

# BALL BEARING BUSHING DIE SETS



**DANLY DIE SET**

® A Division of Connell Limited Partnership

# Ball Bearing Die Sets



*Smooth, free-rolling operation for high accuracy, plus ease of assembly that lowers costs.*



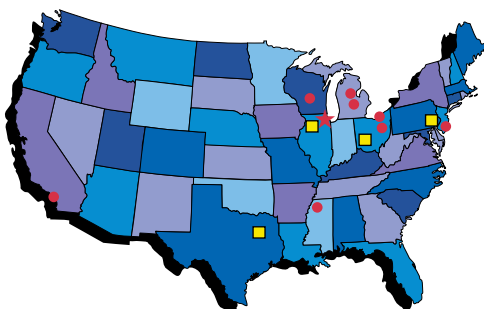
With competitive pressures on the rise, the longer life and easier assembly of Danly's Ball Bearing Die Set just might be the edge you're looking for. Its fast assembly slashes cost in building and maintaining the die. And Danly's uncompromised material quality is legendary for long-lasting, profitable value.

### **Total Quality Management (TQM)**

Materials for Danly ball bearing bushing die sets and components are subjected 100% to inbound material inspections. Statistical process control (SPC) helps assure a high degree of precision throughout the manufacturing process. And, of course, the finished product is verified before shipment to our customers.

But, quality assurance requires even a greater commitment than just these benchmark tests. At Danly, Total Quality Management enlists every department, every workstation, every facet of the company's operation into a comprehensive quality effort. After all, the perfect product shipped on time, but billed incorrectly, is still a quality problem.

From the sales and customer service representatives who assist you with your order, to the shipping department that expedites your delivery, quality at Danly is a team effort and it's everyone's top priority.



## **Eight Manufacturing Locations To Serve You**

- ★ Customer Service Center/Branch Office
- Manufacturing
- Branch Offices





**Danly**                      **Other**

Unlike others, the ball bearings in Danly cages are spun a full 360° into place for maximum protection from accidental ball dislodgement.



Specially-designed spiral patterns are drilled into Danly Ball Cages to control tracking and grooving.



Special equipment spins ball bearings in place, then Danly Ball Cages move on to rigid quality inspection.

### Ask About Our Complete Line of Diemakers' Supplies

- Plain Bearing Die Sets
- Catalog Die Sets
- Pins and Bushings
- Die Springs
- Basic and Ball Lock Punches
- Self Lubricating Bushings
- Gold Bond Pressroom Accessories

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## Back Post Series AS-33BB

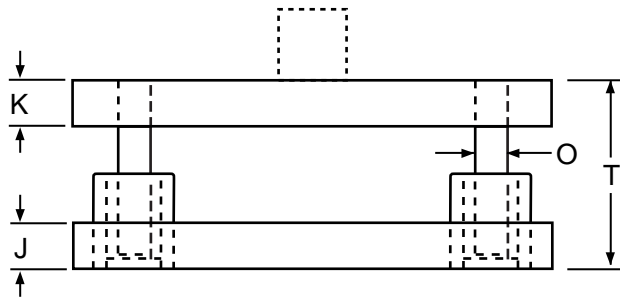
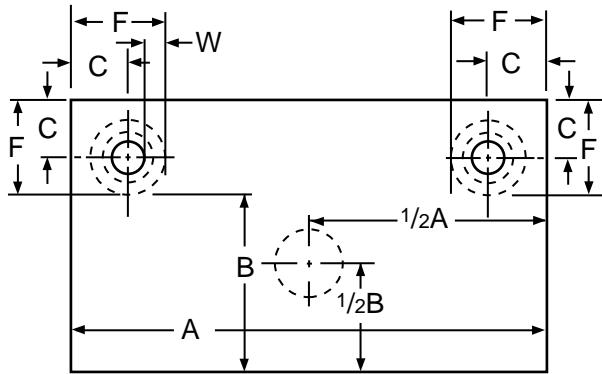
### UNLIMITED SIZES

Sizes are not limited to any dimensions. Suggested minimum dimensions are shown below.

| MINIMUM THICKNESS RECOMMENDED | K  | 1 ¼    | 1 ¼  | 1 ½  |           |           |    | 1 ¾ |           |           |    | 2  | 2 ½    | 3      |     |    |        |        |    |    |    |    |    |    |    |     |
|-------------------------------|----|--------|------|------|-----------|-----------|----|-----|-----------|-----------|----|----|--------|--------|-----|----|--------|--------|----|----|----|----|----|----|----|-----|
|                               | J  | 1 ¼    | 1 ½  |      | 1 ¾       |           |    |     | 2         |           |    |    | 2 ¼    | 2 ¾    | 3 ¼ |    |        |        |    |    |    |    |    |    |    |     |
| POST DIAMETER                 | O  | 1      | 1 ¼  |      | 1 ½       |           |    |     | 1 ¾       |           |    |    | 2      | 2 ½    | 3   |    |        |        |    |    |    |    |    |    |    |     |
| DIE SPACE A                   | →  | 8      | 10   | 12   | 14        | 16        | 18 | 20  | 22        | 24        | 26 | 28 | 30     | 32     | 34  | 36 | 40     | 45     | 50 | 55 | 60 | 65 | 70 | 80 | 90 | 100 |
| B<br>↓                        | 6  | Yellow |      | Red  |           | Blue      |    |     |           | Dark Blue |    |    |        | Green  |     |    |        | Orange |    |    |    |    |    |    |    |     |
|                               | 8  | Yellow |      | Red  |           | Blue      |    |     |           | Dark Blue |    |    |        | Green  |     |    |        | Orange |    |    |    |    |    |    |    |     |
|                               | 10 | Yellow | Red  |      | Blue      |           |    |     | Dark Blue |           |    |    | Green  |        |     |    | Orange |        |    |    |    |    |    |    |    |     |
|                               | 12 |        | Red  |      | Blue      |           |    |     | Dark Blue |           |    |    | Green  |        |     |    | Orange |        |    |    |    |    |    |    |    |     |
|                               | 14 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 16 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 18 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 20 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 22 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 24 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 26 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 28 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 30 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 32 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 34 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
|                               | 36 |        |      | Blue |           | Dark Blue |    |     |           | Green     |    |    |        | Orange |     |    |        |        |    |    |    |    |    |    |    |     |
| 40                            |    |        | Blue |      | Dark Blue |           |    |     | Green     |           |    |    | Orange |        |     |    |        |        |    |    |    |    |    |    |    |     |

