2.98	1 7/16	1 1/2	2 15/16	6-1206-855
						2 1/4	3 11/16	6-1209-855
						3	4 7/16	6-1212-855
						3 1/2	4 15/16	6-1214-855
1 3/4"	2 1/8	2 3/4	3 1/8	3.28	1 11/16	1 3/4	3 7/16	6-1407-855
						2 1/2	4 3/16	6-1410-855
						3 1/4	4 15/16	6-1413-855
2"	2 1/2	3 1/4	3 5/8	3.74	1 15/16	2	3 15/16	6-1608-855
						2 3/4	4 11/16	6-1611-855
						3 1/2	5 7/16	6-1614-855
						4 1/4	6 3/16	6-1617-855
2 1/2"	3	3 3/4	4 1/8	4.25	1 15/16	4	5 15/16	6-2016-855
						4 3/4	6 11/16	6-2019-855
						5 1/2	7 7/16	6-2022-855
3"	3 1/2	4 1/4	4 3/4	4.88	1 15/16	4	5 15/16	6-2416-855
						4 3/4	6 11/16	6-2419-855
						5 1/2	7 7/16	6-2422-855

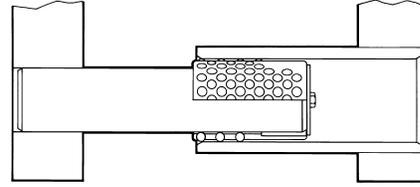
### Bore Sizes for Ball Bearing Bushing and Pin Assembly

Pin Diameter	-825, -835 Bore Diameter	-55 Bore Diameter	Ball Bushing Bore Diameter	Ring System Bore Diameter
1"	0.9991	1.0006	1.8756	-
	0.9985	1.0000	1.8750	-
1 1/4"	1.2489	1.2506	2.1257	-
	1.2482	1.2500	2.1250	-
1 1/2"	1.4989	1.5006	2.5007	2.4997
	1.4982	1.5000	2.5000	2.4990
1 3/4"	1.7489	1.7506	2.7507	2.7497
	1.7482	1.7500	2.7500	2.7490
2"	1.9989	2.0007	3.2509	3.2499
	1.9982	2.0000	3.2500	3.2490
2 1/2"	2.4986	2.5007	3.7509	3.7499
	2.4979	2.5000	3.7500	3.7490
3"	2.9986	3.0007	4.2509	-
	2.9979	3.0000	4.2500	-

# Selecting the Proper Operating Conditions

## Type I

### Continuous Preload

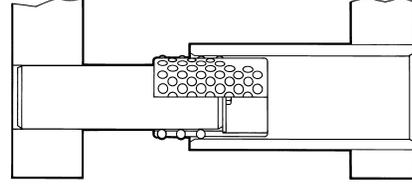


Type **I** is recommended for high speed, high production dies. Throughout the press stroke, all ball bearings remain in preloaded contact with the guide pin and bushing.

Please note that a Type **I** design may be run on a shorter stroke press, but not on a press whose stroke is longer than originally chosen.

## Type IIa

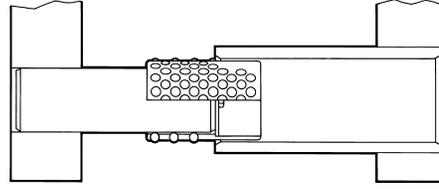
### Preload Partially Relieved



At top stroke, some ball bearings have left preload. On the down stroke they reengage the guide pin and bushing, producing a small upward force which helps counteract the natural tendency of the ball cage to creep downward.

## Type IIb

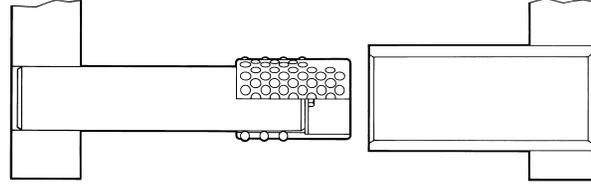
### Preload Relieved



Type **IIb** is recommended if creeping is a problem. As soon as the last ball leaves preload on the up stroke, the cage repositions itself. This feature can eliminate a nagging maintenance chore.

## Type III

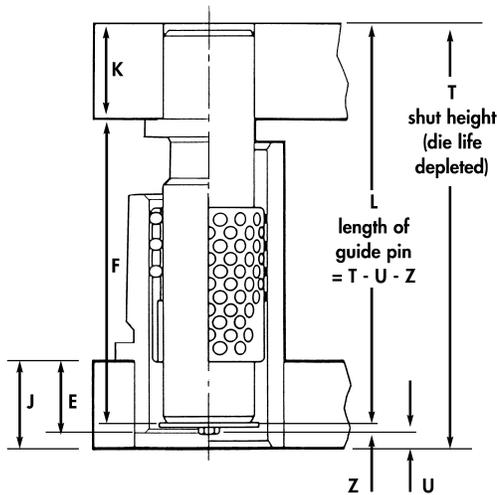
### Disengaged



Type **III** permits an unlimited stroke. Also, if shorter bushings and cages can be used, Type **III** is economical.

However, a pinch point is created when the components disengage, so Type **III** should not be selected if it compromises safety.

# Selecting the Correct Components



## Guide Pins

1. Calculate **L** using one of the following formulas:  
 $L = T - (U + Z)$  for assembly with sleeve bushings  
 $L = T - (U + Z) - J + E$  for demountable bushings
2. For straight pins, select a length equal to **L**. If **L** is not a standard length, choose a longer pin and cut to **L**, or choose a shorter length and recess the pin in the punch holder to **L**, making sure that the minimum press fit length is at least equal to the pin diameter.
3. For demountable pins, select a length so that **K + F** is as close as possible to **L** without exceeding it.

## Bushings

1. If the tool's working stroke is short and there are no off-center loads, select the shortest bushing which will produce the desired operating condition. Turn to the selection chart on pages 26 and 27, find the stroke, and read down that column until it intersects the operating condition you have selected. The bushing you need is listed on that line.
2. When rigidity and resistance to side load are required, use the selection chart to choose the longest bushing consistent with the desired operating condition.

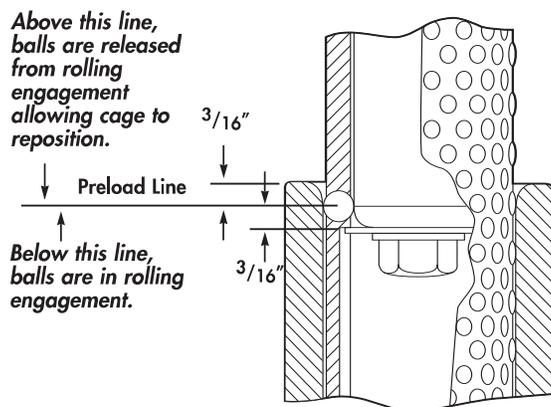
**CAUTION:** Make sure the top of the bushing does not strike the punch holder or the demountable pin clamp screw, either when the die is new or die life is depleted. If it does, select the next shorter bushing.

