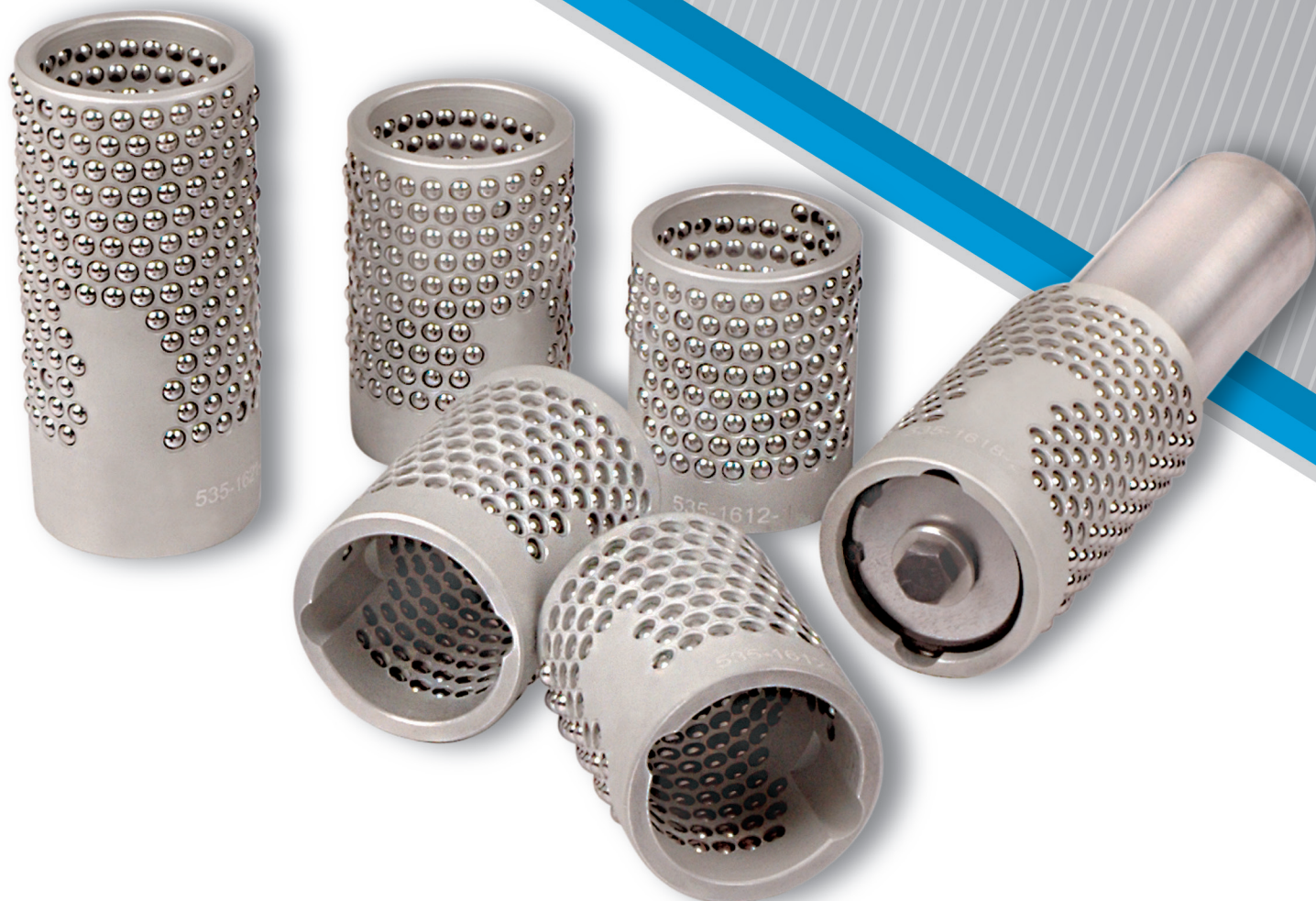




# TYPE D BALL BEARING SYSTEM





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# TABLE OF CONTENTS

## TYPE D BALL BEARING SYSTEM

CONDITION TYPES & DIE SET STYLES		PAGES
CAGE RETENTION TYPES .....		6010
25 D DIE SET .....		6020
35 D DIE SET .....		6030
45 D DIE SET .....		6040
50 D DIE SET .....		6050
75 D DIE SET .....		6060

BALL BEARING DIE SETS		PAGES
TYPE D - CHART .....		6070
TYPE D - FORMULAS .....		6080
TYPE D CAGE SELECTION CHART - CONDITION 1 .....		6090
TYPE D CAGE SELECTION CHART - CONDITION 2 & 3 .....		6100
MAXICAGE SYSTEM - CHART .....		6110
MAXICAGE SYSTEM - FORMULAS .....		6120

PIN AND BUSHING CLAMP LOCATIONS		PAGES
PIN AND BUSHING CLAMP LOCATIONS .....		6130
LOCATIONS CHART - INCH .....		6140

TYPE D COMPONENTS		PAGES
<b>531</b>	BB PF STRAIGHT GUIDE PINS (TYPE D) .....	6150-6160
<b>531M</b>	BB PF STRAIGHT GUIDE PINS (MAXICAGE) .....	6170-6180
<b>532</b>	BB DENT GUIDE PINS (TYPE D) .....	6190-6200
<b>532M</b>	BB DENT GUIDE PINS (MAXICAGE) .....	6210-6220
<b>535</b>	BB CAGES (TYPE D) .....	6230
<b>536</b>	BB DENT SHOULDER BUSHINGS .....	6240
<b>537</b>	BB PF SLEEVE BUSHINGS .....	6250
<b>530-53R</b>	BB WASHER ASSEMBLY KIT .....	6260

OTHER		PAGES
TOLERANCES .....		6270
GLOSSARY OF TERMS .....		6280

## TYPE D BALL CAGE RETENTION METHODS

Superior Die Set offers several ball cage retention methods with our Type D ball bearing system.

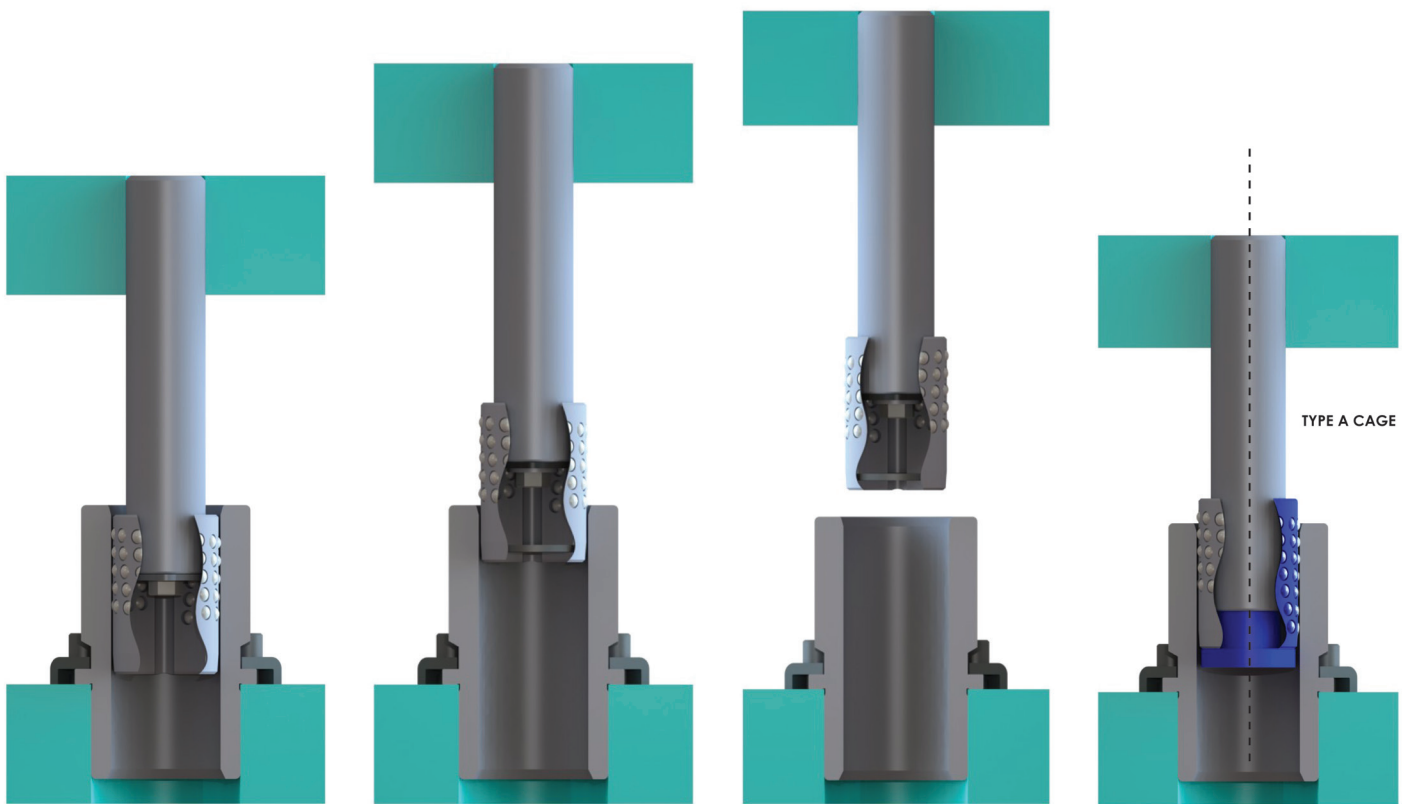
The **Condition 1** method is for dies that maintain constant pin-bushing-ball engagement even at the maximum die open height.

Both Condition 2 & 3 methods allow the cage to rotate freely around the pin while not under pre-load.

The **Condition 2** method is for dies designed so the ball cage never leaves the bushing, but allows the pin to disengage the bushing at the beginning of each stroke.

The **Condition 3** method is for dies that disengage the ball cage completely from the bushing.

Also available, is our original **Maxi-Cage** End Cap to retain the ball cage on the pin. This method maximizes ball bearing engagement by utilizing cages with full coverage of ball bearings unlike most Type D cages. Substitute our Type A cages (see page 5150) when Type D cages lack ball bearing coverage. The Maxi-Cage system increases the maximum stroke offered by our Type D system, too, along with allowing the cage to rotate freely around the pin while not under pre-load.

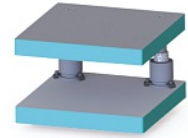


**Condition 1**

**Condition 2**

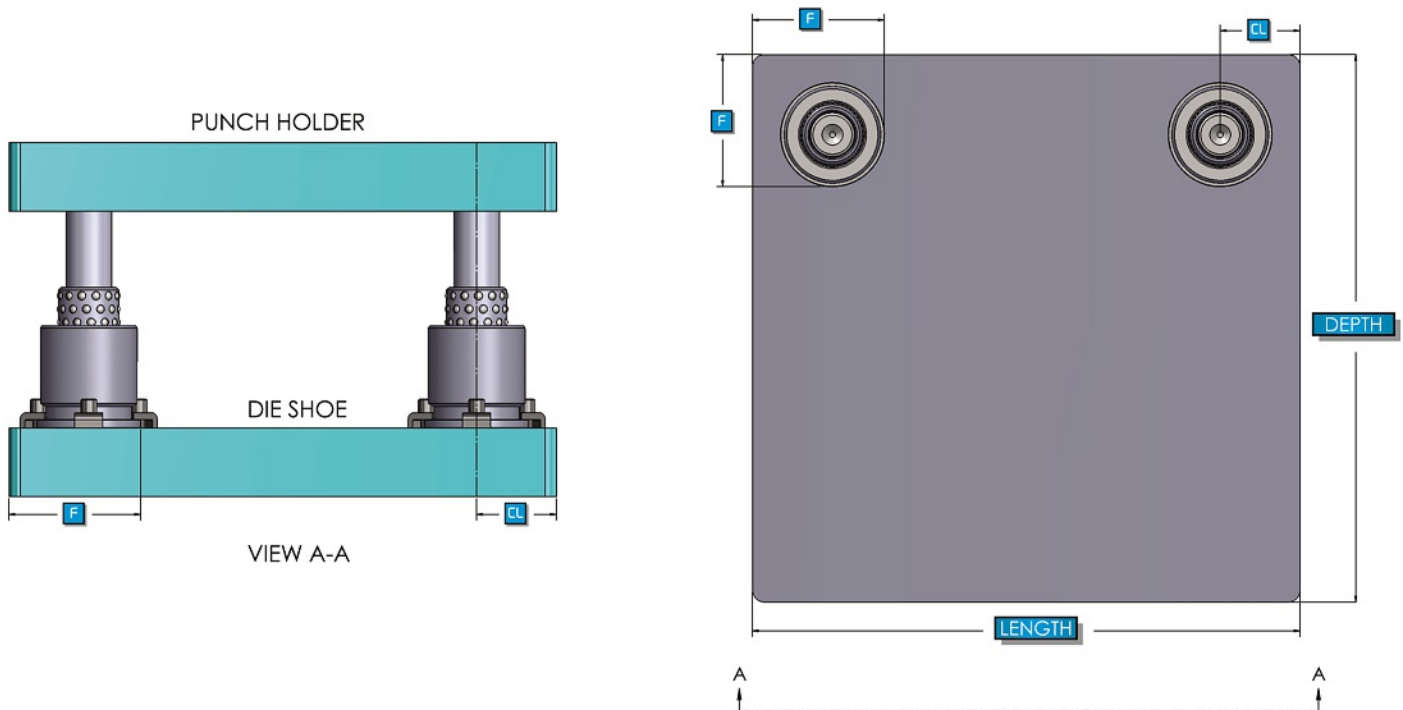
**Condition 3**

**MaxiCage**  
(TYPE A CAGES OPTIONAL)



# STYLE 25 D DIE SET

Superior Style 25 D Two-Pin Rectangular Die Sets have guide pins located to the rear, an ideal design for progressive dies. With stock flow from one side in front of the pins, this style affords maximum work area. Left to Right feed (System LR) bushing clamp locations are standard.