**Note:** Die space sizes are grouped within shaded areas which indicate suggested guide post diameters.

## Back Post Series AS-33BB



| NOM. GUIDE POST DIA.          | C                             | SLEEVE BUSHING                  |                              | SHOULDER BUSHING                |                               |
|-------------------------------|-------------------------------|---------------------------------|------------------------------|---------------------------------|-------------------------------|
|                               |                               | F                               | W                            | F                               | W                             |
| 1                             | 1 <sup>3</sup> / <sub>4</sub> | 2 <sup>11</sup> / <sub>16</sub> | <sup>7</sup> / <sub>16</sub> | 2 <sup>7</sup> / <sub>8</sub>   | <sup>9</sup> / <sub>16</sub>  |
| 1 <sup>1</sup> / <sub>4</sub> | 1 <sup>7</sup> / <sub>8</sub> | 2 <sup>15</sup> / <sub>16</sub> | <sup>7</sup> / <sub>16</sub> | 3 <sup>1</sup> / <sub>16</sub>  | <sup>9</sup> / <sub>16</sub>  |
| 1 <sup>1</sup> / <sub>2</sub> | 2 <sup>1</sup> / <sub>8</sub> | 3 <sup>3</sup> / <sub>8</sub>   | <sup>1</sup> / <sub>2</sub>  | 3 <sup>9</sup> / <sub>16</sub>  | <sup>11</sup> / <sub>16</sub> |
| 1 <sup>3</sup> / <sub>4</sub> | 2 <sup>1</sup> / <sub>4</sub> | 3 <sup>5</sup> / <sub>8</sub>   | <sup>1</sup> / <sub>2</sub>  | 3 <sup>13</sup> / <sub>16</sub> | <sup>11</sup> / <sub>16</sub> |
| 2                             | 2 <sup>1</sup> / <sub>2</sub> | 4 <sup>1</sup> / <sub>8</sub>   | <sup>5</sup> / <sub>8</sub>  | 4 <sup>5</sup> / <sub>16</sub>  | <sup>13</sup> / <sub>16</sub> |
| 2 <sup>1</sup> / <sub>2</sub> | 2 <sup>7</sup> / <sub>8</sub> | 4 <sup>3</sup> / <sub>4</sub>   | <sup>5</sup> / <sub>8</sub>  | 5                               | <sup>13</sup> / <sub>16</sub> |
| 3                             | 3 <sup>1</sup> / <sub>4</sub> | 5 <sup>3</sup> / <sub>8</sub>   | <sup>5</sup> / <sub>8</sub>  | 5 <sup>5</sup> / <sub>8</sub>   | <sup>7</sup> / <sub>8</sub>   |

| THICKNESS OF PLATE CARRIED IN STOCK FOR IMMEDIATE FABRICATION |                               |                               |                               |                               |                               |                               |                               |   |                               |                               |                               |   |
|---|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---|-------------------------------|-------------------------------|-------------------------------|---|
| 1   | 1 <sup>1</sup> / <sub>8</sub> | 1 <sup>1</sup> / <sub>4</sub> | 1 <sup>3</sup> / <sub>8</sub> | 1 <sup>1</sup> / <sub>2</sub> | 1 <sup>5</sup> / <sub>8</sub> | 1 <sup>3</sup> / <sub>4</sub> | 1 <sup>7</sup> / <sub>8</sub> | 2 | 2 <sup>1</sup> / <sub>4</sub> | 2 <sup>1</sup> / <sub>2</sub> | 2 <sup>3</sup> / <sub>4</sub> | 3 |
| 3 <sup>1</sup> / <sub>4</sub>                                 | 3 <sup>1</sup> / <sub>2</sub> | 4                             | 4 <sup>1</sup> / <sub>2</sub> | 5                             | 5 <sup>1</sup> / <sub>2</sub> | 6                             | 6 <sup>1</sup> / <sub>2</sub> | 7 | 7 <sup>1</sup> / <sub>2</sub> | 8                             | 8 <sup>1</sup> / <sub>2</sub> |   |

### WHEN ORDERING SPECIFY:

- Series AS-33BB.
- Dimensions A and B.
- Thickness of die holder J and punch holder K. (K thickness should be at least equal to guide post diameter O. For sleeve bushings, J thickness should be at least 1/4" larger than O.)
- Type of guide post: straight or demountable. Diameter of guide post O if other than listed. See pages 11, 12 or 13. (If larger or smaller guide post than listed is ordered, C and F dimensions will vary accordingly.)
- Type of bushing, demountable or straight sleeve. Refer to pages 14 and 15 for dimensional data.
- Demountable bushing clamp arrangement—state A, B, or C (see page 21).
- Minimum shutheight by specifying T from bottom surface of die holder to top surface of punch holder.
- Stroke or ram movement of press.
- Operating condition (Type I—Pre-loaded, Type II—Relieving, Type III—Disengaging).
- Size of shank, if required. These sets are regularly furnished without shanks. Inserted or welded steel shanks are available at additional cost.
  - 1 1/2 in. dia. x 2 1/8 in. long
  - 1 9/16 in. dia. x 2 1/8 in. long
  - 2 in. dia. x 2 7/8 in. long
  - 2 1/2 in. dia. x 2 7/8 in. long
  - 3 in. dia. x 2 7/8 in. long
- Clamping or lifting holes. Holes can be furnished to your specifications at additional cost.
- How shipment should be made.

**Reverse Sets**—Sets with B greater than A can be furnished if required for special feeding.

**Special Machining**—Sets can be provided with any special machining required. Send print.

**Torch-Cut Holes**—Holes of any shape can be torch-cut to your needs. Send template or print.

These die sets may not be returned for credit.

# Two Post All-Steel Ball Bearing Die Sets



**Center Post Series AS-34BB**



**Diagonal Post Series AS-35BB**

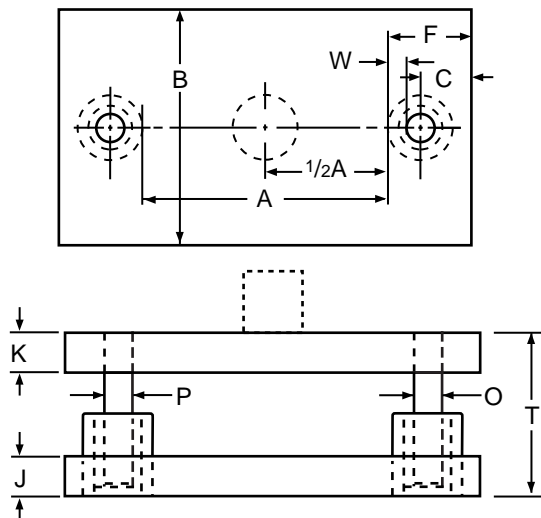
**UNLIMITED SIZES**

Sizes are not limited to any dimensions. Suggested minimum dimensions are shown below.