Guide Pin Length Selection

Nominal Guide Pin Diameter O	Z	U + Z	E
1"	15/32		1 3/16
1 1/4"	15/32		1 3/16
1 1/2"	1/2		1 7/16
1 3/4"	1/2	3/4	1 11/16
2"	1/2		1 15/16
2 1/2"	9/16		1 15/16
3"	9/16		1 15/16

## Cages

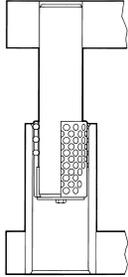
1. The page 26-27 selection chart automatically gives you the correct cage. It is listed on the same line as the bushing you have selected.
2. Different combinations of cages and bushings are possible, but then the selection chart does not apply. You will need to make a layout of the cage travel from the start of preload to bottom stroke. This figure gives you the position of the guide pin, bushing, and cage at the start of preload. From that point on, the cage travels half the distance of the guide pin.



# Bushing and Ball Cage Operating Condition Selection Chart

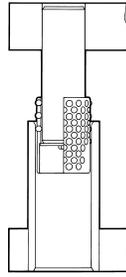
**Type I**

*Continuous Preload*



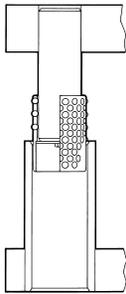
**Type IIa**

*Preload Partially Relieved*



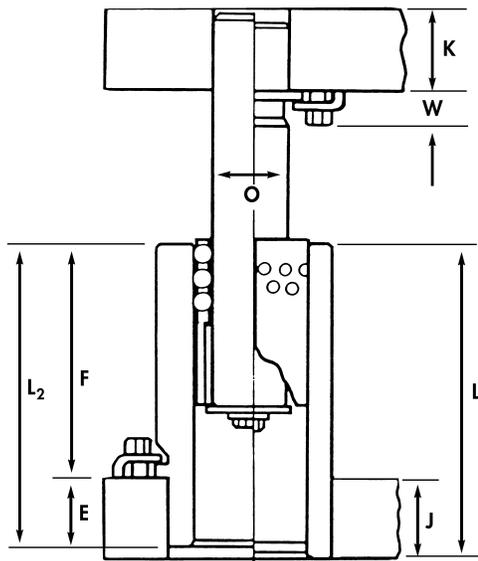
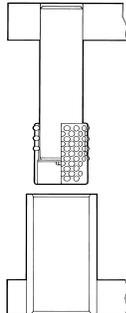
**Type IIb**

*Preload Relieved*



**Type III**

*Disengaged*



Nominal Pin Diameter O	Straight Sleeve L	Demountable Shoulder L <sub>2</sub>	
1"	2 1/2	2 7/16	
	3	2 15/16	
	3 1/2	3 7/16	
	4		
	4 1/2		
1 1/4"	3	2 15/16	
	3 1/2	3 7/16	
	4	3 15/16	
	4 1/2		
	5		
	6		
1 1/2"	3	2 15/16	
	3 3/4	3 11/16	
	4 1/2	4 7/16	
	5	4 15/16	
	6		
	7		
	8		
	9		
1 3/4"	3 1/2	3 7/16	
	4 1/4	4 3/16	
	5	4 15/16	
	6		
	7		
	8		
	9		
	2"	4	3 15/16
		4 3/4	4 11/16
5 1/2		5 7/16	
6 1/4		6 3/16	
7			
8			
9			
10			
2 1/2"		6	5 15/16
		6 3/4	6 11/16
	7 1/2	7 7/16	
	8 1/2		
	9 1/2		
	10 1/2		
3"	-	5 15/16	
	-	6 11/16	
	-	7 7/16	

**Caution:** Be sure bushing does not strike punch holder or demountable pin clamping screw at minimum shut height. If this condition exists, use a shorter bushing and corresponding ball cage.

Ball Cage C	Clamp Screw W	Stroke "S" at minimum shut height (die life depleted)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	5/8	[Bar chart data for C=2, W=5/8]															
2 1/2		[Bar chart data for C=2 1/2, W=5/8]															
3		[Bar chart data for C=3, W=5/8]															
3 1/4		[Bar chart data for C=3 1/4, W=5/8]															
3 1/2		[Bar chart data for C=3 1/2, W=5/8]															
3 3/4		[Bar chart data for C=3 3/4, W=5/8]															
2 3/4	3/4	[Bar chart data for C=2 3/4, W=3/4]															
3 1/4		[Bar chart data for C=3 1/4, W=3/4]															
3 3/4		[Bar chart data for C=3 3/4, W=3/4]															
4		[Bar chart data for C=4, W=3/4]															
4 1/4		[Bar chart data for C=4 1/4, W=3/4]															
4 3/4		[Bar chart data for C=4 3/4, W=3/4]															
2 3/4	3/4	[Bar chart data for C=2 3/4, W=3/4]															
3 1/2		[Bar chart data for C=3 1/2, W=3/4]															
4 1/4		[Bar chart data for C=4 1/4, W=3/4]															
4 1/2		[Bar chart data for C=4 1/2, W=3/4]															
5		[Bar chart data for C=5, W=3/4]															
5 1/2		[Bar chart data for C=5 1/2, W=3/4]															
6	[Bar chart data for C=6, W=3/4]																
3 1/4	3/4	[Bar chart data for C=3 1/4, W=3/4]															
4		[Bar chart data for C=4, W=3/4]															
4 3/4		[Bar chart data for C=4 3/4, W=3/4]															
5 1/4		[Bar chart data for C=5 1/4, W=3/4]															
5 3/4		[Bar chart data for C=5 3/4, W=3/4]															
6 1/4		[Bar chart data for C=6 1/4, W=3/4]															
6 3/4	[Bar chart data for C=6 3/4, W=3/4]																
3 3/4	3/4	[Bar chart data for C=3 3/4, W=3/4]															
4 1/2		[Bar chart data for C=4 1/2, W=3/4]															
5 1/4		[Bar chart data for C=5 1/4, W=3/4]															
5 5/8		[Bar chart data for C=5 5/8, W=3/4]															
6		[Bar chart data for C=6, W=3/4]															
6 1/2		[Bar chart data for C=6 1/2, W=3/4]															
7		[Bar chart data for C=7, W=3/4]															
7 1/2		[Bar chart data for C=7 1/2, W=3/4]															
5 3/4	3/4	[Bar chart data for C=5 3/4, W=3/4]															
6 1/2		[Bar chart data for C=6 1/2, W=3/4]															
7 1/4		[Bar chart data for C=7 1/4, W=3/4]															
7 3/4		[Bar chart data for C=7 3/4, W=3/4]															
8 1/4		[Bar chart data for C=8 1/4, W=3/4]															
8 3/4		[Bar chart data for C=8 3/4, W=3/4]															
5 3/4	3/4	[Bar chart data for C=5 3/4, W=3/4]															
6 1/2		[Bar chart data for C=6 1/2, W=3/4]															
7 1/4		[Bar chart data for C=7 1/4, W=3/4]															

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# READY Metric Plain Bearing and Ball Bearing Components

The following 11 pages represent our extensive line of metric guide components, which have been used by European toolmakers and stamping plants for over 30 years.