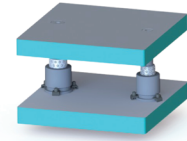


**WHEN ORDERING PLEASE SPECIFY:**

1. Style 25 D, Ball Bearing
2. Quantity
3. Punch Holder (PH)  
Thickness Depth Length
4. Die Shoe (DS)  
Thickness Depth Length
5. Pin Type, Size or Min. Shut Height
6. Bushing Type
9. Cage Retention Method,  
See page 6010.
8. Shank Type and Size (if required)
9. For Ball Bearing Die Set Information,  
See page 6070.

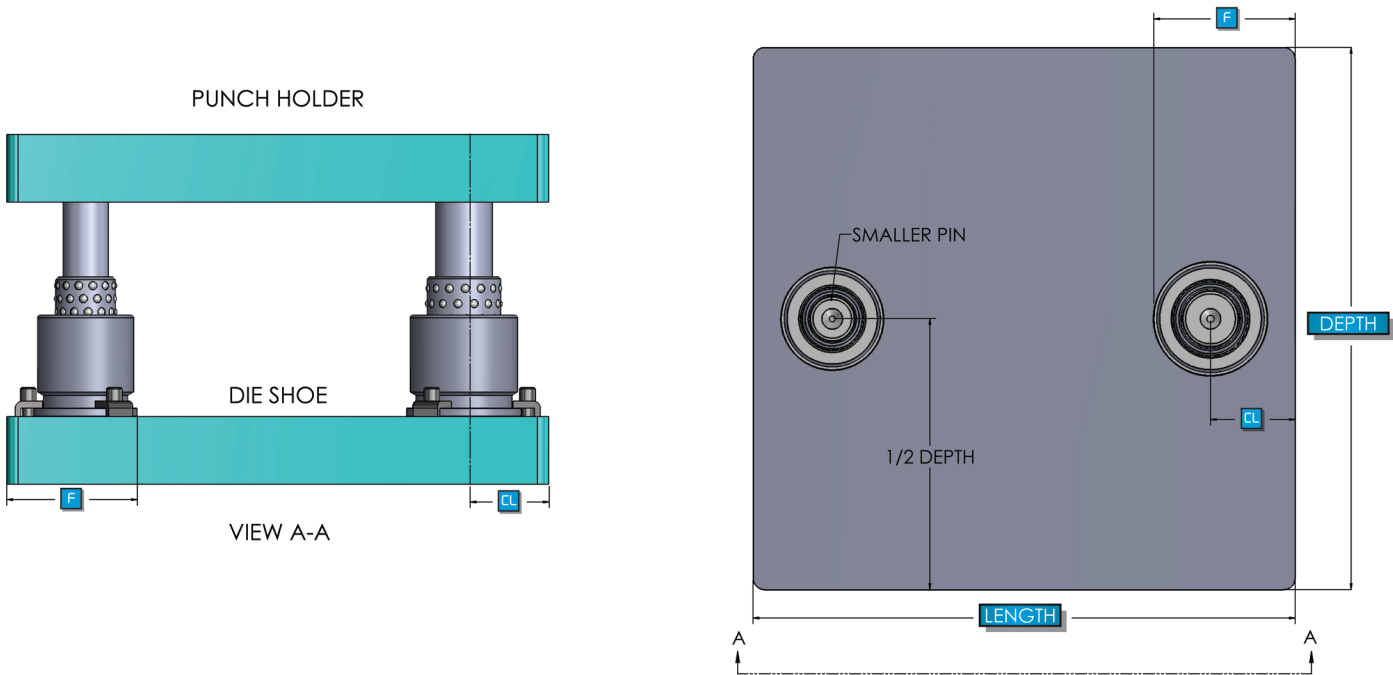
STANDARD PIN LOCATIONS - BALL BEARING							
PIN DIAMETER	1	1¼	1½	1¾	2	2½	3
STRAIGHT SLEEVE (F)	2.688	2.938	3.375	3.625	4.125	4.750	5.375
DEMOUNT. BUSHING (F)	2.892	3.142	3.642	3.892	4.392	5.017	5.704
CL	1.750	1.875	2.125	2.250	2.500	2.875	3.250

**NOTE:** See note on page 6070.



# STYLE 35 D DIE SET

Superior Style 35 D Two-Pin Rectangular Die Sets have guide pins located to the centerline of the depth dimensions. Style 35 D Die Sets are furnished with guide pins of differing diameters to prevent reversing of the plates during assembly. Front to Back feed (System FB) bushing clamp locations are standard.

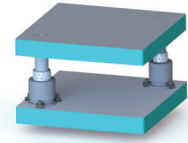


**WHEN ORDERING PLEASE SPECIFY:**

1. Style 35 D, Ball Bearing
2. Quantity
3. Punch Holder (PH)
  - Thickness
  - Depth
  - Length
4. Die Shoe (DS)
  - Thickness
  - Depth
  - Length
5. Pin Type, Size or Min. Shut Height
6. Bushing Type
9. Cage Retention Method, See page 6010.
8. Shank Type and Size (if required)
9. For Ball Bearing Die Set Information, See page 6070.

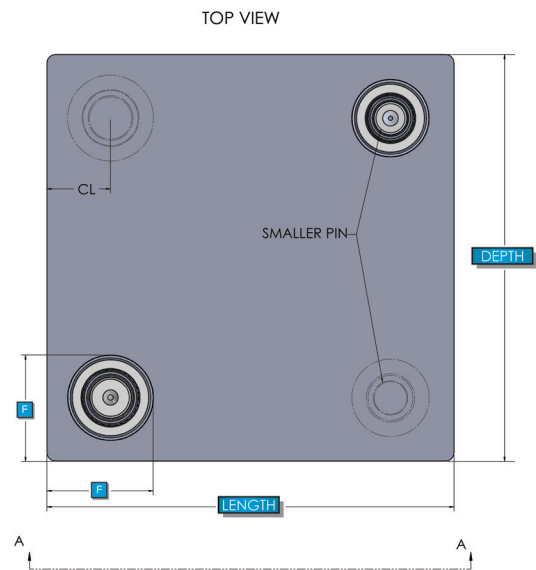
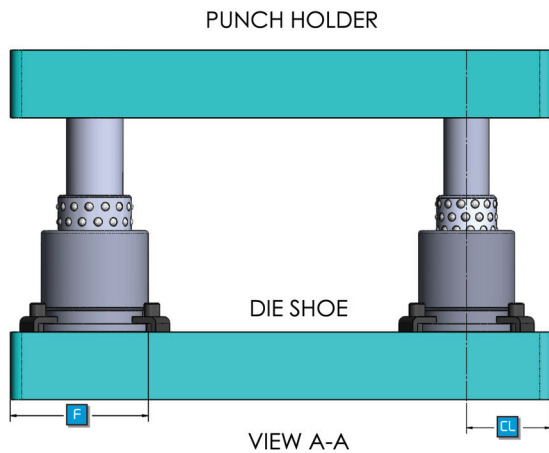
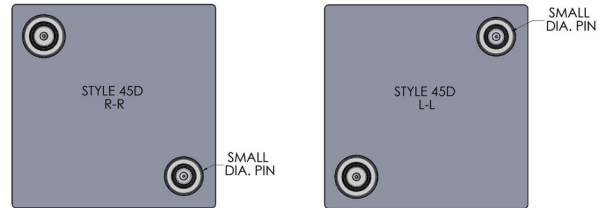
STANDARD PIN LOCATIONS - BALL BEARING							
PIN DIAMETER	1	1¼	1½	1¾	2	2½	3
STRAIGHT SLEEVE (F)	2.688	2.938	3.375	3.625	4.125	4.750	5.375
DEMOUNT. BUSHING (F)	2.892	3.142	3.642	3.892	4.392	5.017	5.704
CL	1.750	1.875	2.125	2.250	2.500	2.875	3.250

**NOTE:** See note on page 6070.  
If different pin diameters, centerline will vary.



# STYLE 45 D DIE SET

Superior Style 45 D Two-Pin Rectangular Die Sets have guide pins located diagonally opposite at positions "RR" or "LL" (see below). Style 45 D Die Sets are furnished with guide pins of differing diameters to prevent reversing of the plates during assembly. Left to Right feed (System LR) bushing clamp locations is standard.

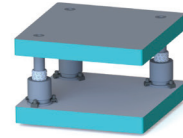


### WHEN ORDERING PLEASE SPECIFY:

1. Style 45 D, Ball Bearing
2. Quantity
3. Punch Holder (PH)
  - Thickness
  - Depth
  - Length
4. Die Shoe (DS)
  - Thickness
  - Depth
  - Length
5. Pin Type, Size or Min. Shut Height
6. Bushing Type
9. Cage Retention Method, See page 6010.
8. Shank Type and Size (if required)
9. For Ball Bearing Die Set Information, See page 6070.

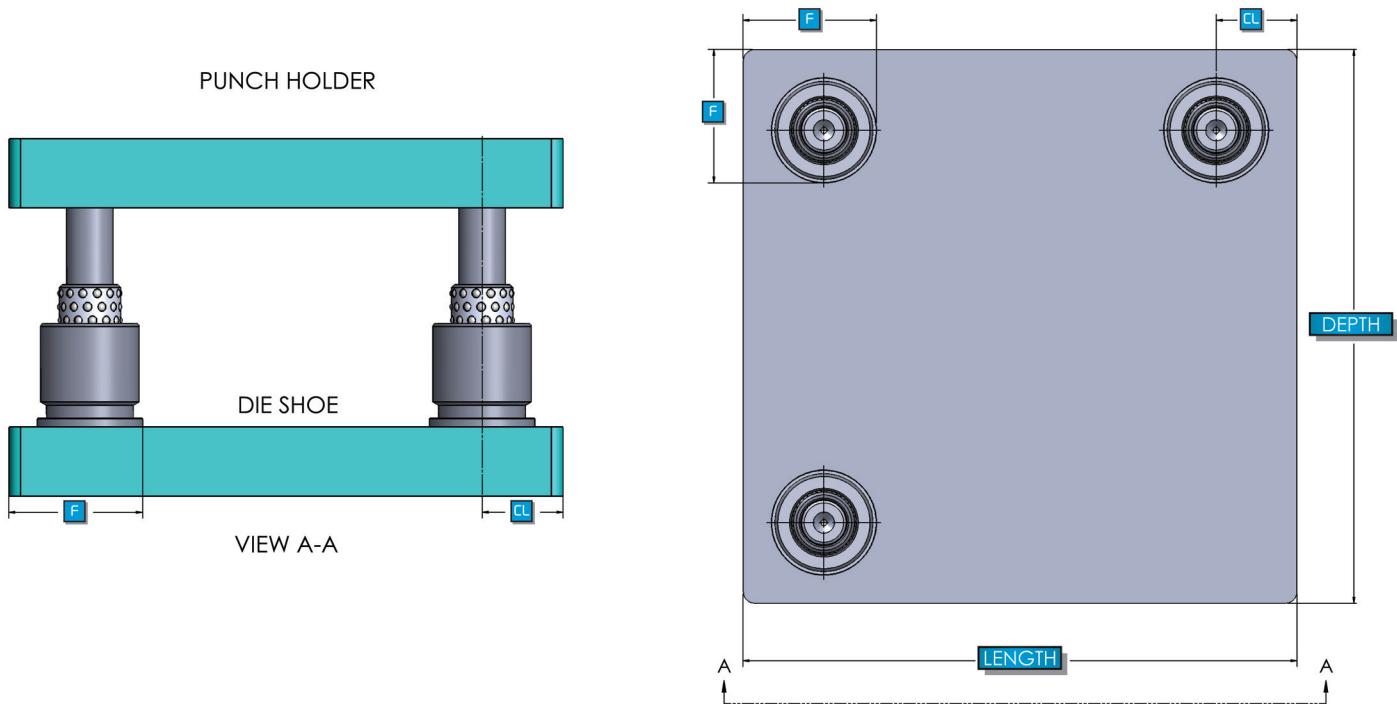
STANDARD PIN LOCATIONS - BALL BEARING							
PIN DIAMETER	1	1¼	1½	1¾	2	2½	3
STRAIGHT SLEEVE (F)	2.688	2.938	3.375	3.625	4.125	4.750	5.375
DEMOUNT. BUSHING (F)	2.892	3.142	3.642	3.892	4.392	5.017	5.704
CL	1.750	1.875	2.125	2.250	2.500	2.875	3.250

**NOTE:** See note on page 6070.  
If different pin diameters, centerline will vary.



# STYLE 50 D DIE SET

Superior Style 50 D Three-Pin Rectangular Die Sets have guide pins located at any three corners. The three-pin layout allows free movement of stock in the corner area wherever the pin is omitted. There is no offset pin on Style 50 D Die Sets. Left to Right feed (System LR) bushing clamp locations is standard.