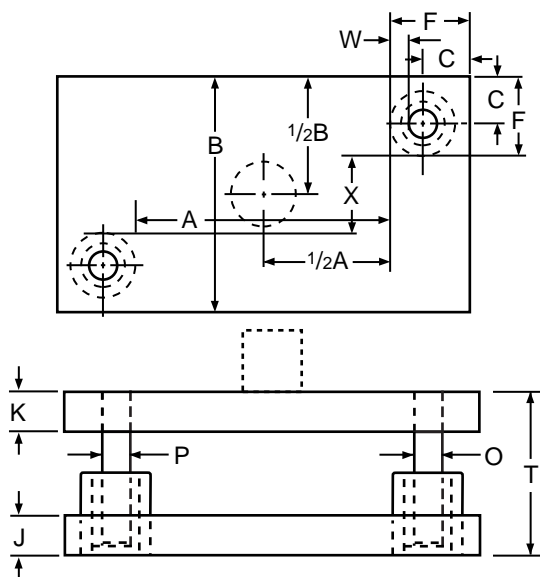
| MINIMUM THICKNESS RECOMMENDED | K      | 1¼     |   |    |    | 1½ |    |    |    | 1¾ |    |    |    | 2  |    |    |     | 2½  |    |    |      | 3    |    |    |    |       |
|-------------------------------|--------|--------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|------|------|----|----|----|-------|
|                               | J      | 1½     |   |    |    | 1¾ |    |    |    | 2  |    |    |    | 2¼ |    |    |     | 2¾  |    |    |      | 3¼   |    |    |    |       |
| POST DIAMETER                 | P      | 1      |   |    |    | 1¼ |    |    |    | 1½ |    |    |    | 1¾ |    |    |     | 2   |    |    |      | 2½   |    |    |    |       |
|                               | O      | 1¼     |   |    |    | 1½ |    |    |    | 1¾ |    |    |    | 2  |    |    |     | 2½  |    |    |      | 3    |    |    |    |       |
| DIE SPACE A                   |        | 6      | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36  | 40  | 45 | 50 | 55   | 60   | 65 | 70 | 80 |       |
| B                             | 6      | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    | Green |
|                               | 8      | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 10     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 12     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 14     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 16     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 18     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 20     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 22     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 24     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 26     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 28     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 30     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 32     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 34     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
|                               | 36     | Yellow |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Red |    |    |      | Blue |    |    |    |       |
| 40                            | Yellow |        |   |    |    |    |    |    |    |    |    |    |    |    |    |    | Red |     |    |    | Blue |      |    |    |    |       |
| 45                            | Yellow |        |   |    |    |    |    |    |    |    |    |    |    |    |    |    | Red |     |    |    | Blue |      |    |    |    |       |
| 50                            | Yellow |        |   |    |    |    |    |    |    |    |    |    |    |    |    |    | Red |     |    |    | Blue |      |    |    |    |       |
| 55                            | Yellow |        |   |    |    |    |    |    |    |    |    |    |    |    |    |    | Red |     |    |    | Blue |      |    |    |    |       |
| 60                            | Yellow |        |   |    |    |    |    |    |    |    |    |    |    |    |    |    | Red |     |    |    | Blue |      |    |    |    |       |

**Note:** Die space sizes are grouped within shaded areas which indicate suggested guide post diameters.

## Center Post Series AS-34BB



## Diagonal Post Series AS-35BB



### WHEN ORDERING SPECIFY:

1. Series AS-34BB or AS-35BB.
2. Dimensions A and B.
3. Thickness of die holder J and punch holder K. (K thickness should be at least equal to guide post diameter O. For sleeve bushings, J thickness should be at least 1/4" larger than O.)
4. Type of guide post: straight or demountable. Diameter of guide post O if other than listed. See pages 11, 12 or 13. (If larger or smaller guide post than listed is ordered, C and F dimensions will vary accordingly.)
5. Type of bushing, demountable or straight sleeve. Refer to pages 14 and 15 for dimensional data.
6. Demountable bushing clamp arrangement—state A, B or C (see page 21).
7. Minimum shutheight by specifying T from bottom surface of die holder to top surface of punch holder.
8. Stroke or ram movement of press.
9. Operating condition (Type I—Pre-loaded, Type II—Relieving, Type III—Disengaging.)
10. Size of shank, if required. These sets are regularly furnished without shanks. Inserted or welded steel shanks are available at additional cost.

- 1 1/2 in. dia. x 2 1/8 in. long
- 1 5/16 in. dia. x 2 1/8 in. long
- 2 in. dia. x 2 7/8 in. long
- 2 1/2 in. dia. x 2 7/8 in. long
- 3 in. dia. x 2 7/8 in. long

11. Clamping or lifting holes. Holes can be furnished to your specifications at additional cost.
12. How shipment should be made.

**Reverse Sets**—Sets with B greater than A can be furnished if required for special feeding.

**Special Machining**—Sets can be provided with any special machining required. Send print.

**Torch-Cut Holes**—Holes of any shape can be torch-cut to your needs. Send template or print.

These die sets may not be returned for credit.

| NOM. GUIDE POST DIA. | C     | SLEEVE BUSHING |      | SHOULDER BUSHING |       |
|----------------------|-------|----------------|------|------------------|-------|
|                      |       | F              | W    | F                | W     |
| 1                    | 1 3/4 | 2 11/16        | 7/16 | 2 7/8            | 9/16  |
| 1 1/4                | 1 7/8 | 2 15/16        | 7/16 | 3 1/16           | 9/16  |
| 1 1/2                | 2 1/8 | 3 3/8          | 1/2  | 3 9/16           | 11/16 |
| 1 3/4                | 2 1/4 | 3 5/8          | 1/2  | 3 13/16          | 11/16 |
| 2                    | 2 1/2 | 4 1/8          | 5/8  | 4 5/16           | 13/16 |
| 2 1/2                | 2 7/8 | 4 3/4          | 5/8  | 5                | 13/16 |
| 3                    | 3 1/4 | 5 3/8          | 5/8  | 5 5/8            | 7/8   |

Diameter of Larger Post determines C and F dimensions for both posts.  
X = B Minus 2F.

| THICKNESS OF PLATE CARRIED IN STOCK FOR IMMEDIATE FABRICATION |       |       |       |       |       |       |       |   |       |       |       |   |
|---|-------|-------|-------|-------|-------|-------|-------|---|-------|-------|-------|---|
| 1   | 1 1/8 | 1 1/4 | 1 3/8 | 1 1/2 | 1 5/8 | 1 3/4 | 1 7/8 | 2 | 2 1/4 | 2 1/2 | 2 3/4 | 3 |
| 3 1/4   | 3 1/2 | 4     | 4 1/2 | 5     | 5 1/2 | 6     | 6 1/2 | 7 | 7 1/2 | 8     | 8 1/2 |   |