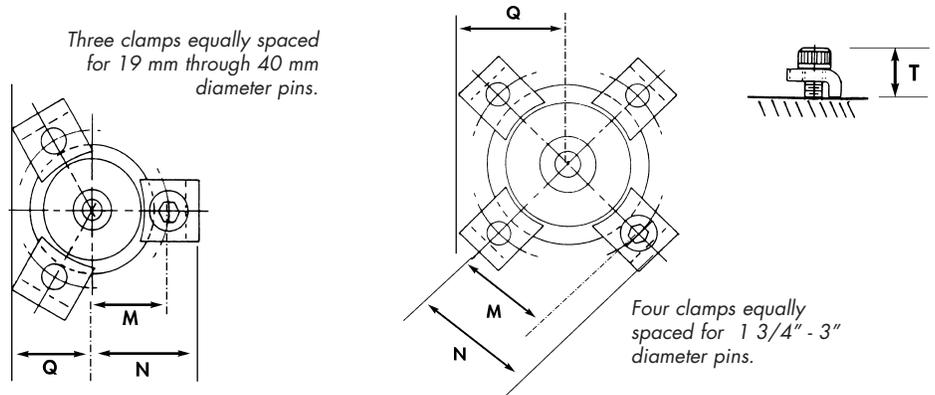
Our design is elegantly simple. All of our guide pillars, press fit and demountable, fit an R6 bored hole. All our bushings, ball bearing and plain bearing, straight and demountable, fit an H6 bored hole:

As with our line of inch components, each Ready metric pillar can be used either as a plain bearing or ball bearing pin. Every pin and bushing is color coded for Selective Fit™, providing you with the correct running clearance for your application.

**Metric Hole Boring Chart**

Pin Diameter O	Pin R6 Bore	Standard Bushing H6 Bore	Ball Bushing H6 Bore
19	18.976	28.016	-
	18.963	28.000	-
25	24.976	38.016	45.016
	24.963	38.000	45.000
32	31.971	45.016	54.019
	31.955	45.000	54.000
40	39.971	54.019	65.019
	39.955	54.000	65.000
50	49.971	65.019	81.022
	49.955	65.000	81.000
63	62.965	81.022	95.022
	62.946	81.000	95.000
80	79.963	100.022	112.022
	79.944	100.000	112.000

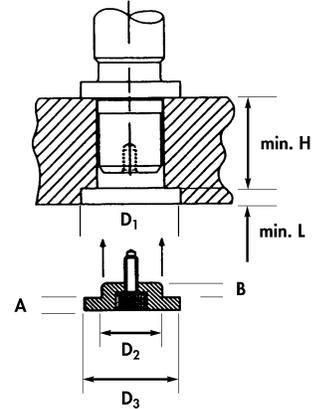
## Metric Clamp Data



Diameter O	DEMOUNTABLE PIN						
	Radius		Q	Qty per Pillar	Clamp	Socket Head Cap Screws	
	M	N				S	T
19	16	23.5	19	3	6-90-1	M 6 x 18	15
25	20.3	27.8	20.8	3	6-90-1	M 6 x 18	15
32	25.5	35.5	24.6	3	6-93-1	M 8 x 22	19.4
40	30	40	26.9	3	6-93-1	M 8 x 22	19.4
50	36.5	46.5	38.5	4	6-93-1	M 8 x 22	19.4
63	42.5	52.5	42.7	4	6-93-1	M 8 x 22	19.4
80	51	61	48.8	4	6-93-1	M 8 x 22	19.4

# Metric Clamp Data (cont.)

Pin Diameter O	Pillar Retaining Plug								Catalog Number	Screw
	D1	min. L	min. H	A	B	D2	D3			
19	26	3.5	26	3.3	4.2	18	25	6-18-3	M 5 x 16	
25	33	5.5	30	5	4.2	24	32	6-24-3	M 6 x 20	
32	41	5.5	39	5	7	30	40	6-30-3	M 8 x 25	
40	51	5.5	49	5	10	40	50	6-40-3	M 10 x 30	
50	64	5.5	60	5	13	50	63	6-50-3	M 12 x 40	
63	77	5.5	70	5	19	63	76	6-63-3	M 16 x 40	
80	94	5.5	87	5	25	80	93	6-80-3	M 20 x 50	

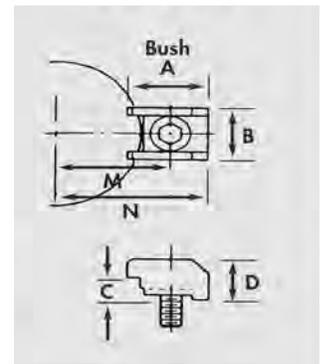
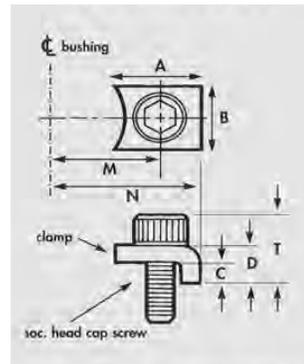


## Extra Long, Long and Short Shoulder Bushings

Pillar Dia.	Clamps per Bush	Screw	Clamp number	A mm	B mm	C mm	D mm	M mm	N mm
19	2	M6	6-95-1	12.3	12.7	3.2	5.6	19.5	25.5
25	3	M6	6-90-1	14.3	15.9	4.9	8.7	27.5	35
32	3	M8	6-93-1	19.8	15.9	6.5	11.4	32.5	42.5
40	3	M8	6-93-1	19.8	15.9	6.5	11.4	37	47
50	4	M8	6-93-1	19.8	15.9	6.5	11.4	44.5	54.5
63	4	M8	6-93-1	19.8	15.9	6.5	11.4	52	62
80	4	M8	6-93-1	19.8	15.9	6.5	11.4	62	72

Clamp Numbers:  
6-90-1, 6-93-1, 6-95-1

Clamp Numbers:  
6-96-1, 6-97-1



## Low Profile Bushings

Pillar Dia.	Clamps per Bush	Screw	Clamp number	A mm	B mm	C mm	D mm	M mm	N mm
19	2	M6	6-95-1	12.3	12.7	3.2	5.6	19.5	25.5
25	3	M6	6-96-1	17.5	14.5	5	10	30	37
32	3	M6	6-96-1	17.5	14.5	5	10	34	41
40	3	M8	6-97-1	24.6	18.9	7.9	13	39.5	50.5
50	4	M8	6-97-1	24.6	18.9	7.9	13	46	57
63	4	M8	6-97-1	24.6	18.9	7.9	13	56	67.5
80	4	M8	6-97-1	24.6	18.9	7.9	13	66	77

## Ball Bearing Stripper Plate Bushings

Pillar Dia.	Clamps per Bush	Screw	Clamp number	A mm	B mm	C mm	D mm	M mm	N mm
25	3	M6	6-96-1	17.5	14.5	5	10	32.5	39.5
32	3	M6	6-96-1	17.5	14.5	5	10	37	44
40	4	M6	6-96-1	17.5	14.5	5	10	44.5	51.5
50	4	M6	6-96-1	17.5	14.5	5	10	52.5	59.5