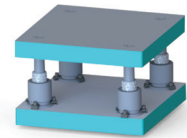
**WHEN ORDERING PLEASE SPECIFY:**

1. Style 50 D, Ball Bearing
2. Quantity
3. Punch Holder (PH)  
Thickness Depth Length
4. Die Shoe (DS)  
Thickness Depth Length
5. Pin Type, Size or Min. Shut Height
6. Bushing Type
9. Cage Retention Method,  
See page 6010.
8. Shank Type and Size (if required)
9. For Ball Bearing Die Set Information,  
See page 6070.
10. Which Pin To Omit (ex. Omit Right Front)

STANDARD PIN LOCATIONS - BALL BEARING							
PIN DIAMETER	1	1¼	1½	1¾	2	2½	3
STRAIGHT SLEEVE (F)	2.688	2.938	3.375	3.625	4.125	4.750	5.375
DEMOUNT. BUSHING (F)	2.892	3.142	3.642	3.892	4.392	5.017	5.704
CL	1.750	1.875	2.125	2.250	2.500	2.875	3.250

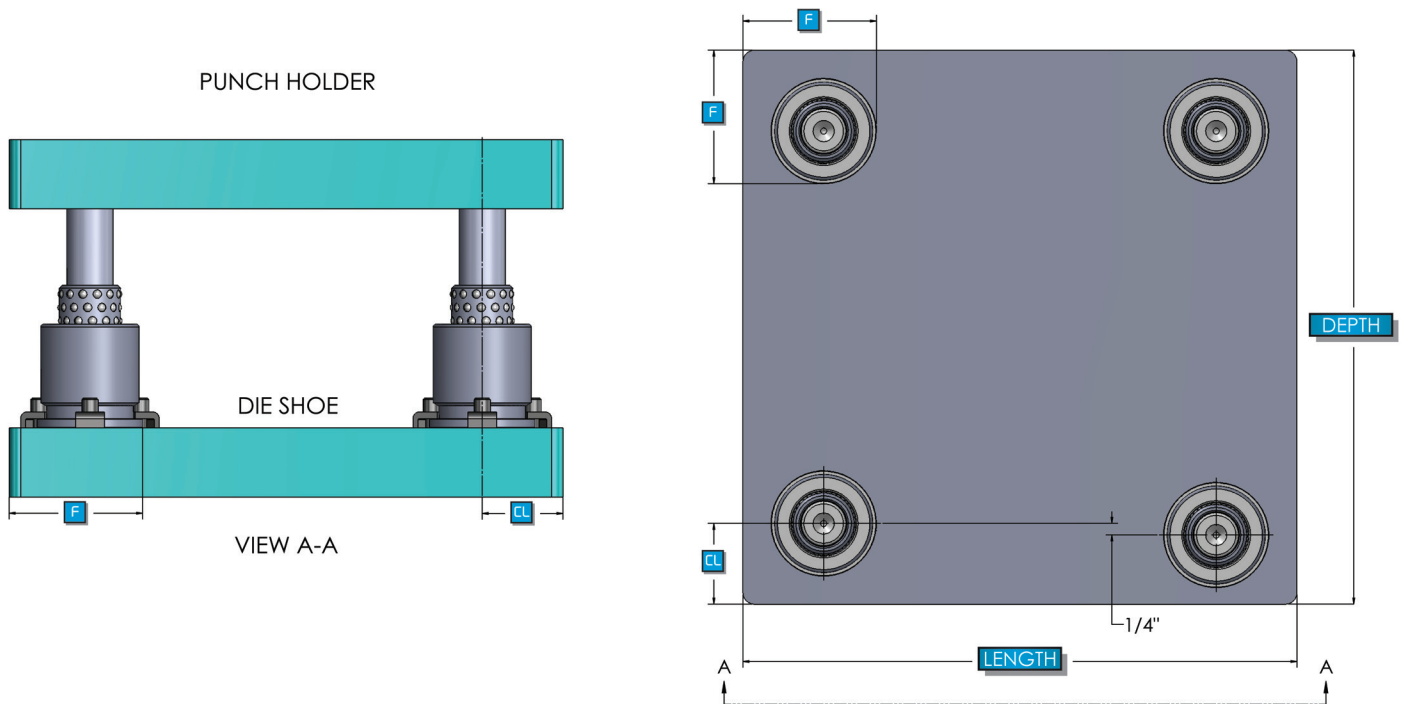
**NOTE:** See note on page 6070.





# STYLE 75 D DIE SET

Superior Style 75 D Four-Pin Rectangular Die Sets are designed to provide maximum resistance to side thrust and misalignment. On Style 75 D Die Sets, the right front pin is offset 1/4" to front to prevent reversing of the plates during assembly. On "Inverted" die sets (pins in die shoe of ball bearing sets), the right rear pin is offset. Left to Right feed (System LR) bushing clamp locations is standard.



### WHEN ORDERING PLEASE SPECIFY:

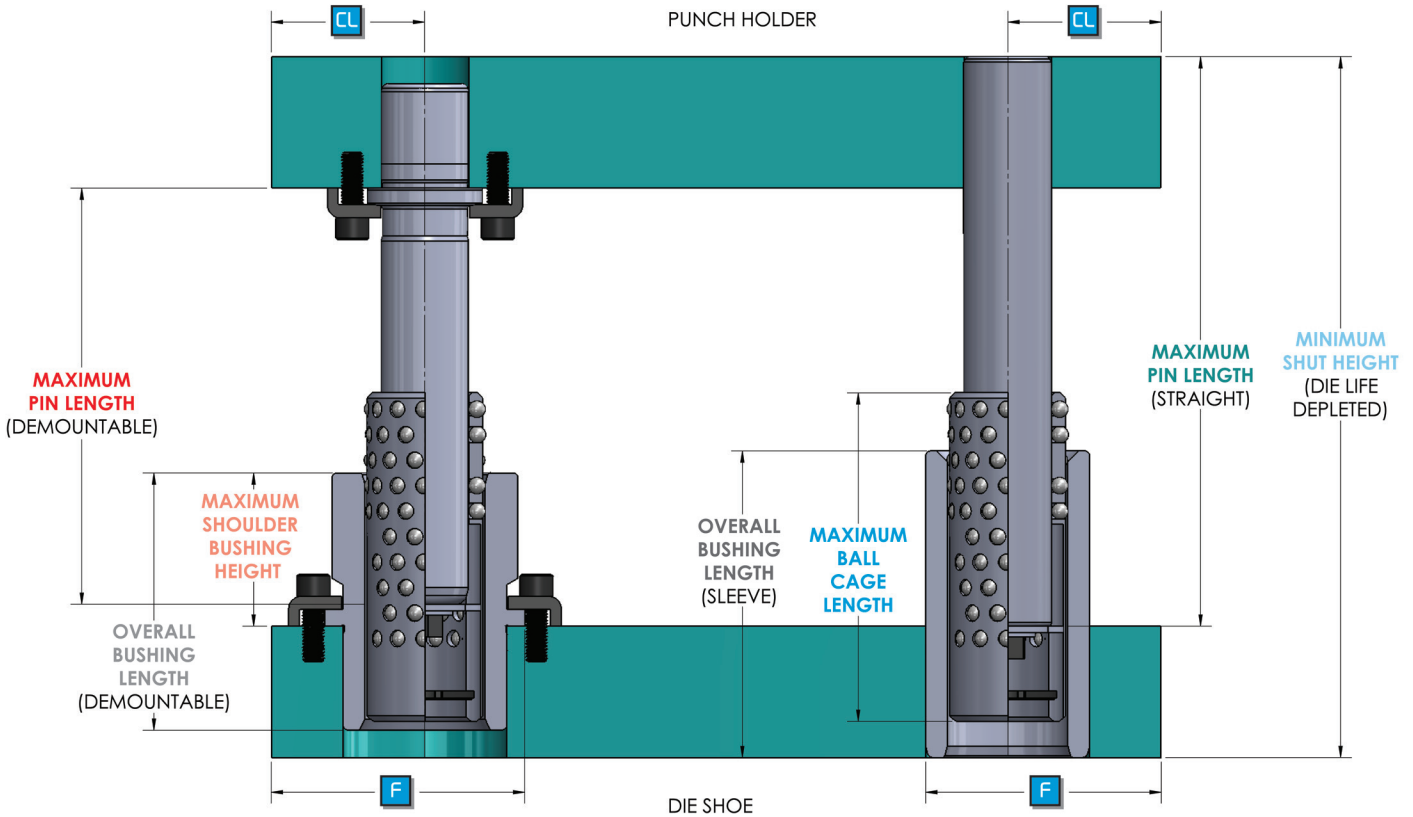
1. Style 75 D, Ball Bearing
2. Quantity
3. Punch Holder (PH)
  - Thickness
  - Depth
  - Length
4. Die Shoe (DS)
  - Thickness
  - Depth
  - Length
5. Pin Type, Size or Min. Shut Height
6. Bushing Type
9. Cage Retention Method, See page 6010.
8. Shank Type and Size (if required)
9. For Ball Bearing Die Set Information, See page 6070.

STANDARD PIN LOCATIONS - BALL BEARING							
PIN DIAMETER	1	1¼	1½	1¾	2	2½	3
STRAIGHT SLEEVE (F)	2.688	2.938	3.375	3.625	4.125	4.750	5.375
DEMOUNT. BUSHING (F)	2.892	3.142	3.642	3.892	4.392	5.017	5.704
CL	1.750	1.875	2.125	2.250	2.500	2.875	3.250

**NOTE:** See note on page 6070.

## BALL BEARING DIE SETS - TYPE D

Superior Type D Ball Bearing Die Sets are manufactured with multiple cage retention methods (See page 6010). These components are used instead of friction guide pins and bushings and contribute to longer die life. Ideal applications for Ball Bearing Die Sets are those which require high press speeds and easier assembly/disassembly of the die set.



STANDARD PIN LOCATIONS - BALL BEARING							
PIN DIAMETER	1	1¼	1½	1¾	2	2½	3
STRAIGHT SLEEVE (F)	2.688	2.938	3.375	3.625	4.125	4.750	5.375
DEMOUNT. BUSHING (F)	2.892	3.142	3.642	3.892	4.392	5.017	5.704
CL	1.750	1.875	2.125	2.250	2.500	2.875	3.250

NOTE: F Dimension for –

**Straight Sleeve Bushings** - refer to distance from edge of die shoe to the inside edge of the bushing.

**Demountable Bushings** - refer to distance from edge of die shoe to inside edge of bushing flange.

## BALL BEARING DIE SETS - TYPE D

Dia.	Z (Type 1)	Z (Type 2 & 3)
1	5/16	15/32
1 1/4	5/16	15/32
1 1/2	3/8	1/2
1 3/4	3/8	1/2
2	3/8	1/2
2 1/2	1/2	9/16
3	1/2	9/16

### MAXIMUM PIN LENGTH



- Straight Guide Pin

$$\text{MAXIMUM PIN LENGTH} = \text{MINIMUM SHUT HEIGHT} - Z - \frac{1}{4}"$$



- Dem't Guide Pin

$$\text{MAXIMUM PIN LENGTH} = \text{MINIMUM SHUT HEIGHT} - \text{PUNCH HOLDER THICKNESS} - Z - \frac{1}{4}"$$

**NOTE:** Select nearest shorter stocked pin length

### MAXIMUM SHOULDER BUSHING HEIGHT



- Straight Guide Pin

$$\text{MAXIMUM BUSHING HEIGHT} = \text{MINIMUM SHUT HEIGHT} - \left( \text{PUNCH HOLDER THICKNESS} + \text{DIE SHOE THICKNESS} \right) - \frac{1}{4}"$$

- Dem't Guide Pin

$$\text{MAXIMUM BUSHING HEIGHT} = \text{MINIMUM SHUT HEIGHT} - \left( \text{PUNCH HOLDER THICKNESS} + \text{DIE SHOE THICKNESS} \right) - 1"$$

**NOTE:** Select nearest shorter stocked shoulder height

### MAXIMUM STRAIGHT SLEEVE BUSHING LENGTH



- Straight Guide Pin

$$\text{MAXIMUM SLEEVE BUSHING LENGTH} = \text{MINIMUM SHUT HEIGHT} - \text{PUNCH HOLDER THICKNESS} - \frac{1}{4}"$$