## Four Post Series AS-37BB

### UNLIMITED SIZES

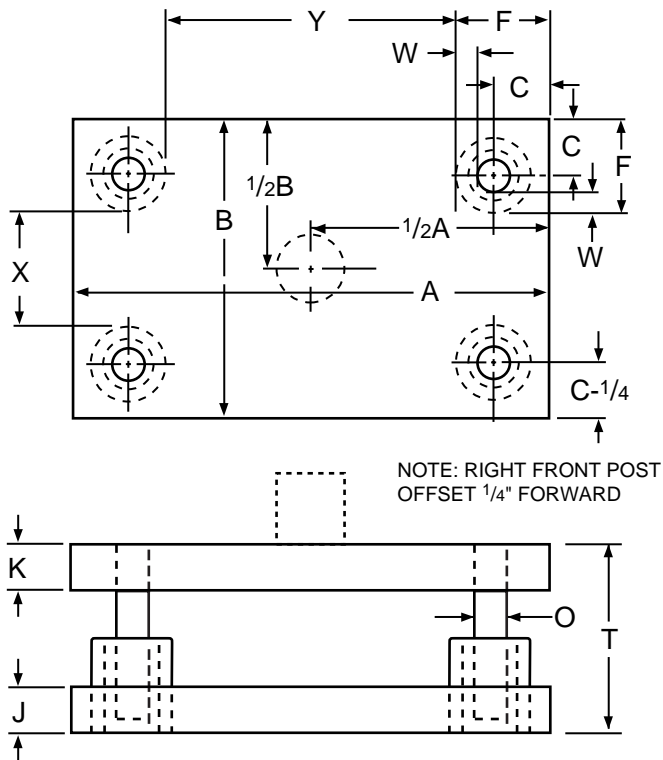
Sizes are not limited to any dimensions. Suggested minimum dimensions are shown below.

| MINIMUM THICKNESS RECOMMENDED | K  | 1¼     |        | 1¼     |        | 1½     |        |     | 1¾  |     |     | 2   |     |     | 2½  |     |     |     |     |     |     |     |     |     |     |     |
|-------------------------------|----|--------|--------|--------|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                               | J  | 1¼     |        | 1½     |        | 1¾     |        |     | 2   |     |     | 2¼  |     |     | 2¾  |     |     |     |     |     |     |     |     |     |     |     |
| POST DIAMETER                 | O  | 1      |        | 1¼     |        | 1½     |        |     | 1¾  |     |     | 2   |     |     | 2½  |     |     |     |     |     |     |     |     |     |     |     |
| DIE SPACE A                   |    | 8      | 10     | 12     | 14     | 16     | 18     | 20  | 22  | 24  | 26  | 28  | 30  | 32  | 34  | 36  | 40  | 45  | 50  | 55  | 60  | 65  | 70  | 80  | 90  | 100 |
| B<br>↓                        | 8  | Yellow | Yellow | Orange | Orange | Orange | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 10 | Yellow | Yellow | Orange | Orange | Orange | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 12 |        | Yellow | Orange | Orange | Orange | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 14 |        |        | Orange | Orange | Orange | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 16 |        |        |        | Orange | Orange | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 18 |        |        |        |        | Orange | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 20 |        |        |        |        |        | Orange | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 22 |        |        |        |        |        |        | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 24 |        |        |        |        |        |        |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 26 |        |        |        |        |        |        |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 28 |        |        |        |        |        |        |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 30 |        |        |        |        |        |        |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 32 |        |        |        |        |        |        |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
|                               | 34 |        |        |        |        |        |        |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| 36                            |    |        |        |        |        |        |        |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |     |
| 40                            |    |        |        |        |        |        |        |     |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |     |
| 45                            |    |        |        |        |        |        |        |     |     |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |     |
| 50                            |    |        |        |        |        |        |        |     |     |     |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red | Red |     |
| 55                            |    |        |        |        |        |        |        |     |     |     |     |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red | Red |     |
| 60                            |    |        |        |        |        |        |        |     |     |     |     |     |     |     |     |     |     |     | Red | Red | Red | Red | Red | Red | Red |     |

**Note:** Die space sizes are grouped within shaded areas which indicate suggested guide post diameters.



## Series AS-37BB



### WHEN ORDERING SPECIFY:

1. Series AS-37BB.
2. Dimensions A and B.
3. Thickness of die holder J and punch holder K. (K thickness should be at least equal to guide post diameter O. For sleeve bushings, J thickness should be at least 1/4" larger than O).
4. Type of guide post: straight or demountable. Diameter of guide post O if other than listed. See Pages 11, 12 or 13. (If larger or smaller guide post than listed is ordered, C and F dimensions will vary accordingly.)
5. Type of bushing, demountable or straight sleeve. Refer to pages 14 and 15 for dimensional data.
6. Demountable bushing clamp arrangement—state A, B or C (see page 21).
7. Minimum shutheight by specifying T from bottom surface of die holder to top surface of punch holder.
8. Stroke or ram movement of press.
9. Operating condition (Type I—Pre-loaded, Type II—Relieving, Type III—Disengaging.)
10. Size of shank, if required. These sets are regularly furnished without shanks. Inserted or welded steel shanks are available at additional cost.

| NOM. GUIDE POST DIA. | C     | SLEEVE BUSHING |      | SHOULDER BUSHING |       |
|----------------------|-------|----------------|------|------------------|-------|
|                      |       | F              | W    | F                | W     |
| 1                    | 1 3/4 | 2 11/16        | 7/16 | 2 7/8            | 9/16  |
| 1 1/4                | 1 7/8 | 2 15/16        | 7/16 | 3 1/16           | 9/16  |
| 1 1/2                | 2 1/8 | 3 3/8          | 1/2  | 3 9/16           | 11/16 |
| 1 3/4                | 2 1/4 | 3 5/8          | 1/2  | 3 13/16          | 11/16 |
| 2                    | 2 1/2 | 4 1/8          | 5/8  | 4 5/16           | 13/16 |
| 2 1/2                | 2 7/8 | 4 3/4          | 5/8  | 5                | 13/16 |
| 3                    | 3 1/4 | 5 3/8          | 5/8  | 5 5/8            | 7/8   |

X = B Minus 2F    Y = A Minus 2F

- 1 1/2 in. dia. x 2 1/8 in. long
- 1 9/16 in. dia. x 2 1/8 in. long
- 2 in. dia. x 2 7/8 in. long
- 2 1/2 in. dia. x 2 7/8 in. long
- 3 in. dia. x 2 7/8 in. long

11. Clamping or lifting holes. Holes can be furnished to your specifications at additional cost.
12. How shipment should be made.