## DEMOUNTABLE BALL BEARING BUSHINGS

Nominal Diameter	Radius		Size				Clamp No.	Per Unit	Screw size	T
	M	N	A	B	C	D				
25	32.5	43	19.8	15.9	6.5	11.4	6-93-1	3	M8 X 20	19.4
32	37	47								
40	43.5	54								
50	52.5	63								
63	59.5	70								

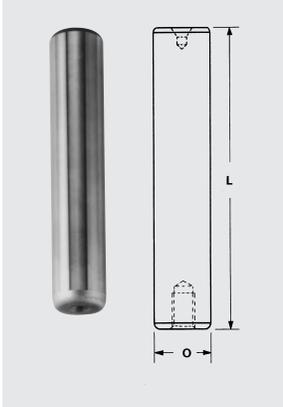
**Precision Pin Selection Guide**

Nominal Pin Diameter O	Length L	Catalog Number
19	100	5-1910-82
	110	5-1911-82
	120	5-1912-82
	130	5-1913-82
	140	5-1914-82
	150	5-1915-82
	160	5-1916-82
	170	5-1917-82
	180	5-1918-82
	190	5-1919-82
200	5-2120-82	
25	100	5-2510-82
	110	5-2511-82
	120	5-2512-82
	130	5-2513-82
	140	5-2514-82
	150	5-2515-82
	160	5-2516-82
	170	5-2517-82
	180	5-2518-82
	190	5-2519-82
	200	5-2520-82
	220	5-2522-82
	240	5-2524-82
	260	5-2526-82
280	5-2528-82	
32	130	5-3213-82
	140	5-3214-82
	150	5-3215-82
	160	5-3216-82
	170	5-3217-82
	180	5-3218-82
	190	5-3219-82
	200	5-3220-82
	220	5-3222-82
	240	5-3224-82
	260	5-3226-82
	280	5-3228-82
320	5-3232-82	

Nominal Pin Diameter O	Length L	Catalog Number
40	130	5-4013-82
	140	5-4014-82
	150	5-4015-82
	160	5-4016-82
	170	5-4017-82
	180	5-4018-82
	190	5-4019-82
	200	5-4020-82
	220	5-4022-82
	240	5-4024-82
	260	5-4026-82
	280	5-4028-82
	320	5-4032-82
	360	5-4036-82
50	160	5-5016-82
	180	5-5018-82
	200	5-5020-82
	220	5-5022-82
	240	5-5024-82
	260	5-5026-82
	280	5-5028-82
	320	5-5032-82
	330	5-5033-82
	360	5-5036-82
400	5-5040-82	
450	5-5045-82	
63	200	5-6320-82
	220	5-6322-82
	240	5-6324-82
	260	5-6326-82
	280	5-6328-82
	320	5-6332-82
	360	5-6336-82
	400	5-6340-82
	450	5-6345-82
	500	5-6350-82
80	240	5-8024-82
	260	5-8026-82
	280	5-8028-82
	320	5-8032-82
	360	5-8036-82
	400	5-8040-82
	450	5-8045-82
	500	5-8050-82

**Demountable Pin Selection Guide**

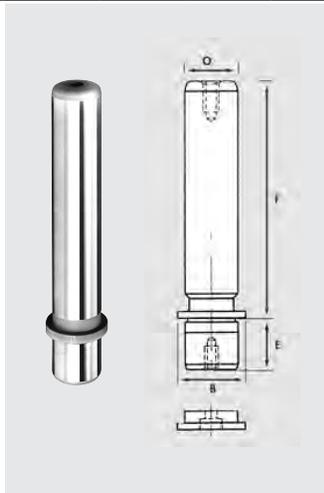
O	B	E	Length F	Catalog Number
19	25.6	20	70	5-1907-83
			80	5-1908-83
			90	5-1909-83
			100	5-1910-83
			110	5-1911-83
			120	5-1912-83
			130	5-1913-83
			140	5-1914-83
			150	5-1915-83
			160	5-1916-83
25	32.6	24	70	5-2507-83
			80	5-2508-83
			90	5-2509-83
			100	5-2510-83
			110	5-2511-83
			120	5-2512-83
			130	5-2513-83
			140	5-2514-83
			150	5-2515-83
			160	5-2516-83
			170	5-2517-83
			180	5-2518-83
200	5-2520-83			
32	40.6	30	90	5-3209-83
			100	5-3210-83
			110	5-3211-83
			120	5-3212-83
			130	5-3213-83
			140	5-3214-83
			150	5-3215-83
			160	5-3216-83
			170	5-3217-83
			180	5-3218-83
			200	5-3220-83
			220	5-3222-83
240	5-3224-83			
280	5-3228-83			
40	50.8	37	100	5-4010-83
			110	5-4011-83
			120	5-4012-83
			130	5-4013-83
			140	5-4014-83
			150	5-4015-83
			160	5-4016-83
			170	5-4017-83
			180	5-4018-83
			200	5-4020-83
			220	5-4022-83
			240	5-4024-83
			280	5-4028-83



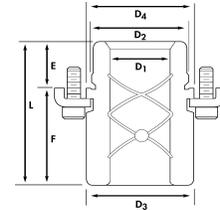
Guide Pin Tap Sizes		Recommended Seating Torque
Nominal Pin Diameter O	Tap Size	Kg-M
25 - 32	M6	0.90
40 - 80	M10	4.40

**Demountable Pin  
Selection Guide Continued**

O	B	E	Length F	Catalog Number
50	63.8	45	110	5-5011-83
			120	5-5012-83
			130	5-5013-83
			140	5-5014-83
			150	5-5015-83
			160	5-5016-83
			170	5-5017-83
			180	5-5018-83
			200	5-5020-83
			220	5-5022-83
			240	5-5024-83
			260	5-5026-83
			280	5-5028-83
			320	5-5032-83
63	76	49	120	5-6312-83
			140	5-6314-83
			160	5-6316-83
			180	5-6318-83
			200	5-6320-83
			220	5-6322-83
			240	5-6324-83
			280	5-6328-83
80	93	60	180	5-8018-83
			200	5-8020-83
			220	5-8022-83
			240	5-8024-83
			280	5-8028-83
			320	5-8032-83
			360	5-8036-83
			400	5-8040-83



**Demountable Steel  
Bushings and Sintered  
Bronze Bushings**



**Low Profile Bushings**

D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	D <sub>4</sub> mm	E mm	F mm	L mm	X mm	Steel Catalog Number	Sintered Bronze Catalog Number
19	28	28	32.5	18	10	28	6	6-1928-68	6-1928-48
25	38	36	47	23	10	33	6	6-2538-68	6-2538-48
32	45	43	54	30	10	40	10	6-3245-68	6-3245-48
40	54	48	63	38	14	52	10	6-4054-68	6-4054-48
50	65	64	75	48	14	62	20	6-5065-68	6-5065-48
63	81	79	93	61	14	75	20	6-6381-68	6-6381-48
80	100	99	115	78	14	92	32	6-8010-68	6-8010-48



**Short Shoulder Bushings**

D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	D <sub>4</sub> mm	E mm	F mm	L mm	Steel Catalog Number	Sintered Bronze Catalog Number
19	28	28.5	32.5	18	16	34	6-1928-63	6-1928-43
25	38	44	47	23	21	44	6-2538-63	6-2538-43
32	45	51	54	25	21	48	6-3245-63	6-3245-43
40	54	60	63	30	21	51	6-4054-63	6-4054-43
50	65	73	75	35	25	60	6-5065-63	6-5065-43
63	81	90	93	48	27	75	6-6381-63	6-6381-43
80	100	110	115	48	27	75	6-8010-63	6-8010-43