- Dem't Guide Pin

$$\text{MAXIMUM SLEEVE BUSHING LENGTH} = \text{MINIMUM SHUT HEIGHT} - \text{PUNCH HOLDER THICKNESS} - 1"$$

**NOTE:** Select nearest shorter stocked bushing length

### MAXIMUM BALL CAGE LENGTH



- 1) Calculate bushing part number, as described above
- 2) Calculate stroke of die
- 3) Locate bushing part number on tables from selected pages: Condition 1 (page 6090), Condition 2 & 3 (page 6100)
- 4) Choose respective cage part number.  
Apply maximum stroke length for Condition 1 only



## BALL BEARING DIE SETS - TYPE D

TYPE D BALL CAGE SELECTION CHART - CONDITION 1

Dia.	Bushing Part Number		Maximum Stroke	Cage Part Number	Maximum Stroke	Cage Part Number
	Demountable	Straight				
1"	536-0813	537-0812	0.75 1.25 1.75 2.25	535-0808-1	0.75 1.25 1.75 2.25 2.75	535-0806-1
	536-0821	537-0814				
	536-0823	537-0816				
		537-0818				
		537-0820				
1 1/4"	536-1013	537-1012	0.75 1.25 1.75 2.25 3.25	535-1008-1	0.75 1.25 1.75 2.25 2.75 3.75	535-1006-1
	536-1021	537-1014				
	536-1023	537-1016				
		537-1018				
		537-1020				
1 1/2"		537-1024				
	536-1221	537-1215	1.00 1.50 2.00 2.50 3.50 4.50	535-1210-1	0.75 1.50 2.00 2.50 3.00 4.00 5.00	535-1208-1
	536-1230	537-1218				
	536-1232	537-1220				
		537-1222				
		537-1224				
		537-1228				
	537-1232					
1 3/4"	536-1422	537-1417	1.00 1.50 2.00 3.00 4.00 5.00	535-1412-1	1.00 1.50 2.00 2.50 3.50 4.50 5.50	535-1410-1
	536-1431	537-1420				
		537-1422				
		537-1424				
		537-1428				
		537-1432				
		537-1436				
2"	536-1623	537-1619	0.75 1.50 2.25 3.25 4.25 5.25	535-1614-1	0.75 1.50 2.25 3.00 4.00 5.00 6.00	535-1612-1
	536-1632	537-1622				
	536-1641	537-1625				
	536-1650	537-1628				
		537-1632				
		537-1636				
2 1/2"		537-1640				
	536-2040	537-2024	0.75 1.50 2.25 3.25 4.25 5.25	535-2016-1		
	536-2043	537-2027				
	536-2052	537-2030				
		537-2034				
		537-2038				
	537-2042					
3"	536-2440	537-2424	0.75 1.50 2.25 3.25 4.25 5.25	535-2416-1		
	536-2443	537-2427				
	536-2452	537-2430				
		537-2434				
		537-2438				
	537-2442					

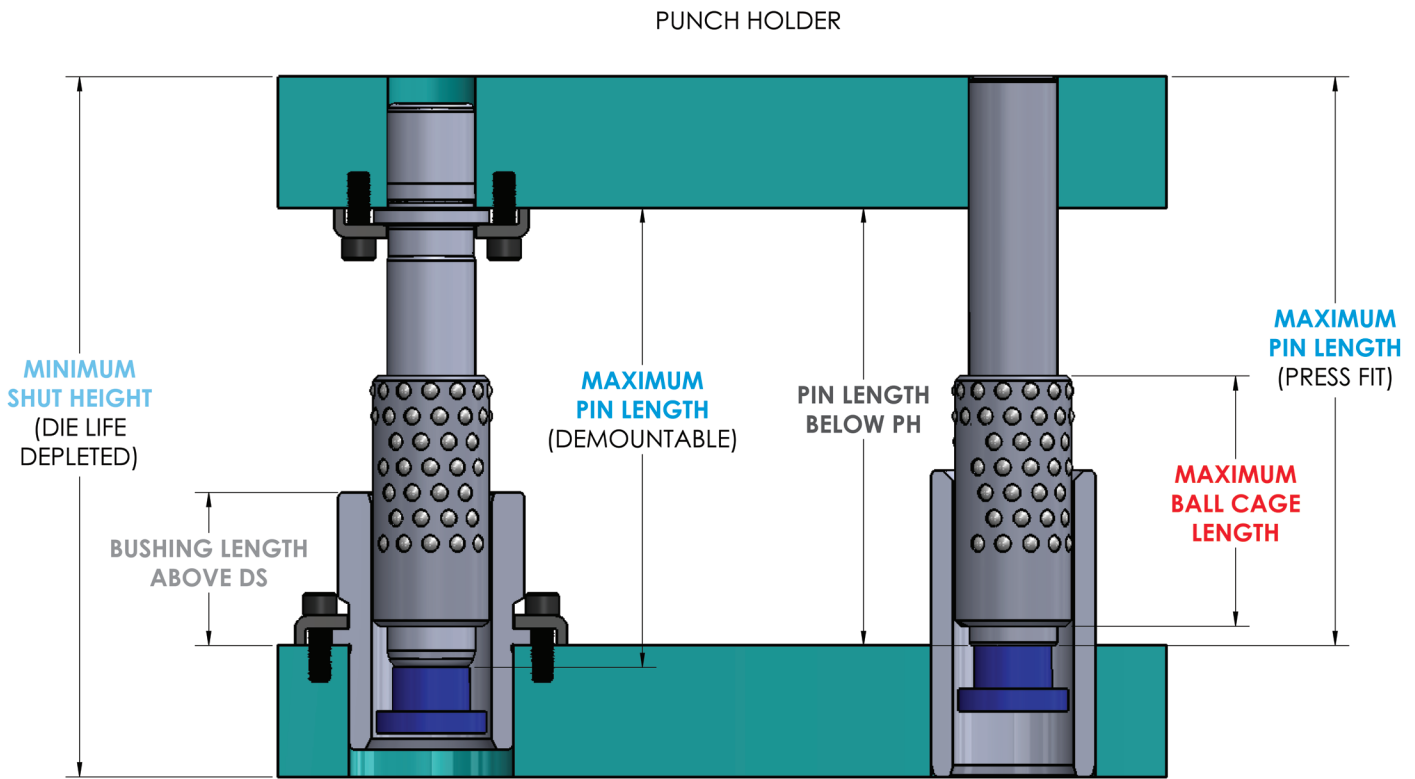


## BALL BEARING DIE SETS - TYPE D

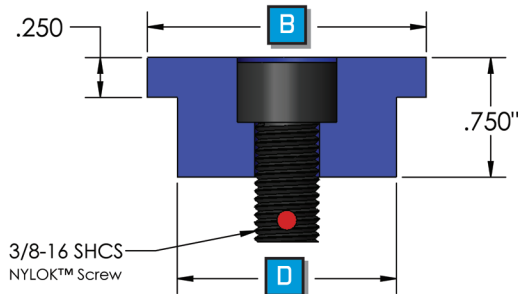
TYPE D BALL CAGE PART NUMBER - CONDITION 2 & 3			
Dia	Bushing Part Number		Cage Part Number
	Demountable	Straight	
1"	536-0811	537-0810	535-0808-2
	536-0813	537-0812	535-0810-2
	536-0821	537-0814	535-0812-2
	536-0823	537-0816	535-0813-2
		537-0818	535-0814-2
		537-0820	535-0815-2
1 1/4"	536-1013	537-1012	535-1011-2
	536-1021	537-1014	535-1013-2
	536-1023	537-1016	535-1015-2
		537-1018	535-1016-2
		537-1020	535-1017-2
		537-1024	535-1019-2
1 1/2"	536-1212	537-1212	535-1211-2
	536-1221	537-1215	535-1214-2
	536-1230	537-1218	535-1217-2
	536-1232	537-1220	535-1218-2
		537-1222	535-1220-2
		537-1224	535-1220-2
		537-1228	535-1222-2
		537-1232	535-1224-2
1 3/4"	536-1413	537-1414	535-1413-2
	536-1422	537-1417	535-1416-2
	536-1431	537-1420	535-1419-2
		537-1422	535-1421-2
		537-1424	535-1421-2
		537-1428	535-1423-2
		537-1432	535-1425-2
		537-1436	535-1427-2
2"	536-1620	537-1616	535-1615-2
	536-1623	537-1619	535-1618-2
	536-1632	537-1622	535-1621-2
	536-1641	537-1625	535-1623-2
	536-1650	537-1628	535-1624-2
		537-1632	535-1626-2
		537-1636	535-1628-2
		537-1640	535-1630-2
2 1/2"	536-2040	537-2024	535-2023-2
	536-2043	537-2027	535-2026-2
	536-2052	537-2030	535-2029-2
		537-2034	535-2031-2
		537-2038	535-2033-2
		537-2042	535-2035-2
3"	536-2440	537-2424	535-2423-2
	536-2443	537-2427	535-2426-2
	536-2452	537-2430	535-2429-2
		537-2434	535-2431-2
		537-2438	535-2433-2
		537-2442	535-2435-2

## BALL BEARING DIE SETS - MAXICAGE

The Superior MaxiCage System is typically used when there is partial or full disengagement of the guide pin and bushing. While under this no-preload condition, the end cap permits the ball cage to rotate freely about the guide pin. Type D or Type A ball cages can be used in this system. The MaxiCage System maximizes Type A Ball Cage surface bearing efficiency - with complete ball coverage throughout the cage.



DIE SHOE



END CAP DIMENSIONS							
PIN DIAMETER	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
PART NO.	334-0804	334-1004	334-1204	334-1404	334-1604	334-2004	334-2404
D	7/8"	1 1/8"	1 3/8"	1 5/8"	1 7/8"	2 3/8"	2 7/8"
B	1 1/4"	1 1/2"	1 3/4"	2"	2 3/8"	2 7/8"	3 3/8"

## BALL BEARING DIE SETS - MAXICAGE

### MAXIMUM BUSHING LENGTH

See Type D Ball Bearing



### MAXIMUM BALL CAGE LENGTH

#### STEP 1.

$$\bullet C = \text{PIN LENGTH BELOW PH} + .375''$$

#### STEP 2.

$$\bullet E = \text{PIN LENGTH BELOW PH} + \text{BUSHING LENGTH ABOVE DS} + \text{PH THICKNESS} + \text{DS THICKNESS} + .500''$$

#### STEP 3.

$$\bullet A = E - \text{MINIMUM SHUT HEIGHT}$$

**NOTE:** Select nearest shorter stocked ball cage length

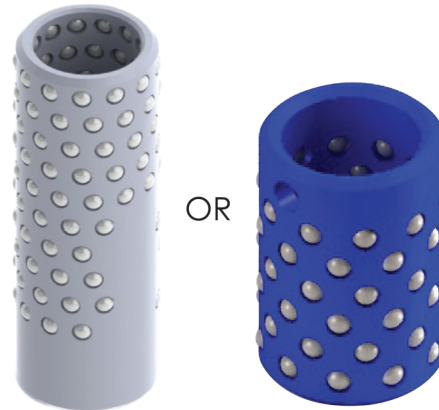
#### STEP 4.

- Straight Guide Pin

$$\text{MAXIMUM BALL CAGE LENGTH} = C - \frac{A}{2}$$

- Dem't Guide Pin

$$\text{MAXIMUM BALL CAGE LENGTH} = \left( C - \frac{A}{2} \right) - .625''$$



OR

### MAXIMUM PIN LENGTH



- Straight Guide Pin

$$\text{MAXIMUM PIN LENGTH} = \text{MINIMUM SHUT HEIGHT} - 1''$$



- Dem't Guide Pin

$$\text{MAXIMUM PIN LENGTH} = \text{MINIMUM SHUT HEIGHT} - (\text{PH} + 1'')$$

**NOTE:** Select nearest shorter stocked pin length

# PIN AND BUSHING CLAMP LOCATIONS

## CLAMP LOCATION SYSTEMS

Three pin and bushing clamp location systems are available for Superior die sets. The LR, FB and R systems allow for various material feeding directions and should be considered when ordering any die set. Special pin and bushing clamp configurations are available as an option.

## CLAMPS

Clamps are available in three styles. See chart for specific die set component application. All slip fit demountable guide pins or bushings are supplied with clamps and screws.

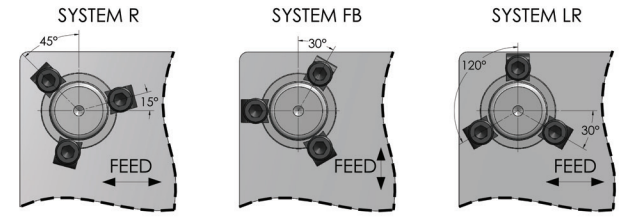
### WHEN ORDERING PLEASE SPECIFY:

1. Clamp Part Number C-DS or C-DL
2. Quantity

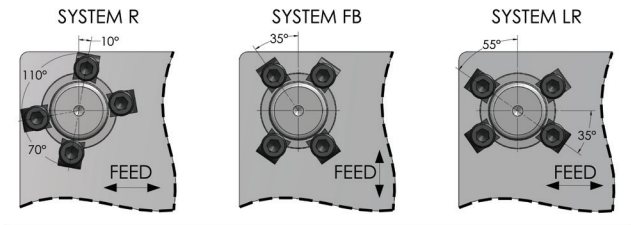
- NOTE:**
1. Pins 1", 1 1/4", 1 1/2" have 3 clamps.
  2. Bushings 1", 1 1/4" have 3 clamps.
  3. All else have 4 clamps.