**Reverse Sets**—Sets with B greater than A can be furnished if required for special feeding.

**Special Machining**—Sets can be provided with any special machining required. Send print.

**Torch-Cut Holes**—Holes of any shape can be torch-cut to your needs. Send template or print.

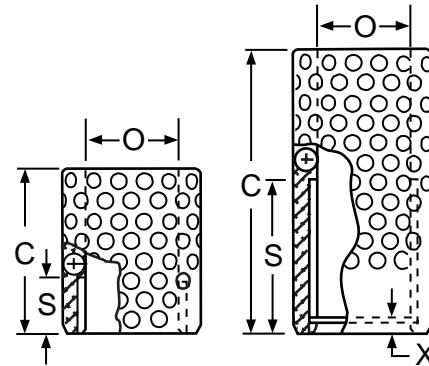
These die sets may not be returned for credit.

| THICKNESS OF PLATE CARRIED IN STOCK FOR IMMEDIATE FABRICATION |       |       |       |       |       |       |       |   |       |       |       |   |
|---|-------|-------|-------|-------|-------|-------|-------|---|-------|-------|-------|---|
| 1   | 1 1/8 | 1 1/4 | 1 3/8 | 1 1/2 | 1 5/8 | 1 3/4 | 1 7/8 | 2 | 2 1/4 | 2 1/2 | 2 3/4 | 3 |
| 3 1/4   | 3 1/2 | 4     | 4 1/2 | 5     | 5 1/2 | 6     | 6 1/2 | 7 | 7 1/2 | 8     | 8 1/2 |   |

# Ball Bearing Cages



| Nom. Post Dia. |    |         | TYPE I CATALOG NUMBER | TYPE II CATALOG NUMBER |      |
|----------------|----|---------|-----------------------|------------------------|------|
| O              | C  | S       |                       |                        | X    |
| 1              | 1½ | 7/16    | 6-0806-82-1           |                        | 3/16 |
|                | 2  | 11/16   | 6-0808-82-1           |                        |      |
|                | 2  | 1 1/16  |                       | 6-0808-82-2            |      |
|                | 2½ | 1 5/16  |                       | 6-0810-82-2            |      |
|                | 3  | 1 9/16  |                       | 6-0812-82-2            |      |
|                | 3¼ | 1 13/16 |                       | 6-0813-82-2            |      |
|                | 3½ | 2 1/16  |                       | 6-0814-82-2            |      |
| 1¼             | 3¾ | 2 5/16  |                       | 6-0815-82-2            | 3/16 |
|                | 1½ | 7/16    | 6-1006-82-1           |                        |      |
|                | 2  | 1 1/16  | 6-1008-82-1           |                        |      |
|                | 2¾ | 1 7/16  |                       | 6-1011-82-2            |      |
|                | 3¼ | 1 11/16 |                       | 6-1013-82-2            |      |
|                | 3¾ | 1 15/16 |                       | 6-1015-82-2            |      |
|                | 4  | 2 3/16  |                       | 6-1016-82-2            |      |
| 1½             | 4¼ | 2 7/16  |                       | 6-1017-82-2            | ¼    |
|                | 4¾ | 2 11/16 |                       | 6-1019-82-2            |      |
|                | 2  | 1 1/16  | 6-1208-82-1           |                        |      |
|                | 2½ | 1 5/16  | 6-1210-82-1           |                        |      |
|                | 2¾ | 1 7/16  |                       | 6-1211-82-2            |      |
|                | 3½ | 1 13/16 |                       | 6-1214-82-2            |      |
|                | 4¼ | 2 3/16  |                       | 6-1217-82-2            |      |
| 1¾             | 4½ | 2 7/16  |                       | 6-1218-82-2            | ¼    |
|                | 5  | 2 15/16 |                       | 6-1220-82-2            |      |
|                | 5½ | 3 1/16  |                       | 6-1222-82-2            |      |
|                | 6  | 3 15/16 |                       | 6-1224-82-2            |      |
|                | 2½ | 1 5/16  | 6-1410-82-1           |                        |      |
|                | 3  | 1 3/16  | 6-1412-82-1           |                        |      |
|                | 3¾ | 1 11/16 |                       | 6-1413-82-2            |      |
| 2              | 4  | 2 1/16  |                       | 6-1416-82-2            | ¼    |
|                | 4¾ | 2 7/16  |                       | 6-1419-82-2            |      |
|                | 5¼ | 2 15/16 |                       | 6-1421-82-2            |      |
|                | 5¾ | 3 1/16  |                       | 6-1423-82-2            |      |
|                | 6¼ | 3 15/16 |                       | 6-1425-82-2            |      |
|                | 6¾ | 4 1/16  |                       | 6-1427-82-2            |      |
|                | 2½ | 3       | 1 3/16                | 6-1612-82-1            |      |
| 3½             |    | 1 7/16  | 6-1614-82-1           |                        |      |
| 3¾             |    | 1 15/16 |                       | 6-1615-82-2            |      |
| 4½             |    | 2 5/16  |                       | 6-1618-82-2            |      |
| 5¼             |    | 2 11/16 |                       | 6-1621-82-2            |      |
| 5 5/8          |    | 3 1/16  |                       | 6-1623-82-2            |      |
| 6              |    | 3 7/16  |                       | 6-1624-82-2            |      |
| 3              | 6½ | 3 15/16 |                       | 6-1626-82-2            | 3/8  |
|                | 7  | 4 1/16  |                       | 6-1628-82-2            |      |
|                | 7½ | 4 15/16 |                       | 6-1630-82-2            |      |
|                | 4  | 1 1/16  | 6-2016-82-1           |                        |      |
|                | 5¾ | 3       |                       | 6-2023-82-2            |      |
|                | 6½ | 3 3/8   |                       | 6-2026-82-2            |      |
|                | 7¼ | 3 3/4   |                       | 6-2029-82-2            |      |
| 3½             | 7¾ | 4 ¼     |                       | 6-2031-82-2            | 3/8  |
|                | 8¼ | 4 ¾     |                       | 6-2033-82-2            |      |
|                | 8¾ | 5 ¼     |                       | 6-2035-82-2            |      |
|                | 4  | 1 1/16  | 6-2416-82-1           |                        |      |
|                | 5¾ | 3       |                       | 6-2423-82-2            |      |
|                | 6½ | 3 3/8   |                       | 6-2426-82-2            |      |
|                | 7¼ | 3 ¾     |                       | 6-2429-82-2            |      |
| 4              | 7¾ | 4 ¼     |                       | 6-2431-82-2            | 3/8  |
|                | 8¼ | 4 ¾     |                       | 6-2433-82-2            |      |
|                | 8¾ | 5 ¼     |                       | 6-2435-82-2            |      |



**TYPE I**  
For Type I  
Ball Bearing  
Bushing Assembly  
(See page 17  
for length C)

**TYPE II**  
For Type II and III  
Ball Bearing  
Bushing Assemblies  
(See page 19  
for length C)

Ball cages are made of a heat treated aluminum alloy with tough, wear-resistant qualities. They are manufactured to rigid quality control standards to assure a smooth, burr-free finish that reduces friction and the possibility of scoring.