**Standard Shoulder Bushings**

D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	D <sub>4</sub> mm	E mm	F mm	L mm	Steel Catalog Number	Sintered Bronze Catalog Number
19	28	28.5	32.5	18	32	50	6-1928-64	6-1928-44
25	38	44	47	23	47	70	6-2538-64	6-2538-44
32	45	51	54	25	50	75	6-3245-64	6-3245-44
40	54	60	63	30	50	80	6-4054-64	6-4054-44
50	65	73	75	35	50	85	6-5065-64	6-5065-44
63	81	90	93	48	52	100	6-6381-64	6-6381-44
80	100	110	115	48	52	100	6-8010-64	6-8010-44



**Extra Long Shoulder Bushings**

D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	D <sub>4</sub> mm	E mm	F mm	L mm	Steel Catalog Number	Sintered Bronze Catalog Number
25	38	44	47	23	75	98	6-2538-65	6-2538-45
32	45	51	54	25	75	100	6-3245-65	6-3245-45
40	54	60	63	30	85	115	6-4054-65	6-4054-45
50	65	73	75	35	100	135	6-5065-65	6-5065-45
63	81	90	93	48	100	148	6-6381-65	6-6381-45



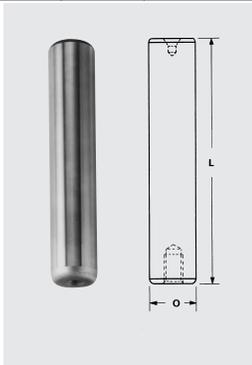
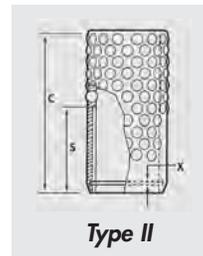
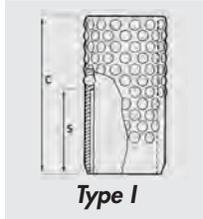
Please Note: The Demountable Clamp Data is located on page 21.

**Precision Pin Selection Guide**

Nominal Pin Diameter O	Length L	Catalog Number	Nominal Pin Diameter O	Length L	Catalog Number	
19	100	5-1910-82	40	130	5-4013-82	
	110	5-1911-82		140	5-4014-82	
	120	5-1912-82		150	5-4015-82	
	130	5-1913-82		160	5-4016-82	
	140	5-1914-82		170	5-4017-82	
	150	5-1915-82		180	5-4018-82	
	160	5-1916-82		190	5-4019-82	
	170	5-1917-82		200	5-4020-82	
	180	5-1918-82		220	5-4022-82	
	190	5-1919-82		240	5-4024-82	
	200	5-2120-82		260	5-4026-82	
	25	100		5-2510-82	40	280
110		5-2511-82	320	5-4032-82		
120		5-2512-82	360	5-4036-82		
130		5-2513-82	50	160		5-5016-82
140		5-2514-82		180		5-5018-82
150		5-2515-82		200		5-5020-82
160		5-2516-82		220	5-5022-82	
170		5-2517-82		240	5-5024-82	
180		5-2518-82		260	5-5026-82	
190		5-2519-82	280	5-5028-82		
200		5-2520-82	320	5-5032-82		
220		5-2522-82	330	5-5033-82		
240	5-2524-82	360	5-5036-82			
260	5-2526-82	400	5-5040-82			
280	5-2528-82	450	5-5045-82			
32	130	5-3213-82	63	200	5-6320-82	
	140	5-3214-82		220	5-6322-82	
	150	5-3215-82		240	5-6324-82	
	160	5-3216-82		260	5-6326-82	
	170	5-3217-82		280	5-6328-82	
	180	5-3218-82		320	5-6332-82	
	190	5-3219-82	360	5-6336-82		
	200	5-3220-82	400	5-6340-82		
	220	5-3222-82	450	5-6345-82		
	240	5-3224-82	500	5-6350-82		
	260	5-3226-82	80	240	5-8024-82	
	280	5-3228-82		260	5-8026-82	
320	5-3232-82	280		5-8028-82		
		320		5-8032-82		
		360		5-8036-82		
		400		5-8040-82		
		450	5-8045-82			
		500	5-8050-82			

**Ball Bearing Cage Selection Guide**

Nominal Pillar Diameter D mm	Type I		Catalog Number	Nominal Pillar Diameter D mm	C mm	Type II		Catalog Number
	C mm	S mm				S mm	X mm	
25	36	11.5	6-2503-81	25	55	31	4.2	6-2505-82
	48	17.5	6-2504-81		70	40		6-2507-82
32	36	11.5	6-3203-81		90	47		6-2509-82
	48	17.5	6-3204-81		100	55		6-2510-82
40	48	17.5	6-4004-81		110	65		6-2511-82
	50	23.5	6-4006-81	32	70	40	4.2	6-3207-82
50	70	28.5	6-5007-81		90	47		6-3209-82
	84	35.5	6-5008-81		105	55		6-3210-82
63	98	42.5	6-6309-81		115	65		6-3211-82
	98	42.5	6-8009-81		125	75		6-3212-82
40	70	40	5.8	135	85	6-3213-82		
				70	40	6-4007-82		
				85	48	6-4008-82		
				105	55	6-4010-82		
				115	65	6-4011-82		
50	120	65	7.0	125	75	6-4012-82		
				135	85	6-4013-82		
				145	98	6-4014-82		
				155	107	6-4015-82		
				105	58	6-5010-82		
63	120	65	7.0	120	65	6-5012-82		
				140	75	6-5014-82		
				150	85	6-5015-82		
				160	95	6-5016-82		
				170	108	6-5017-82		
80	185	121	8.5	185	121	6-5018-82		
				195	133	6-5019-82		
				145	76	6-6314-82		
				165	86	6-6316-82		
				180	96	6-6318-82		
63	190	107	7.0	190	107	6-6319-82		
				205	121	6-6320-82		
				215	132	6-6321-82		
				145	76	6-8014-82		
				165	86	6-8016-82		
80	180	96	8.5	180	96	6-8018-82		
				190	107	6-8019-82		
				205	121	6-8020-82		
				215	132	6-8021-82		



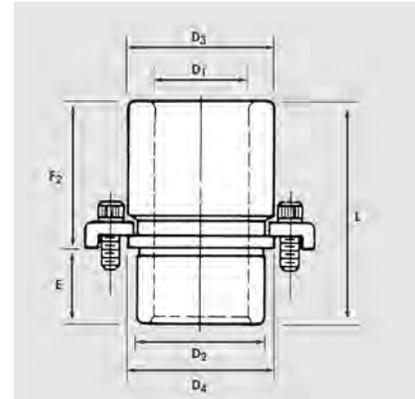
**Washer Assemblies**

Pin Diameter mm	Ball Cage		Screw Size
	Type I	Type II	
25	6-2500-81	6-2500-82	M6
32	6-3200-81	6-3200-82	M6
40	6-4000-81	6-4000-82	M10
50	6-5000-81	6-5000-82	M10
63	6-6300-81	6-6300-82	M10
80	6-8000-81	6-8000-82	M10