### PINS

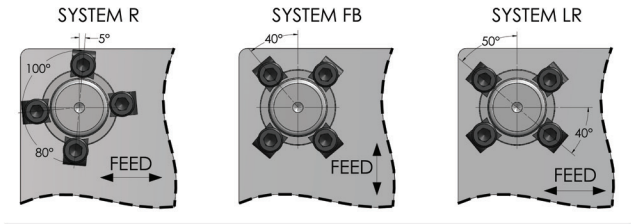
#### 1", 1 1/4", & 1 1/2" NOM. DIA.



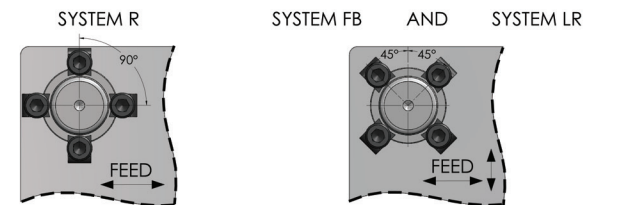
#### 1 3/4" NOM. DIA.



#### 2" NOM. DIA.

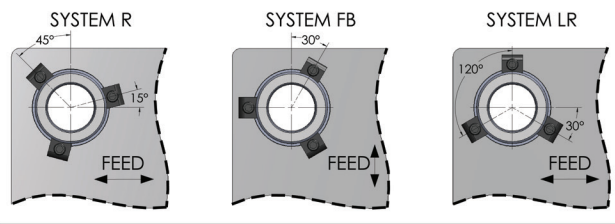


#### 2 1/2" & 3" NOM. DIA.

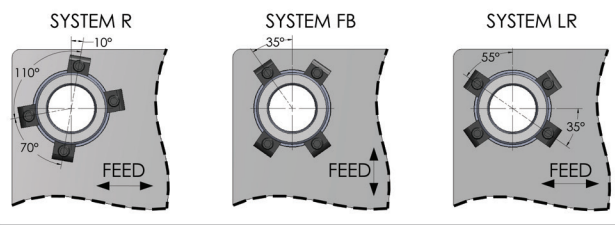


### BUSHINGS

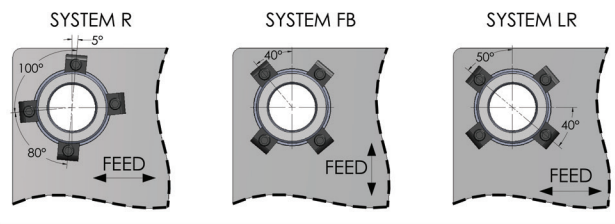
#### 1" & 1 1/4" NOM. DIA.



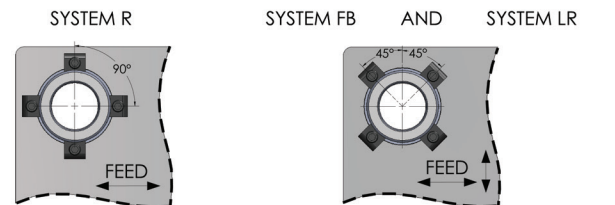
#### 1 1/2" & 1 3/4" NOM. DIA.



#### 2" NOM. DIA.



#### 2 1/2" & 3" NOM. DIA.



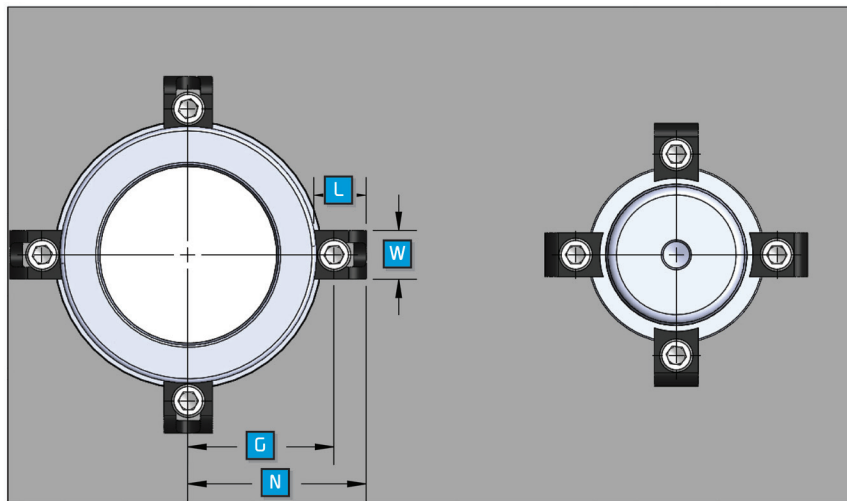


# PIN AND BUSHING CLAMP LOCATIONS

CLAMP DIMENSIONS												
COMPONENT	NOM. DIA. BUSH I.D. PIN O.D.	LOCATION		CLAMP DIMENSIONS SIZE					CLAMP NO.	QTY	SCREW SIZE	BORING SIZE FOR PIN OR BUSHING +.0005/-0000
		G	N	L	W	C	D	H				
BUSHINGS: DEMOUNTABLE BALL BEARING TYPE D	1	1.313	1.698	0.745	0.688	0.188	0.370	0.688	C-S	3	5/16 x 3/4	1.8750
	1 1/4	1.438	1.823	0.745	0.688	0.188	0.370	0.688	C-S	3	5/16 x 3/4	2.1250
	1 1/2	1.688	2.073	0.745	0.688	0.188	0.370	0.688	C-S	4	5/16 x 3/4	2.5000
	1 3/4	1.813	2.198	0.745	0.688	0.188	0.370	0.688	C-S	4	5/16 x 3/4	2.7500
	2	2.063	2.448	0.745	0.688	0.188	0.370	0.688	C-S	4	5/16 x 3/4	3.2500
	2 1/2	2.313	2.698	0.745	0.688	0.188	0.370	0.688	C-S	4	5/16 x 3/4	3.7500
GUIDE PINS: DEMOUNTABLE TYPE D	1	0.813	1.125	0.615	0.685	0.193	0.342	0.594	C-DS	3	1/4 x 3/4	0.9980
	1 1/4	0.984	1.391	0.827	0.685	0.250	0.439	0.752	C-DL	3	5/16 x 3/8	1.2480
	1 1/2	1.125	1.531	0.827	0.685	0.250	0.439	0.752	C-DL	3	5/16 x 3/8	1.4975
	1 3/4	1.297	1.703	0.827	0.685	0.250	0.439	0.752	C-DL	4	5/16 x 3/8	1.7475
	2	1.422	1.828	0.827	0.685	0.250	0.439	0.752	C-DL	4	5/16 x 3/8	1.9975
	2 1/2	1.672	2.078	0.827	0.685	0.250	0.439	0.752	C-DL	4	5/16 x 3/8	2.4970
3	1.922	2.328	0.827	0.685	0.250	0.439	0.752	C-DL	4	5/16 x 3/8	2.9970	

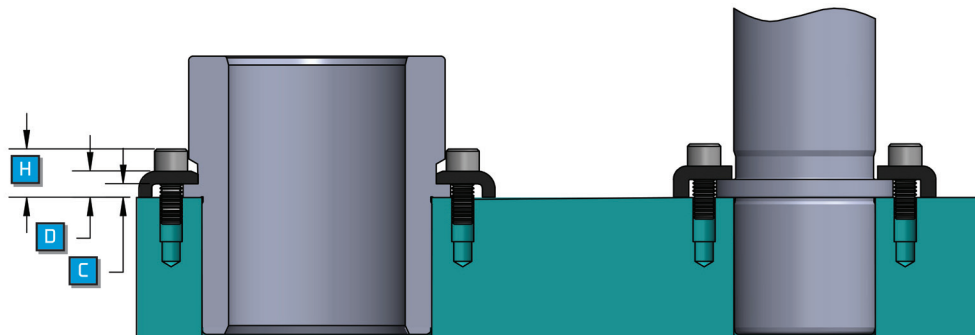
TYPE D BUSHING

TYPE D PIN



BUSHING CLAMP  
PART NO. C-S

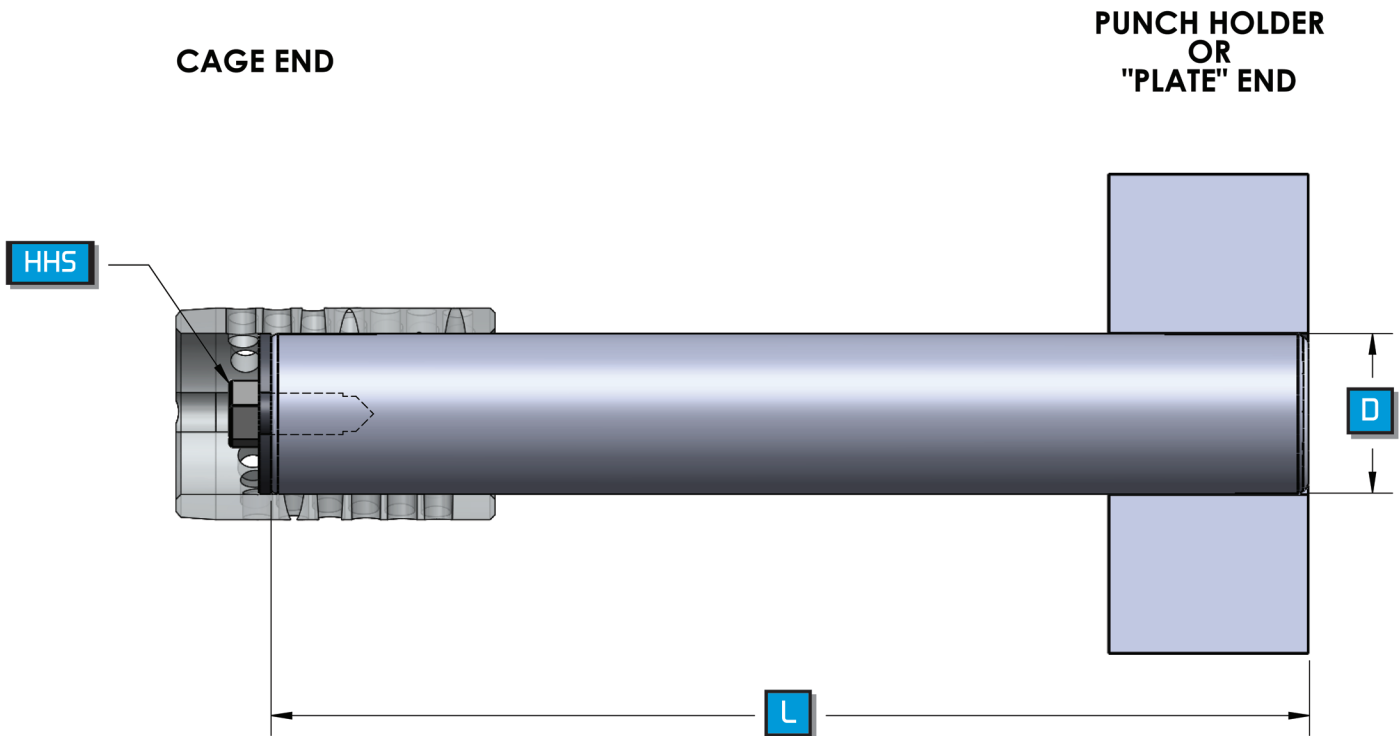
PIN CLAMP  
PART NO. C-DS (1" Dia. only)  
C-DL (1 1/4" Dia. and up)





# BALL BEARING PRESS FIT STRAIGHT GUIDE PINS

## TYPE D



Diameter	HHS
1"	5/16"-18
1 1/4"	5/16"-18
1 1/2"	3/8"-16
1 3/4"	3/8"-16
2"	3/8"-16
2 1/2"	1/2"-13
3"	1/2"-13

**WHEN ORDERING PLEASE SPECIFY:**

1. Part Number
2. Quantity

**Hardened to 60 +/- 2 Rc**



# BALL BEARING PRESS FIT STRAIGHT GUIDE PINS

# TYPE D

BALL BEARING PRESS FIT STRAIGHT GUIDE PINS - TYPE D

L	Dia = 1"	Dia = 1 1/4"	Dia = 1 1/2"	Dia = 1 3/4"	Dia = 2"	Dia = 2 1/2"	Dia = 3"
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
3.250	531-0813						
3.750	531-0815						
4.250	531-0817	531-1017	531-1217				
4.500	531-0818						
4.750	531-0819	531-1019					
5.000	531-0820		531-1220	531-1420			
5.250	531-0821	531-1021					
5.500	531-0822	531-1022					
5.750	531-0823	531-1023	531-1223	531-1423	531-1623		
6.000	531-0824	531-1024	531-1224				
6.500	531-0826	531-1026	531-1226	531-1426	531-1626		
7.000	531-0828	531-1028	531-1228	531-1428			
7.250					531-1629		
7.500	531-0830	531-1030	531-1230	531-1430	531-1630		
7.750					531-1631		
8.000	531-0832	531-1032	531-1232	531-1432	531-1632	531-2032	
8.500	531-0834	531-1034	531-1234	531-1434	531-1634		531-2434
8.750						531-2035	
9.000	531-0836	531-1036	531-1236	531-1436	531-1636		
9.250							531-2437
9.500			531-1238	531-1438	531-1638	531-2038	
10.000		531-1040	531-1240	531-1440	531-1640	531-2040	531-2440
10.500			531-1242	531-1442	531-1642		
11.000		531-1044	531-1244	531-1444	531-1644	531-2044	531-2444
11.500			531-1246	531-1446	531-1646		
12.000		531-1048	531-1248	531-1448	531-1648	531-2048	531-2448
12.500			531-1250	531-1450	531-1650		
13.000			531-1252	531-1452	531-1652	531-2052	531-2452
14.000			531-1256	531-1456	531-1656	531-2056	531-2456
15.000				531-1460	531-1660		
16.000					531-1664		
17.000				531-1468	531-1668	531-2068	531-2468
18.000					531-1672	531-2072	
20.000						531-2080	531-2480