Ball bearings are vacuum degassed quality, fatigue resistant steel and are thoroughly inspected for roundness, smooth finish and dimensional tolerance.

Ball cages are mounted to drilled and tapped guide posts by a special washer assembly which permits cage to rotate freely around guide post, when not under pre-load.

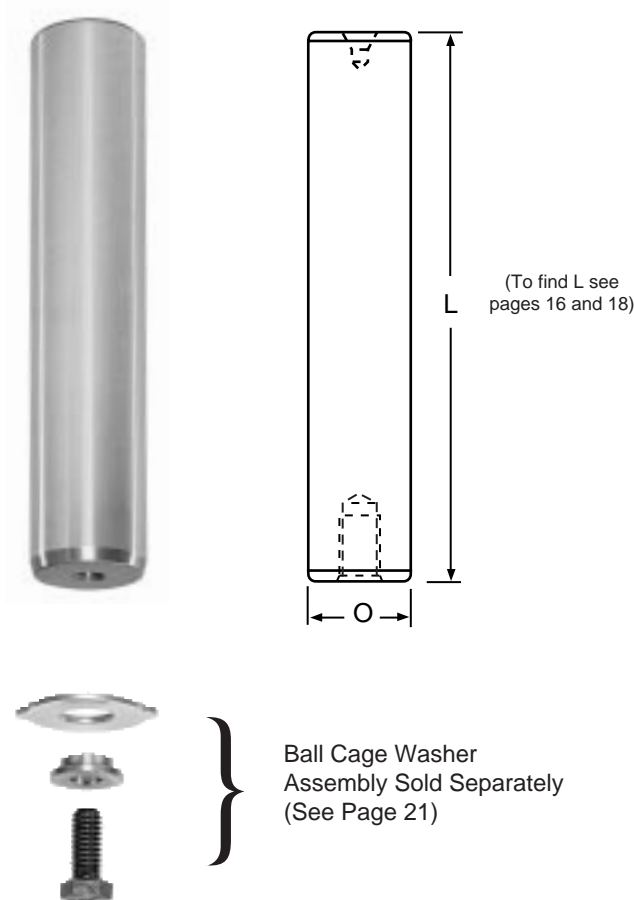
Ball bearings are arranged in a spiral pattern in the cage to minimize tracking or grooving and assure uniform wear. Each ball is retained by spinning for maximum security.

# Ball Bearing Guide Posts



| Nom. Dia. "O" | LENGTH L  | CATALOG NUMBER |
|---------------|-----------|----------------|
| 1             | 3¼        | 5-0813-82      |
|               | 3¾        | 5-0815-82      |
|               | 4¼        | 5-0817-82      |
|               | 4½        | 5-0818-82      |
|               | 4¾        | 5-0819-82      |
|               | 5         | 5-0820-82      |
|               | 5¼        | 5-0821-82      |
|               | 5½        | 5-0822-82      |
|               | 5¾        | 5-0823-82      |
|               | 6         | 5-0824-82      |
|               | 6½        | 5-0826-82      |
|               | 7         | 5-0828-82      |
|               | 7½        | 5-0830-82      |
|               | 8         | 5-0832-82      |
| 8½            | 5-0834-82 |                |
| 9             | 5-0836-82 |                |
| 1¼            | 4¼        | 5-1017-82      |
|               | 4¾        | 5-1019-82      |
|               | 5¼        | 5-1021-82      |
|               | 5½        | 5-1022-82      |
|               | 5¾        | 5-1023-82      |
|               | 6         | 5-1024-82      |
|               | 6½        | 5-1026-82      |
|               | 7         | 5-1028-82      |
|               | 7½        | 5-1030-82      |
|               | 8         | 5-1032-82      |
|               | 8½        | 5-1034-82      |
|               | 9         | 5-1036-82      |
| 10            | 5-1040-82 |                |
| 11            | 5-1044-82 |                |
| 12            | 5-1048-82 |                |
| 1½            | 4¼        | 5-1217-82      |
|               | 5         | 5-1220-82      |
|               | 5¾        | 5-1223-82      |
|               | 6         | 5-1224-82      |
|               | 6½        | 5-1226-82      |
|               | 7         | 5-1228-82      |
|               | 7½        | 5-1230-82      |
|               | 8         | 5-1232-82      |
|               | 8½        | 5-1234-82      |
|               | 9         | 5-1236-82      |
|               | 9½        | 5-1238-82      |
|               | 10        | 5-1240-82      |
|               | 10½       | 5-1242-82      |
|               | 11        | 5-1244-82      |
| 11½           | 5-1246-82 |                |
| 12            | 5-1248-82 |                |
| 12½           | 5-1250-82 |                |
| 13            | 5-1252-82 |                |
| 14            | 5-1256-82 |                |
| 1¾            | 5         | 5-1420-82      |
|               | 5¾        | 5-1423-82      |
|               | 6½        | 5-1426-82      |
|               | 7         | 5-1428-82      |
|               | 7½        | 5-1430-82      |
| 8             | 5-1432-82 |                |

| Nom. Dia. "O" | LENGTH L  | CATALOG NUMBER |
|---------------|-----------|----------------|
| 1¾            | 8½        | 5-1434-82      |
|               | 9         | 5-1436-82      |
|               | 9½        | 5-1438-82      |
|               | 10        | 5-1440-82      |
|               | 10½       | 5-1442-82      |
|               | 11        | 5-1444-82      |
|               | 11½       | 5-1446-82      |
|               | 12        | 5-1448-82      |
|               | 12½       | 5-1450-82      |
|               | 13        | 5-1452-82      |
| 14            | 5-1456-82 |                |
| 15            | 5-1460-82 |                |
| 17            | 5-1468-82 |                |
| 2             | 5¾        | 5-1623-82      |
|               | 6½        | 5-1626-82      |
|               | 7¼        | 5-1629-82      |
|               | 7½        | 5-1630-82      |
|               | 7¾        | 5-1631-82      |
|               | 8         | 5-1632-82      |
|               | 8½        | 5-1634-82      |
|               | 9         | 5-1636-82      |
|               | 9½        | 5-1638-82      |
|               | 10        | 5-1640-82      |
| 10½           | 5-1642-82 |                |
| 11            | 5-1644-82 |                |
| 11½           | 5-1646-82 |                |
| 12            | 5-1648-82 |                |
| 12½           | 5-1650-82 |                |
| 13            | 5-1652-82 |                |
| 14            | 5-1656-82 |                |
| 15            | 5-1660-82 |                |
| 16            | 5-1664-82 |                |
| 17            | 5-1668-82 |                |
| 18            | 5-1672-82 |                |
| 2½            | 8         | 5-2032-82      |
|               | 8¾        | 5-2035-82      |
|               | 9½        | 5-2038-82      |
|               | 10        | 5-2040-82      |
|               | 11        | 5-2044-82      |
|               | 12        | 5-2048-82      |
|               | 13        | 5-2052-82      |
|               | 14        | 5-2056-82      |
|               | 17        | 5-2068-82      |
|               | 18        | 5-2072-82      |
| 20            | 5-2080-82 |                |
| 3             | 8½        | 5-2434-82      |
|               | 9¼        | 5-2437-82      |
|               | 10        | 5-2440-82      |
|               | 11        | 5-2444-82      |
|               | 12        | 5-2448-82      |
|               | 13        | 5-2452-82      |
|               | 14        | 5-2456-82      |
| 17            | 5-2468-82 |                |
| 20            | 5-2480-82 |                |