### Straight Sleeve Bushing Selection Guide



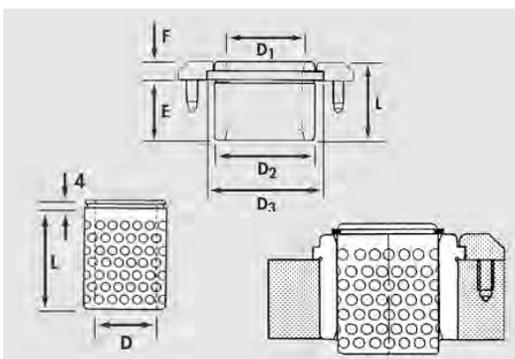
Nominal Pillar Diameter mm	I. D.		O. D.		Length L mm	Catalog Number
	A mm	B mm	A mm	B mm		
25	33	45	65	6-2506-86		
			80	6-2508-86		
			95	6-2509-86		
			110	6-2511-86		
			130	6-2513-86		
32	40	54	80	6-3208-86		
			95	6-3209-86		
			110	6-3211-86		
			130	6-3213-86		
			150	6-3215-86		
			170	6-3217-86		
40	48	65	80	6-4008-86		
			95	6-4009-86		
			110	6-4011-86		
			130	6-4013-86		
			150	6-4015-86		
			170	6-4017-86		
			190	6-4019-86		
			215	6-4021-86		
50	62	81	110	6-5011-86		
			130	6-5013-86		
			150	6-5015-86		
			170	6-5017-86		
			190	6-5019-86		
			215	6-5021-86		
63	75	95	240	6-5024-86		
			265	6-5026-86		
			150	6-6315-86		
			170	6-6317-86		
			190	6-6319-86		
			215	6-6321-86		
80	92	112	240	6-6324-86		
			265	6-6326-86		
			150	6-8015-86		
			170	6-8017-86		
			190	6-8019-86		
			215	6-8021-86		
			240	6-8024-86		
			265	6-8026-86		



### Demountable Bushing Selection Guide

Nominal Post Diameter D	D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	D <sub>4</sub> mm	E mm	F <sub>2</sub> mm	L mm	Catalog Number
25	33	45	50	54	30	35	65	6-2503-85
						50	80	6-2505-85
						65	95	6-2506-85
32	40	54	59	63	30	50	80	6-3205-85
						65	95	6-3206-85
						80	110	6-3208-85
40	48	65	73	75	30	50	80	6-4005-85
						65	95	6-4006-85
						80	110	6-4008-85
						100	130	6-4010-85
						120	150	6-4012-85
50	62	81	91	91	50	60	110	6-5006-85
						80	130	6-5008-85
						100	150	6-5010-85
						120	170	6-5012-85
63	75	95	105	105	50	100	150	6-6310-85
						120	170	6-6312-85
						140	190	6-6314-85

### Stripper Plate Bushing and Cage Selection Guide



D mm	D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	E mm	F mm	L mm	Bushing Catalog Number	L mm	Cage Catalog Number
25	33	45	51	20	10	30	6-2520-87	40	6-2504-83
				25		35	52	6-2505-83	
32	40	54	60	20	10	30	6-3220-87	40	6-3204-83
				25		35	52	6-3205-83	
				32		42			
40	48	65	75	29	10	39	6-4029-87	52	6-4005-83
				36		46	64	6-4006-83	
				44		54			
50	62	81	91	36	10	46	6-5036-87	74	6-5007-83
				44		54	88	6-5008-83	
63	75	95	105	50	10	60	6-6350-87	98	6-6309-83

### Demountable Pin Selection Guide

O	B	E	Length F	Catalog Number
19	25.6	20	70	5-1907-83
			80	5-1908-83
			90	5-1909-83
			100	5-1910-83
			110	5-1911-83
			120	5-1912-83
			130	5-1913-83
			140	5-1914-83
			150	5-1915-83
			160	5-1916-83
25	32.6	24	70	5-2507-83
			80	5-2508-83
			90	5-2509-83
			100	5-2510-83
			110	5-2511-83
			120	5-2512-83
			130	5-2513-83
			140	5-2514-83
			150	5-2515-83
			160	5-2516-83
32	40.6	30	90	5-3209-83
			100	5-3210-83
			110	5-3211-83
			120	5-3212-83
			130	5-3213-83
			140	5-3214-83
			150	5-3215-83
			160	5-3216-83
			170	5-3217-83
			180	5-3218-83
40	50.8	37	100	5-4010-83
			110	5-4011-83
			120	5-4012-83
			130	5-4013-83
			140	5-4014-83
			150	5-4015-83
			160	5-4016-83
			170	5-4017-83
			180	5-4018-83
			200	5-4020-83
220	5-4022-83			
240	5-4024-83			
280	5-4028-83			

O	B	E	Length F	Catalog Number
50	63.8	45	110	5-5011-83
			120	5-5012-83
			130	5-5013-83
			140	5-5014-83
			150	5-5015-83
			160	5-5016-83
			170	5-5017-83
			180	5-5018-83
			200	5-5020-83
			220	5-5022-83
			240	5-5024-83
			260	5-5026-83
			280	5-5028-83
			320	5-5032-83
360	5-5036-83			
400	5-5040-83			
63	76	49	120	5-6312-83
			140	5-6314-83
			160	5-6316-83
			180	5-6318-83
			200	5-6320-83
			220	5-6322-83
			240	5-6324-83
			280	5-6328-83
			320	5-6332-83
			360	5-6336-83
80	93	60	180	5-8018-83
			200	5-8020-83
			220	5-8022-83
			240	5-8024-83
			280	5-8028-83
			320	5-8032-83
			360	5-8036-83
			400	5-8040-83

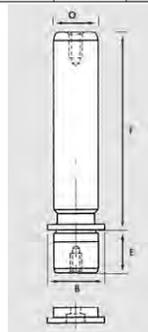
### Ball Bearing Cage Selection Guide



Type I

Nominal Pillar Diameter D mm	Type I		Catalog Number
	C mm	S mm	
25	36	11.5	6-2503-81
	48	17.5	6-2504-81
32	36	11.5	6-3203-81
	48	17.5	6-3204-81
40	48	17.5	6-4004-81
	50	23.5	6-4006-81
50	70	28.5	6-5007-81
	84	35.5	6-5008-81
63	98	42.5	6-6309-81
80	98	42.5	6-8009-81