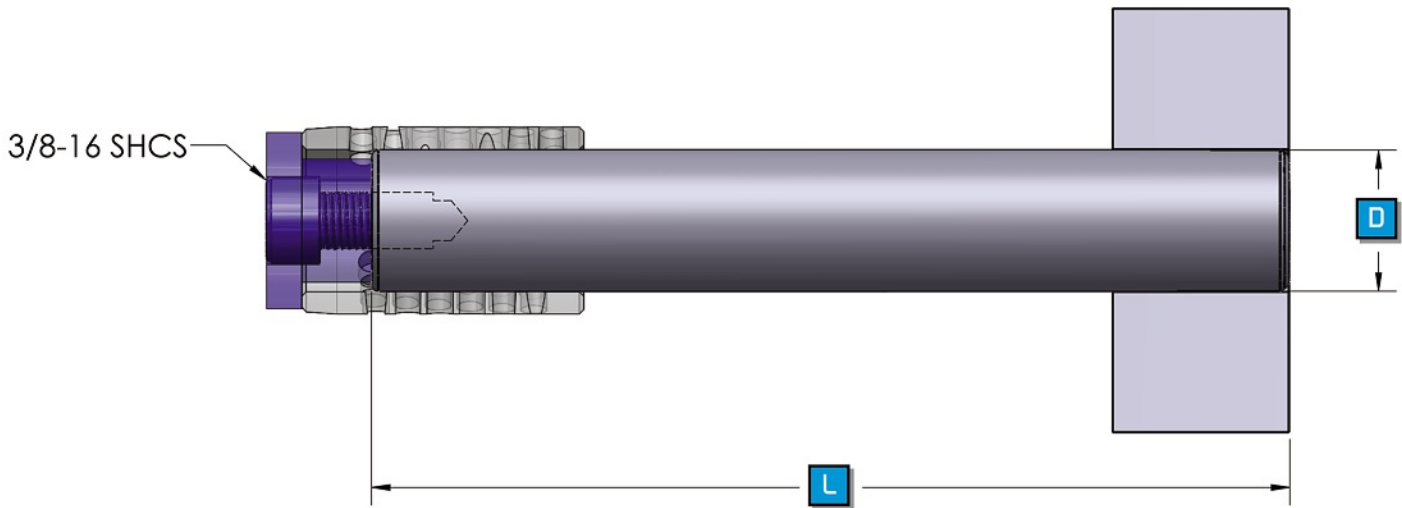


# BALL BEARING PRESS FIT STRAIGHT GUIDE PINS

# MAXICAGE

CAGE END

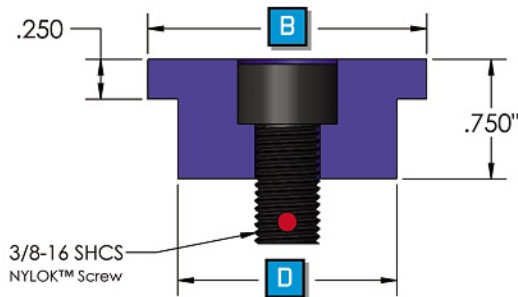
PUNCH HOLDER  
OR  
"PLATE" END



WHEN ORDERING PLEASE SPECIFY:

1. Part Number
2. Quantity

Hardened to 60 +/- 2 Rc



END CAP DIMENSIONS							
PIN DIAMETER	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
PART NO.	334-0804	334-1004	334-1204	334-1404	334-1604	334-2004	334-2404
D	7/8"	1 1/8"	1 3/8"	1 5/8"	1 7/8"	2 3/8"	2 7/8"
B	1 1/4"	1 1/2"	1 3/4"	2"	2 3/8"	2 7/8"	3 3/8"



# BALL BEARING PRESS FIT STRAIGHT GUIDE PINS

# MAXICAGE

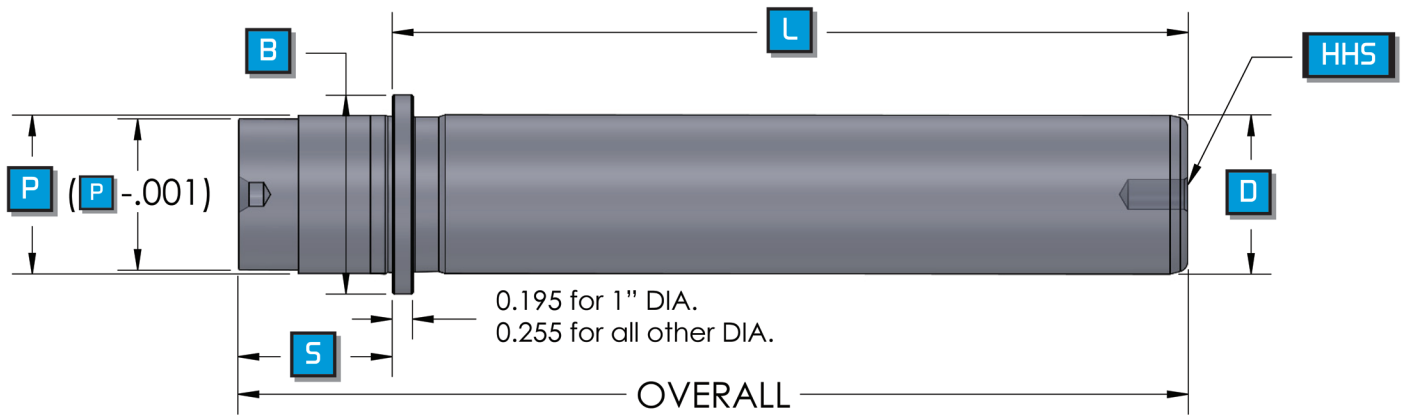
**BALL BEARING PRESS FIT STRAIGHT GUIDE PINS - MAXICAGE - TYPE D**

L	Dia = 1"	Dia = 1 1/4"	Dia = 1 1/2"	Dia = 1 3/4"	Dia = 2"	Dia = 2 1/2"	Dia = 3"
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
3.250	531M0813						
3.750	531M0815						
4.250	531M0817	531M1017	531M1217				
4.500	531M0818						
4.750	531M0819	531M1019					
5.000	531M0820		531M1220	531M1420			
5.250	531M0821	531M1021					
5.500	531M0822	531M1022					
5.750	531M0823	531M1023	531M1223	531M1423	531M1623		
6.000	531M0824	531M1024	531M1224				
6.500	531M0826	531M1026	531M1226	531M1426	531M1626		
7.000	531M0828	531M1028	531M1228	531M1428			
7.250					531M1629		
7.500	531M0830	531M1030	531M1230	531M1430	531M1630		
7.750					531M1631		
8.000	531M0832	531M1032	531M1232	531M1432	531M1632	531M2032	
8.500	531M0834	531M1034	531M1234	531M1434	531M1634		531M2434
8.750						531M2035	
9.000	531M0836	531M1036	531M1236	531M1436	531M1636		
9.250							531M2437
9.500			531M1238	531M1438	531M1638	531M2038	
10.000		531M1040	531M1240	531M1440	531M1640	531M2040	531M2440
10.500			531M1242	531M1442	531M1642		
11.000		531M1044	531M1244	531M1444	531M1644	531M2044	531M2444
11.500			531M1246	531M1446	531M1646		
12.000		531M1048	531M1248	531M1448	531M1648	531M2048	531M2448
12.500			531M1250	531M1450	531M1650		
13.000			531M1252	531M1452	531M1652	531M2052	531M2452
14.000			531M1256	531M1456	531M1656	531M2056	531M2456
15.000				531M1460	531M1660		
16.000					531M1664		
17.000				531M1468	531M1668	531M2068	531M2468
18.000					531M1672	531M2072	
20.000						531M2080	531M2480



# DEMOUNTABLE BALL BEARING GUIDE PINS

## TYPE D



Diameter	P	B	S	HHS
1"	0.9990	1.313	1.19	5/16"-18
1 1/4"	1.2489	1.563	1.19	5/16"-18
1 1/2"	1.4984	1.875	1.44	3/8"-16
1 3/4"	1.7484	2.250	1.69	3/8"-16
2"	1.9984	2.500	1.94	3/8"-16
2 1/2"	2.4979	3.031	1.94	1/2"-13
3"	2.9979	3.500	2.44	1/2"-13

**WHEN ORDERING PLEASE SPECIFY:**

1. Part Number
2. Quantity

Hardened to 60 +/- 2 Rc



# DEMOUNTABLE BALL BEARING GUIDE PINS

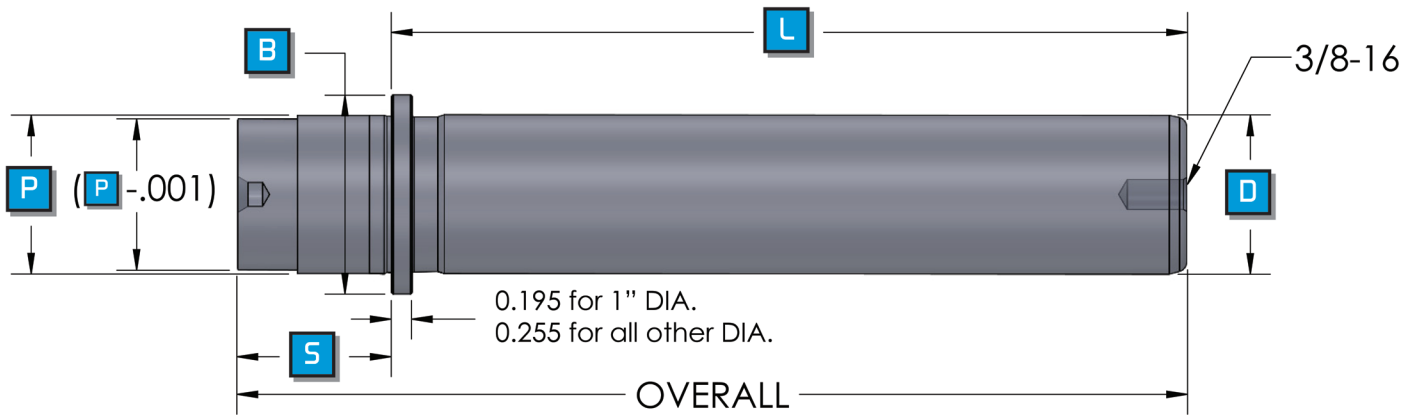
# TYPE D

DEMOUNTABLE BALL BEARING GUIDE PINS - TYPE D							
L	Dia = 1"	Dia = 1 1/4"	Dia = 1 1/2"	Dia = 1 3/4"	Dia = 2"	Dia = 2 1/2"	Dia = 3"
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
2.50	532-0810						
2.75	532-0811						
3.00	532-0812						
3.25	532-0813	532-1013	532-1213				
3.50	532-0814	532-1014	532-1214				
3.75	532-0815	532-1015	532-1215	532-1415			
4.00	532-0816	532-1016	532-1216	532-1416			
4.25	532-0817	532-1017	532-1217	532-1417	532-1617		
4.50	532-0818	532-1018	532-1218	532-1418	532-1618		
4.75	532-0819	532-1019		532-1419	532-1619		
5.00			532-1220		532-1620		
5.25	532-0821	532-1021		532-1421	532-1621		
5.50			532-1222		532-1622		
5.75	532-0823	532-1023		532-1423	532-1623		
6.00			532-1224		532-1624	532-2024	532-2424
6.25	532-0825	532-1025		532-1425			
6.50			532-1226		532-1626	532-2026	532-2426
6.75	532-0827	532-1027		532-1427			
7.00			532-1228		532-1628	532-2028	
7.25	532-0829	532-1029		532-1429			
7.50			532-1230		532-1630		532-2430
7.75	532-0831	532-1031		532-1431			
8.00			532-1232		532-1632	532-2032	
8.25				532-1433			
8.50			532-1234		532-1634		532-2434
8.75		532-1035		532-1435			
9.00			532-1236		532-1636	532-2036	
9.25				532-1437			
9.50			532-1238		532-1638		532-2438
9.75		532-1039		532-1439			
10.00			532-1240		532-1640	532-2040	
10.25				532-1441			
10.50			532-1242		532-1642		532-2442
10.75		532-1043		532-1443			
11.00			532-1244		532-1644	532-2044	
11.25				532-1445			
11.50			532-1246				532-2446
12.00					532-1648	532-2048	
12.25				532-1449			
12.50			532-1250				532-2450
13.00					532-1652	532-2052	
13.25				532-1453			
13.50							532-2454
14.00					532-1656	532-2056	
14.25				532-1457			
14.50							532-2458
15.00					532-1660	532-2060	
15.25				532-1461			
16.00					532-1664		
17.50							532-2470
18.00						532-2072	