Danly Precision Guide Posts for Ball Bearing Bushing Assemblies feature vacuum degassed, bearing quality, electric furnace alloy steel with a smooth, hard-wearing surface that assures free-rolling of balls and extends guide post life.

Each post is drilled and tapped at the bottom for mounting of the ball cage washer assembly. This unique mounting method permits the ball cage, except when under pre-load, to freely rotate a full 360 degrees around the guide post.

| GUIDE POST TAP SIZES |              | RECOMMENDED SEATING TORQUE |          |
|----------------------|--------------|----------------------------|----------|
| NOM. DIA. "O"        | TAP SIZE     | LBS.-IN.                   | LBS.-FT. |
| 1-1¼                 | 5/16-18 N.C. | 320                        | 26       |
| 1½-1¾-2              | 3/8-16 N.C.  | 560                        | 47       |
| 2½-3                 | ½-13 N.C.    | 1350                       | 112      |

# Demountable Ball Bearing Guide Posts



Danly Demountable Guide Posts for ball bearing bushing assemblies feature vacuum degassed, bearing quality, electric furnace alloy steel with a smooth, hard-wearing surface that assures free-rolling of balls and extends guide post life.

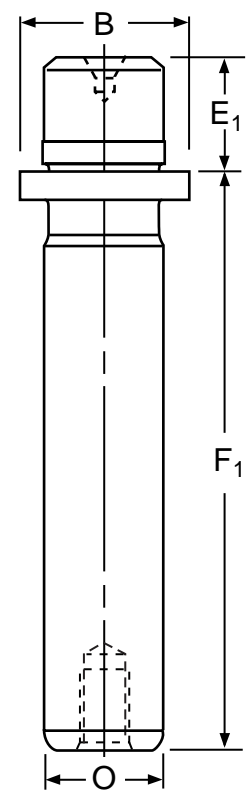
Each post is drilled and tapped at the bottom for mounting of the ball cage washer assembly. This unique mounting method utilizes the entire surface of the guide post for guiding and permits the ball cage, except when under pre-load, to freely rotate a full 360 degrees around the guide post. This free-flowing movement eliminates scoring or tracking of the guide post surface.

| POST DIAMETER                 |                                | LENGTH                         |                | CATALOG NUMBER | CLAMP DATA                     |                                 |                                |      | POST TAP SIZE                               |
|-------------------------------|--------------------------------|--------------------------------|----------------|----------------|--------------------------------|---------------------------------|--------------------------------|------|---|
| O                             | B                              | E <sub>1</sub>                 | F <sub>1</sub> |                | M                              | N                               | P                              | Y    |   |
| 1                             | 1 <sup>5</sup> / <sub>16</sub> | 1 <sup>3</sup> / <sub>16</sub> | 2.50           | 5-0810-826     | 1 <sup>3</sup> / <sub>16</sub> | 1 <sup>1</sup> / <sub>8</sub>   | 7 <sup>7</sup> / <sub>8</sub>  | .610 | 5 <sup>5</sup> / <sub>16</sub> - 18<br>N.C. |
|                               |                                |                                | 2.75           | 5-0811-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 3.00           | 5-0812-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 3.25           | 5-0813-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 3.50           | 5-0814-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 3.75           | 5-0815-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.00           | 5-0816-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.25           | 5-0817-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.50           | 5-0818-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.75           | 5-0819-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 5.25           | 5-0821-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 5.75           | 5-0823-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 6.25           | 5-0825-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 6.75           | 5-0827-826     |                                |                                 |                                |      |   |
| 7.25                          | 5-0829-826                     |                                |                |                |                                |                                 |                                |      |   |
| 7.75                          | 5-0831-826                     |                                |                |                |                                |                                 |                                |      |   |
| 1 <sup>1</sup> / <sub>4</sub> | 1 <sup>9</sup> / <sub>16</sub> | 1 <sup>3</sup> / <sub>16</sub> | 3.25           | 5-1013-826     | 6 <sup>3</sup> / <sub>64</sub> | 1 <sup>25</sup> / <sub>64</sub> | 1                              | .750 | 5 <sup>5</sup> / <sub>16</sub> - 18<br>N.C. |
|                               |                                |                                | 3.50           | 5-1014-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 3.75           | 5-1015-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.00           | 5-1016-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.25           | 5-1017-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.50           | 5-1018-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.75           | 5-1019-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 5.25           | 5-1021-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 5.75           | 5-1023-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 6.25           | 5-1025-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 6.75           | 5-1027-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 7.25           | 5-1029-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 7.75           | 5-1031-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 8.75           | 5-1035-826     |                                |                                 |                                |      |   |
| 9.75                          | 5-1039-826                     |                                |                |                |                                |                                 |                                |      |   |
| 10.75                         | 5-1043-826                     |                                |                |                |                                |                                 |                                |      |   |
| 1 <sup>1</sup> / <sub>2</sub> | 1 <sup>7</sup> / <sub>8</sub>  | 1 <sup>7</sup> / <sub>16</sub> | 3.25           | 5-1213-826     | 1 <sup>1</sup> / <sub>8</sub>  | 1 <sup>17</sup> / <sub>32</sub> | 1 <sup>1</sup> / <sub>16</sub> | .750 | 3 <sup>3</sup> / <sub>8</sub> - 16<br>N.C.  |
|                               |                                |                                | 3.50           | 5-1214-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 3.75           | 5-1215-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.00           | 5-1216-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.25           | 5-1217-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 4.50           | 5-1218-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 5.00           | 5-1220-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 5.50           | 5-1222-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 6.00           | 5-1224-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 6.50           | 5-1226-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 7.00           | 5-1228-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 7.50           | 5-1230-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 8.00           | 5-1232-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 8.50           | 5-1234-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 9.00           | 5-1236-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 9.50           | 5-1238-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 10.00          | 5-1240-826     |                                |                                 |                                |      |   |
|                               |                                |                                | 10.50          | 5-1242-826     |                                |                                 |                                |      |   |
| 11.00                         | 5-1244-826                     |                                |                |                |                                |                                 |                                |      |   |
| 11.50                         | 5-1246-826                     |                                |                |                |                                |                                 |                                |      |   |
| 12.50                         | 5-1250-826                     |                                |                |                |                                |                                 |                                |      |   |