Nominal Pillar Diameter D mm	C mm	Type II		Catalog Number
		S mm	X mm	
25	55	31	4.2	6-2505-82
	70	40		6-2507-82
	90	47		6-2509-82
	100	55		6-2510-82
	110	65		6-2511-82
32	70	40	4.2	6-3207-82
	90	47		6-3209-82
	105	55		6-3210-82
	115	65		6-3211-82
	125	75		6-3212-82
40	135	85	5.8	6-3213-82
	70	40		6-4007-82
	85	48		6-4008-82
	105	55		6-4010-82
	115	65		6-4011-82
50	125	75	7.0	6-4012-82
	135	85		6-4013-82
	145	98		6-4014-82
	155	107		6-4015-82
	105	58		6-5010-82
63	120	65	7.0	6-5012-82
	140	75		6-5014-82
	150	85		6-5015-82
	160	95		6-5016-82
	170	108		6-5017-82
80	185	121	8.5	6-5018-82
	195	133		6-5019-82
	145	76		6-6314-82
	165	86		6-6316-82
	180	96		6-6318-82
63	190	107	7.0	6-6319-82
	205	121		6-6320-82
	215	132		6-6321-82
	145	76		6-8014-82
	165	86		6-8016-82
80	180	96	8.5	6-8018-82
	190	107		6-8019-82
	205	121		6-8020-82
	215	132		6-8021-82



Type II

### Washer Assemblies

Pin Diameter mm	Ball Cage		Screw Size
	Type I	Type II	
25	6-2500-81	6-2500-82	M6
32	6-3200-81	6-3200-82	M6
40	6-4000-81	6-4000-82	M10
50	6-5000-81	6-5000-82	M10
63	6-6300-81	6-6300-82	M10
80	6-8000-81	6-8000-82	M10

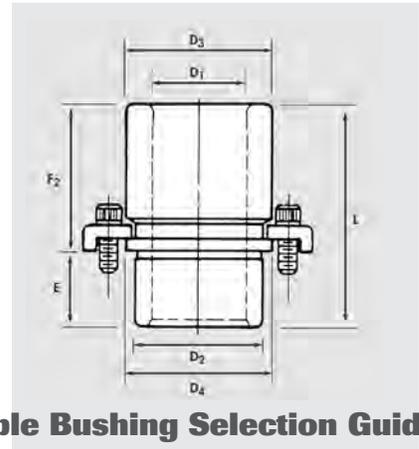
Washer  
Assemblies sold  
separately for  
ball bearing  
applications.



### Straight Sleeve Bushing Selection Guide



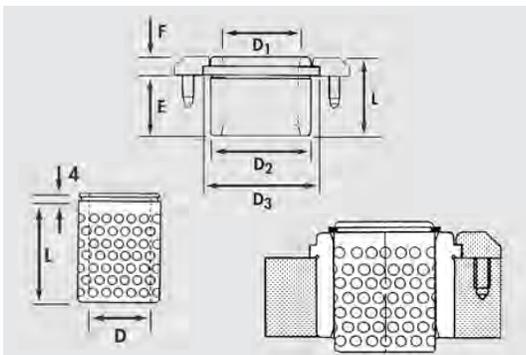
Nominal Pillar Diameter mm	I. D.		O. D.		Length L mm	Catalog Number
	A mm	B mm	B mm	B mm		
25	33	45	65	65	65	6-2506-86
			80	80	80	6-2508-86
			95	95	95	6-2509-86
			110	110	110	6-2511-86
			130	130	130	6-2513-86
32	40	54	80	80	80	6-3208-86
			95	95	95	6-3209-86
			110	110	110	6-3211-86
			130	130	130	6-3213-86
			150	150	150	6-3215-86
			170	170	170	6-3217-86
40	48	65	80	80	80	6-4008-86
			95	95	95	6-4009-86
			110	110	110	6-4011-86
			130	130	130	6-4013-86
			150	150	150	6-4015-86
			170	170	170	6-4017-86
			190	190	190	6-4019-86
			215	215	215	6-4021-86
			265	265	265	6-4026-86
50	62	81	110	110	110	6-5011-86
			130	130	130	6-5013-86
			150	150	150	6-5015-86
			170	170	170	6-5017-86
			190	190	190	6-5019-86
			215	215	215	6-5021-86
			240	240	240	6-5024-86
265	265	265	6-5026-86			
63	75	95	150	150	150	6-6315-86
			170	170	170	6-6317-86
			190	190	190	6-6319-86
			215	215	215	6-6321-86
			240	240	240	6-6324-86
			265	265	265	6-6326-86
80	92	112	150	150	150	6-8015-86
			170	170	170	6-8017-86
			190	190	190	6-8019-86
			215	215	215	6-8021-86
			240	240	240	6-8024-86
265	265	265	6-8026-86			



### Demountable Bushing Selection Guide

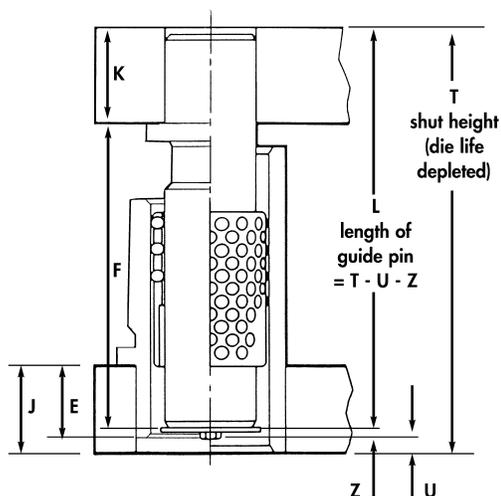
Nominal Post Diameter D	D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	D <sub>4</sub> mm	E mm	F <sub>2</sub> mm	L mm	Catalog Number
25	33	45	50	54	30	35	65	6-2503-85
						50	80	6-2505-85
						65	95	6-2506-85
32	40	54	59	63	30	50	80	6-3205-85
						65	95	6-3206-85
						80	110	6-3208-85
40	48	65	73	75	30	50	80	6-4005-85
						65	95	6-4006-85
						80	110	6-4008-85
						100	130	6-4010-85
						100	130	6-4010-85
50	62	81	91	91	50	60	110	6-5006-85
						80	130	6-5008-85
						100	150	6-5010-85
						120	170	6-5012-85
63	75	95	105	105	50	100	150	6-6310-85
						120	170	6-6312-85
						140	190	6-6314-85
						140	190	6-6314-85

### Stripper Plate Bushing and Cage Selection Guide



D mm	D <sub>1</sub> mm	D <sub>2</sub> mm	D <sub>3</sub> mm	E mm	F mm	L mm	Evoking Catalog Number	L mm	Cage Catalog Number
25	33	45	51	20	10	30	6-2520-87	40	6-2504-83
				25	10	35	6-2525-87	52	6-2505-83
32	40	54	60	20	10	30	6-3220-87	40	6-3204-83
				25	10	35	6-3225-87	52	6-3205-83
				32	10	42	6-3232-87		
40	48	65	75	29	10	39	6-4029-87	52	6-4005-83
				36	10	46	6-4036-87	64	6-4006-83
				44	10	54	6-4044-87		
50	62	81	91	36	10	46	6-5036-87	74	6-5007-83
				44	10	54	6-5044-87	88	6-5008-83
63	75	95	105	50	10	60	6-6350-87	98	6-6309-83

# Selecting Components



## Guide Pins

1. Calculate **L** using one of the following formulas:

$$L = T - (U + Z) \text{ for assembly with sleeve bushings}$$

$$L = T - (U + Z) - J + E \text{ for demountable bushings}$$

2. For straight pins, select a length equal to **L**. If **L** is not a standard length, choose a longer pin and cut to **L**, or choose a shorter length and recess the pin in the punch holder to **L**, making sure that the minimum press fit length is at least equal to the pin diameter.
3. For demountable pins, select a length so that **K + F** is as close as possible to **L** without exceeding it.