# DEMOUNTABLE BALL BEARING GUIDE PINS

# MAXICAGE

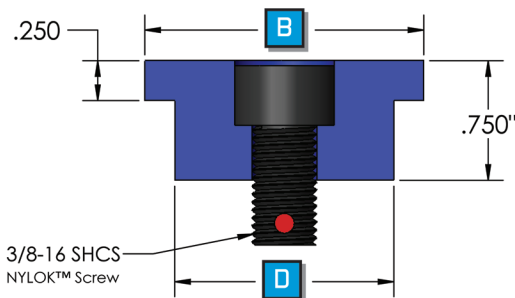


Diameter	P	B	S
1"	0.9990	1.313	1.19
1 1/4"	1.2489	1.563	1.19
1 1/2"	1.4984	1.875	1.44
1 3/4"	1.7484	2.250	1.69
2"	1.9984	2.500	1.94
2 1/2"	2.4979	3.031	1.94
3"	2.9979	3.500	2.44

**WHEN ORDERING PLEASE SPECIFY:**

1. Part Number
2. Quantity

**Hardened to 60 +/- 2 Rc**



### END CAP DIMENSIONS

PIN DIAMETER	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
PART NO.	334-0804	334-1004	334-1204	334-1404	334-1604	334-2004	334-2404
D	7/8"	1 1/8"	1 3/8"	1 5/8"	1 7/8"	2 3/8"	2 7/8"
B	1 1/4"	1 1/2"	1 3/4"	2"	2 3/8"	2 7/8"	3 3/8"





# DEMOUNTABLE BALL BEARING GUIDE PINS

# MAXICAGE

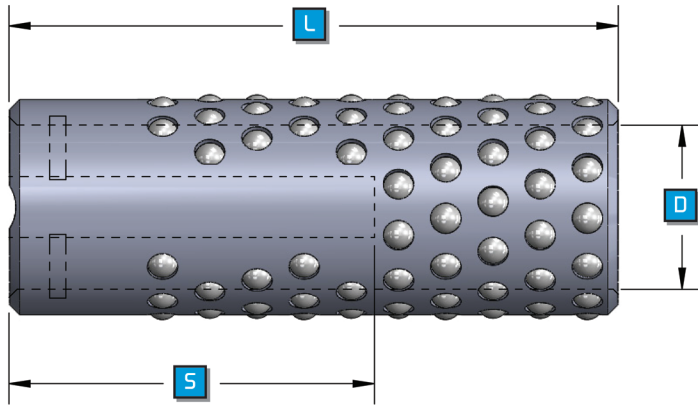
DEMOUNTABLE BALL BEARING GUIDE PINS - MAXICAGE - TYPE D

L	Dia = 1"	Dia = 1 1/4"	Dia = 1 1/2"	Dia = 1 3/4"	Dia = 2"	Dia = 2 1/2"	Dia = 3"
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
2.50	532M0810						
2.75	532M0811						
3.00	532M0812						
3.25	532M0813	532M1013	532M1213				
3.50	532M0814	532M1014	532M1214				
3.75	532M0815	532M1015	532M1215	532M1415			
4.00	532M0816	532M1016	532M1216	532M1416			
4.25	532M0817	532M1017	532M1217	532M1417	532M1617		
4.50	532M0818	532M1018	532M1218	532M1418	532M1618		
4.75	532M0819	532M1019		532M1419	532M1619		
5.00			532M1220		532M1620		
5.25	532M0821	532M1021		532M1421	532M1621		
5.50			532M1222		532M1622		
5.75	532M0823	532M1023		532M1423	532M1623		
6.00			532M1224		532M1624	532M2024	532M2424
6.25	532M0825	532M1025		532M1425			
6.50			532M1226		532M1626	532M2026	532M2426
6.75	532M0827	532M1027		532M1427			
7.00			532M1228		532M1628	532M2028	
7.25	532M0829	532M1029		532M1429			
7.50			532M1230		532M1630		532M2430
7.75	532M0831	532M1031		532M1431			
8.00			532M1232		532M1632	532M2032	
8.25				532M1433			
8.50			532M1234		532M1634		532M2434
8.75		532M1035		532M1435			
9.00			532M1236		532M1636	532M2036	
9.25				532M1437			
9.50			532M1238		532M1638		532M2438
9.75		532M1039		532M1439			
10.00			532M1240		532M1640	532M2040	
10.25				532M1441			
10.50			532M1242		532M1642		532M2442
10.75		532M1043		532M1443			
11.00			532M1244		532M1644	532M2044	
11.25				532M1445			
11.50			532M1246				532M2446
12.00					532M1648	532M2048	
12.25				532M1449			
12.50			532M1250				532M2450
13.00					532M1652	532M2052	
13.25				532M1453			
13.50							532M2454
14.00					532M1656	532M2056	
14.25				532M1457			
14.50							532M2458
15.00					532M1660	532M2060	
15.25				532M1461			
16.00					532M1664		
17.50							532M2470
18.00						532M2072	



# BALL BEARING CAGES

# TYPE D



**WHEN ORDERING PLEASE SPECIFY:**

1. Part Number
2. Quantity

**Note:**

1. 3/16" ball dia. Pin dia. 1" ≤ 1 3/4"
2. 1/4" ball dia. Pin dia. ≥ 2"

**TYPE D BALL BEARING CAGES**

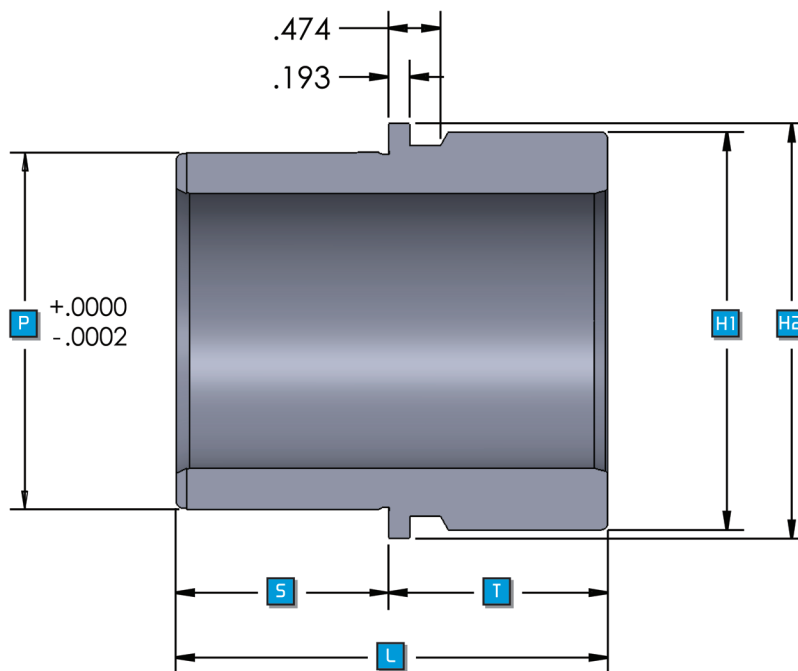
Diameter	L	S	Ball Dia	Part No.
1"	1.500	0.44	.1875	535-0806-1
1"	2.000	0.69	.1875	535-0808-1
1"	2.000	1.06	.1875	535-0808-2
1"	2.500	1.31	.1875	535-0810-2
1"	3.000	1.56	.1875	535-0812-2
1"	3.250	1.81	.1875	535-0813-2
1"	3.500	2.06	.1875	535-0814-2
1"	3.750	2.31	.1875	535-0815-2
1 1/4"	1.500	0.44	.1875	535-1006-1
1 1/4"	2.000	0.69	.1875	535-1008-1
1 1/4"	2.750	1.44	.1875	535-1011-2
1 1/4"	3.250	1.69	.1875	535-1013-2
1 1/4"	3.750	1.94	.1875	535-1015-2
1 1/4"	4.000	2.19	.1875	535-1016-2
1 1/4"	4.250	2.44	.1875	535-1017-2
1 1/4"	4.750	2.94	.1875	535-1019-2
1 1/2"	2.000	0.69	.1875	535-1208-1
1 1/2"	2.500	0.94	.1875	535-1210-1
1 1/2"	2.750	1.44	.1875	535-1211-2
1 1/2"	3.500	1.81	.1875	535-1214-2
1 1/2"	4.250	2.19	.1875	535-1217-2
1 1/2"	4.500	2.44	.1875	535-1218-2
1 1/2"	5.000	2.94	.1875	535-1220-2
1 1/2"	5.500	3.44	.1875	535-1222-2
1 1/2"	6.000	3.94	.1875	535-1224-2

**TYPE D BALL BEARING CAGES**

Diameter	L	S	Ball Dia	Part No.
1 3/4"	2.500	0.94	.1875	535-1410-1
1 3/4"	3.000	1.19	.1875	535-1412-1
1 3/4"	3.250	1.69	.1875	535-1413-2
1 3/4"	4.000	2.06	.1875	535-1416-2
1 3/4"	4.750	2.44	.1875	535-1419-2
1 3/4"	5.250	2.94	.1875	535-1421-2
1 3/4"	5.750	3.44	.1875	535-1423-2
1 3/4"	6.250	3.94	.1875	535-1425-2
1 3/4"	6.750	4.44	.1875	535-1427-2
2"	3.000	1.19	.2500	535-1612-1
2"	3.500	1.44	.2500	535-1614-1
2"	3.750	1.94	.2500	535-1615-2
2"	4.500	2.31	.2500	535-1618-2
2"	5.250	2.69	.2500	535-1621-2
2"	5.750	3.06	.2500	535-1623-2
2"	6.000	3.44	.2500	535-1624-2
2"	6.500	3.94	.2500	535-1626-2
2"	7.000	4.44	.2500	535-1628-2
2"	7.500	4.94	.2500	535-1630-2
2 1/2"	4.000	1.69	.2500	535-2016-1
2 1/2"	5.750	3.00	.2500	535-2023-2
2 1/2"	6.500	3.38	.2500	535-2026-2
2 1/2"	7.250	3.75	.2500	535-2029-2
2 1/2"	7.750	4.25	.2500	535-2031-2
2 1/2"	8.250	4.75	.2500	535-2033-2
2 1/2"	8.750	5.25	.2500	535-2035-2
3"	4.000	1.69	.2500	535-2416-1
3"	5.750	3.00	.2500	535-2423-2
3"	6.500	3.38	.2500	535-2426-2
3"	7.25	3.75	.2500	535-2429-2
3"	7.75	4.25	.2500	535-2431-2
3"	8.25	4.75	.2500	535-2433-2
3"	8.75	5.25	.2500	535-2435-2



# BALL BEARING DEMOUNTABLE SHOULDER BUSHINGS



Diameter	P	S	H1	H2
1"	1.8755	1.19	2.125	2.283
1 1/4"	2.1255	1.19	2.375	2.533
1 1/2"	2.5005	1.44	2.875	3.033
1 3/4"	2.7505	1.69	3.125	3.283
2"	3.2505	1.94	3.625	3.783
2 1/2"	3.7505	1.94	4.125	4.283
3"	4.2505	1.94	4.750	4.908

**WHEN ORDERING PLEASE SPECIFY:**

1. Part Number
2. Quantity

**Hardened to 60 +/- 2 Rc**

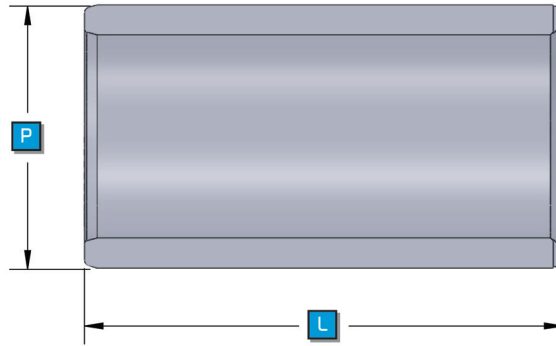
## BALL BEARING DEMOUNTABLE SHOULDER BUSHINGS - TYPE D

Diameter	T = 1.25"		T = 1.50"		T = 1.75"		T = 2.00"		T = 2.25"		T = 2.50"		T = 2.75"		T = 3.00"	
	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.
1"	2.438	536-0811			2.938	536-0813			3.438	536-0821			3.938	536-0823		
1 1/4"					2.938	536-1013			3.438	536-1021			3.938	536-1023		
1 1/2"			2.938	536-1212					3.688	536-1221					4.438	536-1230
1 3/4"					3.438	536-1413					4.188	536-1422				
2"			2.938	536-1612			3.938	536-1620					4.688	536-1623		
2 1/2"			3.438	536-2012			3.938	536-2020							4.938	536-2030
3"							3.938	536-2420							4.938	536-2430

Diameter	T = 3.25"		T = 3.50"		T = 4.00"		T = 4.25"		T = 4.75"		T = 5.00"		T = 5.50"	
	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.	L	Part No.
1"														
1 1/4"														
1 1/2"			4.938	536-1232										
1 3/4"	4.938	536-1431												
2"			5.438	536-1632			6.188	536-1641			6.938	536-1650		
2 1/2"					5.938	536-2040			6.688	536-2043			7.438	536-2052
3"					5.938	536-2440			6.688	536-2443			7.438	536-2452



# BALL BEARING PRESS FIT STRAIGHT BUSHINGS



Diameter	P
1"	1.8745
1 1/4"	2.1245
1 1/2"	2.4995
1 3/4"	2.7495
2"	3.2495
2 1/2"	3.7495
3"	4.2495

**WHEN ORDERING PLEASE SPECIFY:**

1. Part Number
2. Quantity

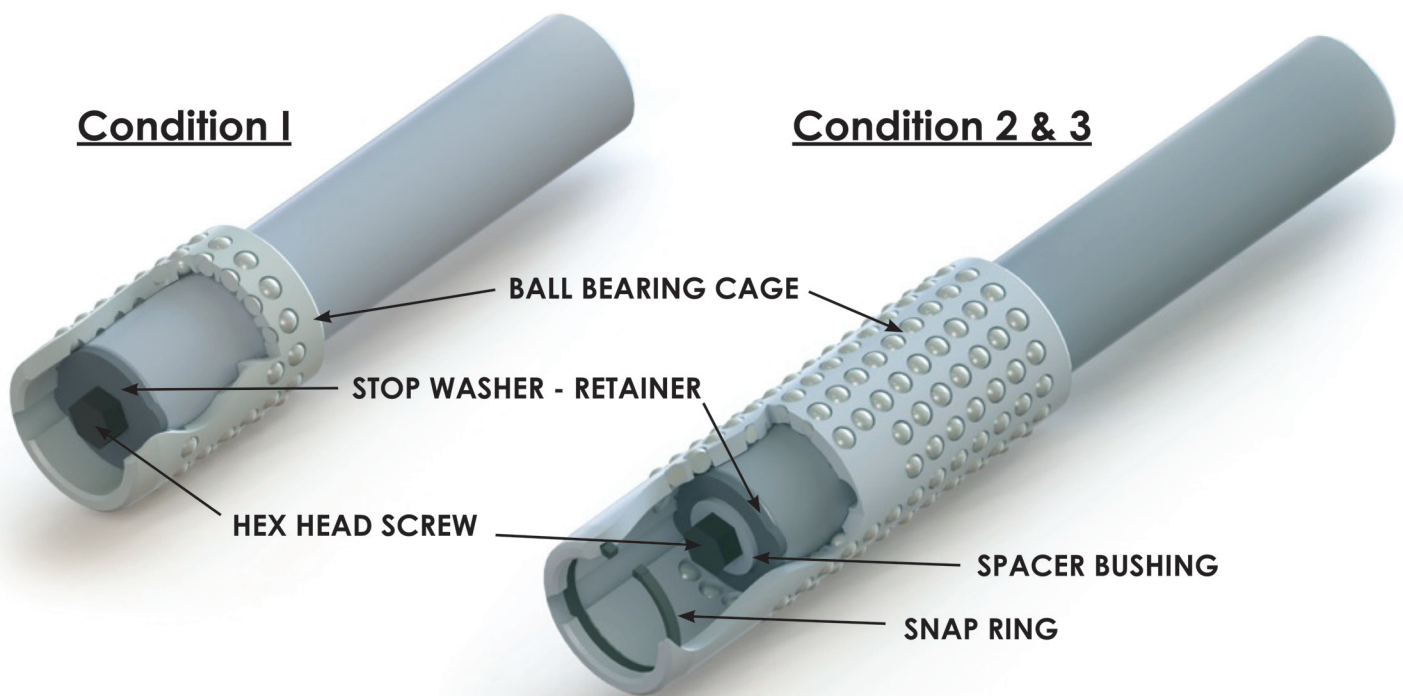
**Hardened to 60 +/- 2 Rc**

BALL BEARING PRESS FIT STRAIGHT BUSHINGS - TYPE D							
L	Dia = 1"	Dia = 1 1/4"	Dia = 1 1/2"	Dia = 1 3/4"	Dia = 2"	Dia = 2 1/2"	Dia = 3"
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
1.00							
1.50							
2.00							
2.50	537-0810						
3.00	537-0812	537-1012	537-1212				
3.50	537-0814	537-1014		537-1414			
3.75			537-1215				
4.00	537-0816	537-1016			537-1616		
4.25				537-1417			
4.50	537-0818	537-1018	537-1218				
4.75					537-1619		
5.00	537-0820	537-1020	537-1220	537-1420			
5.50			537-1222	537-1422	537-1622		
6.00		537-1024	537-1224	537-1424		537-2024	537-2424
6.25					537-1625		
6.50							
6.75						537-2027	537-2427
7.00			537-1228	537-1428	537-1628		
7.50						537-2030	537-2430
8.00			537-1232	537-1432	537-1632		
8.50						537-2034	537-2434
9.00				537-1436	537-1636		
9.50						537-2038	537-2438
10.00					537-1640		
10.50						537-2042	537-2442

## BALL BEARING WASHER ASSEMBLY KIT

The **Condition 1** Washer Assembly parts include only the Stop Washer and Hex Screw. Either Condition 1 or 2 cages can be used with this assembly (ie 535-1210-1).

The **Condition 2 & 3** Washer Assembly parts include a Stop Washer, Spacer Bushing, Snap Ring, and Hex Screw. Only Condition 2 cages should be used with this assembly (ie 535-1211-2).



**PINS & CAGES  
SOLD SEPARATELY**

**BALL BEARING WASHER ASSEMBLY - TYPE D**

Nominal Diameter	Washer Assembly Part Number		Stop Washer - Retainer		Spacer Bushing	Hex Head Screw	Snap Ring
	Cond'n. 1	Cond'n. 2 & 3	Cond'n. 1	Cond'n. 2 & 3	Cond'n. 2 & 3	Cond'n. 1, 2, & 3	Cond'n. 2 & 3
1"	530-08KT-1	530-08KT-2	53W-0800-1	53W-0800-2	53B-0800	X0312C006	53R-0800
1 1/4"	530-10KT-1	530-10KT-2	53W-1000-1	53W-1000-2	53B-0800	X0312C006	53R-1000
1 1/2"	530-12KT-1	530-12KT-2	53W-1200-1	53W-1200-2	53B-1200	X0375C007	53R-1200
1 3/4"	530-14KT-1	530-14KT-2	53W-1400-1	53W-1400-2	53B-1200	X0375C007	53R-1400
2"	530-16KT-1	530-16KT-2	53W-1600-1	53W-1600-2	53B-1200	X0375C007	53R-1600
2 1/2"	530-20KT-1	530-20KT-2	53W-2000-1	53W-2000-2	53B-2400	X0500C010	53R-2000
3"	530-24KT-1	530-24KT-2	53W-2400-1	53W-2400-2	53B-2400	X0500C010	53R-2400



## TOLERANCES

### FRICTION PIN & BUSHING CLEARANCE

PIN DIAMETER	CLEARANCE (IN)
¾"	0.0001 to 0.0006
1"	0.0001 to 0.0006
1¼"	0.0002 to 0.0007
1½"	0.0003 to 0.0008
1¾"	0.0004 to 0.0009
2"	0.0005 to 0.0010
2½"	0.0006 to 0.0011
3"	0.0008 to 0.0013

### FLAT & PARALLEL

		DIE SET TYPE	
		STANDARD	BOSS
PUNCH HOLDER OR DIE SHOE	FLATNESS (PER 12")	.001"	.002"
	PARALLELISM (PER 12")	.001"	.002"
ASSEMBLED DIE SET	PARALLELISM (PER 12")	.0015"	.002"

To calculate flatness/parallelism, divide diagonal of die set by 12". Then multiply by values indicated above.

(example: 48" diagonal ÷ 12" = (4). (4) x .001" = .004" TIR (flat or parallel).

**NOTE:** plates greater than 120" diagonal or less than 1.25" thick calculated upon application.

### PIN SQUARENESS

.001" IN 6" OF PIN LENGTH

### OVERALL TOLERANCES FOR GAS CUT STEEL PLATE EXTERNAL AND INTERNAL SHAPES-MEASURED AT PLATE SURFACE

PLATE THICKNESS	SIZE B/O or PLATE	TOLERANCE		BURNOUT MINIMUMS					SQUARENESS TO SURFACE OF PLT	MINIMUM DIST BETWEEN B/O'S
		PLATE	BURNOUT	WIDTH	LENGTH	DIAMETER	RADIUS	CLR/SIDE		
1/4" to 2"	≤ 30"	+/- .030	+ .060-.000	.312	.750	.750	.160	.060	0.030 TIR	.125*
	>30" ≤ 60"	+/- .060	+ .120-.000							
	>60" ≤ 100"	+/- .090	+ .180-.000							
> 2" to 3"	≤ 30"	+/- .030	+ .060-.000	.375	.875	.875	.160	.060	0.030 TIR	.188*
	>30" ≤ 60"	+/- .060	+ .120-.000							
	>60" ≤ 100"	+/- .090	+ .180-.000							
> 3" to 4 1/2"	≤ 30"	+/- .045	+ .090-.000	.500	1.000	1.125	.190	.090	0.045 TIR	.250*
	>30" ≤ 60"	+/- .090	+ .180-.000							
	>60" ≤ 100"	+/- .125	+ .250-.000							
> 4 1/2" to 6"	≤ 30"	+/- .060	+ .120-.000	.625	1.250	1.250	.190	.125	0.060 TIR	.312*
	>30" ≤ 60"	+/- .090	+ .180-.000							
	>60" ≤ 100"	+/- .125	+ .250-.000							
> 6" to 7 1/2"	≤ 30"	+/- .090	+ .180-.000	1.000	1.750	1.750	.250	.188	0.075 TIR	.438*
	>30" ≤ 60"	+/- .125	+ .250-.000							
	>60" ≤ 100"	+/- .160	+ .320-.000							
> 7 1/2" to 10"	≤ 30"	+/- .100	+ .200-.000	1.750	2.500	2.500	.250	.250	0.100 TIR	.625*
	>30" ≤ 60"	+/- .160	+ .320-.000							
	>60" ≤ 100"	+/- .190	+ .380-.000							
> 10" THICK OR OVER 100" LENGTH				UPON APPLICATION					.010/INCH	.875*

**NOTE:** \* These dimensions are a guide because of the many variables involved.



## GLOSSARY OF TERMS

**AIR VENTS** – slots cut in the plate surface near the bushings to relieve pressure caused by compression of the pin in the bushing.

**BURN-OUT** – an interior torch-cut opening of any shape. See our “Torch-cut Tolerance Chart” (see page 6270) for minimum burn-out sizes.

**CLEAN-UP GRIND (MILL)** – plate thickness is ground (milled) to a tolerance of  $+.062/-0.125$ ” and no raw stock is visible.

**DECIMAL GRIND (MILL)** – plate thickness is ground (milled) to a tolerance other than a clean-up grind.

**FINISHED EDGES** – an edge of a plate that is machined (milled or ground). A torch-cut (or saw-cut) edge is standard unless otherwise specified to be finished.

**GRINDING STANDARD** – Superior has numerous Blanchard grinders (rotary) with a maximum capacity of 160” diagonal and a standard micro-finish of 125 maximum. Also, Superior can surface grind (reciprocating) plates up to 60 x 80” and a standard micro-finish of 63 maximum.

**INVERTED DIE SET** – a die set with the pins and bushings installed in opposite plates. On friction die sets, the pins are installed in the punch holder (top). On ball bearing die sets, the pins are installed in the die shoe (bottom). It is also recommended to use the “S” springs with ball bearing components (see page 1150).

**OPEN DIE SET** – a die set without the pin and bushing holes drilled & bored. The components are shipped loose with the plates. Note: pin diameter must be equal or less than plate thicknesses.

**REVERSE DIE SET** – a die set where the die shoe plate depth (front to back) is greater than the length (left to right).

**SHAPE-CUT PLATE** – a plate with a torch-cut exterior that is neither a perfect rectangle or circle. See our “Torch-cut Tolerance Chart” (page 6270) for minimum shape-cut sizes. Note: a rectangle with torch-cut bolt slots or radiuses on corners is still considered shape-cut.

**STRESS RELIEVING (THERMAL)** – performed to all A36 torch-cut plates under the following circumstances: customer request, ground plate  $< 1 \frac{1}{4}$ ” thick, ground plate with length to depth ratio  $> 3:1$ , welded bosses, severe torch-cutting application, special machining applied. Also, all 4340 and 1045 material plates are stress relieved after torch-cutting.

**SLUG CHUTE** – an angled surface on the edge of a plate that can be supplied torch-cut (standard) or machined. Torch-cut slug chutes must have a minimum angle of 28 degrees.



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