### Guide Pin Length Selection

Nominal Guide Pin Diameter O	Type I Cages		Type II Cages		E
	U	Z	U	Z	
25	3	7	3.5	10.5	30
32	3	7	3.5	10.5	30
40	3	9.5	4	13	30
50	3	9.5	4	13	50
63	3	9.5	4	13	50
80	3	9.5	4	13	--

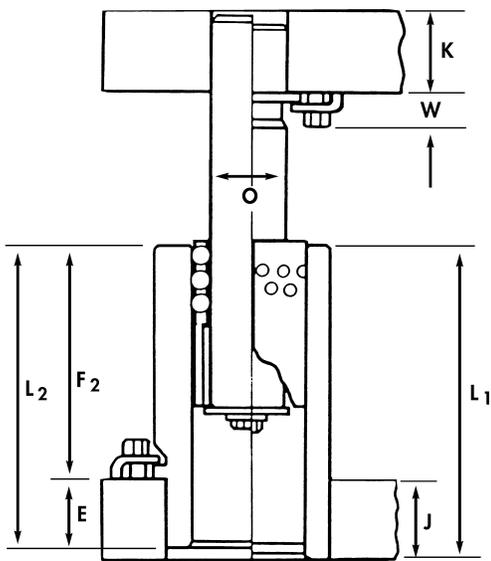
## Bushings

1. If the tool's working stroke is short and there are no off-center loads, choose the shortest bushing. Find the stroke in the selection chart and read down that column until it intersects the color bar. The bushing you need is listed on that line.
2. If rigidity and resistance to side load are required, choose the longest bushing. Check that the top of the bushing will not hit the underside of the punch holder (or clamping screw in the case of demountable pins) at minimum shut height.

CAUTION: Make sure the top of the bushing does not strike the punch holder or the demountable pin clamp screw, either when the die is new or die life is depleted. If it does, select the next shorter bushing.

## Cages

1. For Type I cages, choose the length whose color code in the adjacent selection chart matches that of the bushing you have selected.
2. For Type II cages, the selection chart on page 39 automatically gives you the correct cage. It is listed on the same line as the bushing you have selected.



# Type I Cages

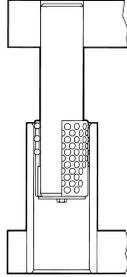
Nominal Pin Diameter O	Demountable Bushing			Straight Sleeve L <sub>1</sub>	Ball Cage C	Stroke "S" at maximum shut height (new dies)								Die Life X		
	F <sub>2</sub>	E	L <sub>2</sub>			20	40	60	80	100	120	140	160			
25	35	30	65	65	36											10
	50	30	80	80												
	65	30	95	95												
				110												
				130		48										
32	50	30	80	80	36										10	
	65	30	95	95												
	80	30	110	110												
				130												
				150		48										
40	50	30	80	80	48										10	
	65	30	95	95												
	80	30	110	110												
	100	30	130	130												
				150												
				170												
50	50	30	80	80	48										10	
	65	30	95	95												
	80	30	110	110												
	100	30	130	130												
				150												
				170												
				190		60										
50	60	50	110	110	70										10	
	80	50	130	130												
	100	50	150	150												
	120	50	170	170												
				190												
				215												
				240		84										
				265												
63	100	50	150	150	98										15	
	120	50	170	170												
	140	50	190	190												
				215												
				240												
80				150	98										15	
				170												
				190												
				215												
				240												

If your selection falls in a white Square, use Type II or Type III.

# Selecting Type II Components

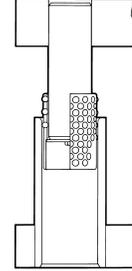
## Type I

Continuous Preload



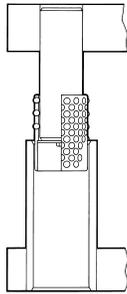
## Type IIa

Preload Partially Relieved



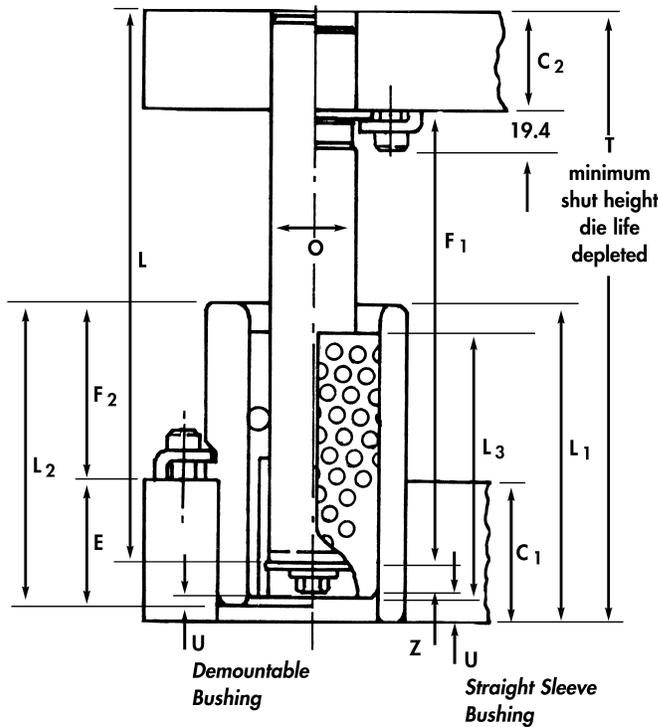
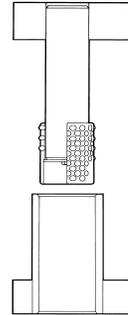
## Type IIb

Preload Relieved



## Type III

Disengaged



**Caution:** Be sure bushing does not strike punch holder (or in the case of demountable pins, the clamps retaining the pins) at minimum shut height. If this condition exists, use a shorter bushing and corresponding ball cage.

# Type II Cages

Nominal Pin Diameter O	Demountable Bushing			Straight Sleeve L <sub>1</sub>	Ball Cage L <sub>3</sub>	Stroke "S" at minimum shut height (die life depleted)																
	F <sub>2</sub>	E	L <sub>2</sub>			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	360
25	35	30	65	65	55																	
	50	30	80	80	70																	
	65	30	95	95	90																	
				110	100																	
				130	110																	
32	50	30	80	80	70																	
	65	30	95	95	90																	
	80	30	110	110	105																	
				130	115																	
				150	125																	
40	50	30	80	80	70																	
	65	30	95	95	85																	
	80	30	110	110	105																	
	100	30	130	130	115																	
				150	125																	
50	60	50	110	110	105																	
	80	50	130	130	120																	
	100	50	150	150	140																	
	120	50	170	170	150																	
				190	160																	
63	100	50	150	150	145																	
	120	50	170	170	165																	
	140	50	190	190	180																	
				215	190																	
				240	205																	
80				150	145																	
				170	165																	
				190	180																	
				215	190																	
				240	205																	
			265	215																		



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