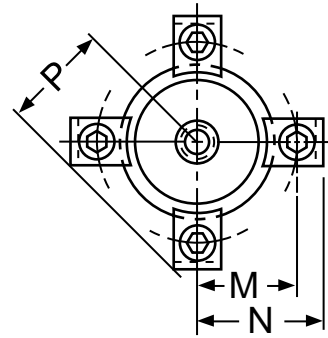
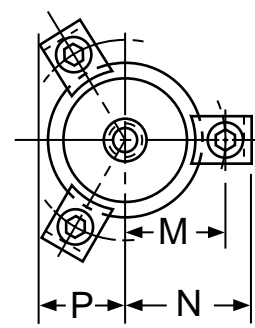


| POST DIAMETER |            | LENGTH         |                | CATALOG NUMBER | CLAMP DATA |         |         |      | POST TAP SIZE    |
|---------------|------------|----------------|----------------|----------------|------------|---------|---------|------|------------------|
| O             | B          | E <sub>1</sub> | F <sub>1</sub> |                | M          | N       | P       | Y    |                  |
| 1 3/4         | 2 1/4      | 1 11/16        | 3.75           | 5-1415-826     | 1 19/64    | 1 45/64 | 1 3/8   | .750 | 3/8 - 16<br>N.C. |
|               |            |                | 4.00           | 5-1416-826     |            |         |         |      |                  |
|               |            |                | 4.25           | 5-1417-826     |            |         |         |      |                  |
|               |            |                | 4.50           | 5-1418-826     |            |         |         |      |                  |
|               |            |                | 4.75           | 5-1419-826     |            |         |         |      |                  |
|               |            |                | 5.25           | 5-1421-826     |            |         |         |      |                  |
|               |            |                | 5.75           | 5-1423-826     |            |         |         |      |                  |
|               |            |                | 6.25           | 5-1425-826     |            |         |         |      |                  |
|               |            |                | 6.75           | 5-1427-826     |            |         |         |      |                  |
|               |            |                | 7.25           | 5-1429-826     |            |         |         |      |                  |
|               |            |                | 7.75           | 5-1431-826     |            |         |         |      |                  |
|               |            |                | 8.25           | 5-1433-826     |            |         |         |      |                  |
|               |            |                | 8.75           | 5-1435-826     |            |         |         |      |                  |
|               |            |                | 9.25           | 5-1437-826     |            |         |         |      |                  |
|               |            |                | 9.75           | 5-1439-826     |            |         |         |      |                  |
|               |            |                | 10.25          | 5-1441-826     |            |         |         |      |                  |
| 10.75         | 5-1443-826 |                |                |                |            |         |         |      |                  |
| 11.25         | 5-1445-826 |                |                |                |            |         |         |      |                  |
| 12.25         | 5-1449-826 |                |                |                |            |         |         |      |                  |
| 13.25         | 5-1453-826 |                |                |                |            |         |         |      |                  |
| 14.25         | 5-1457-826 |                |                |                |            |         |         |      |                  |
| 15.25         | 5-1461-826 |                |                |                |            |         |         |      |                  |
| 2             | 2 1/2      | 1 15/16        | 4.25           | 5-1617-826     | 1 27/64    | 1 53/64 | 1 9/16  | .750 | 3/8 - 16<br>N.C. |
|               |            |                | 4.50           | 5-1618-826     |            |         |         |      |                  |
|               |            |                | 4.75           | 5-1619-826     |            |         |         |      |                  |
|               |            |                | 5.00           | 5-1620-826     |            |         |         |      |                  |
|               |            |                | 5.25           | 5-1621-826     |            |         |         |      |                  |
|               |            |                | 5.50           | 5-1622-826     |            |         |         |      |                  |
|               |            |                | 5.75           | 5-1623-826     |            |         |         |      |                  |
|               |            |                | 6.00           | 5-1624-826     |            |         |         |      |                  |
|               |            |                | 6.50           | 5-1626-826     |            |         |         |      |                  |
|               |            |                | 7.00           | 5-1628-826     |            |         |         |      |                  |
|               |            |                | 7.50           | 5-1630-826     |            |         |         |      |                  |
|               |            |                | 8.00           | 5-1632-826     |            |         |         |      |                  |
|               |            |                | 8.50           | 5-1634-826     |            |         |         |      |                  |
|               |            |                | 9.00           | 5-1636-826     |            |         |         |      |                  |
|               |            |                | 9.50           | 5-1638-826     |            |         |         |      |                  |
|               |            |                | 10.00          | 5-1640-826     |            |         |         |      |                  |
| 10.50         | 5-1642-826 |                |                |                |            |         |         |      |                  |
| 11.00         | 5-1644-826 |                |                |                |            |         |         |      |                  |
| 12.00         | 5-1648-826 |                |                |                |            |         |         |      |                  |
| 13.00         | 5-1652-826 |                |                |                |            |         |         |      |                  |
| 14.00         | 5-1656-826 |                |                |                |            |         |         |      |                  |
| 15.00         | 5-1660-826 |                |                |                |            |         |         |      |                  |
| 16.00         | 5-1664-826 |                |                |                |            |         |         |      |                  |
| 2 1/2         | 3 1/32     | 1 15/16        | 6.00           | 5-2024-826     | 1 43/64    | 2 5/64  | 1 23/32 | .750 | 1/2 - 13<br>N.C. |
|               |            |                | 6.50           | 5-2026-826     |            |         |         |      |                  |
|               |            |                | 7.00           | 5-2028-826     |            |         |         |      |                  |
|               |            |                | 8.00           | 5-2032-826     |            |         |         |      |                  |
|               |            |                | 9.00           | 5-2036-826     |            |         |         |      |                  |
|               |            |                | 10.00          | 5-2040-826     |            |         |         |      |                  |
|               |            |                | 11.00          | 5-2044-826     |            |         |         |      |                  |
|               |            |                | 12.00          | 5-2048-826     |            |         |         |      |                  |
| 15.00         | 5-2060-826 |                |                |                |            |         |         |      |                  |
| 18.00         | 5-2072-826 |                |                |                |            |         |         |      |                  |
| 3             | 3 1/2      | 2 7/16         | 6.00           | 5-2424-826     | 1 59/64    | 2 21/64 | 1 29/32 | .750 | 1/2 - 13<br>N.C. |
|               |            |                | 6.50           | 5-2426-826     |            |         |         |      |                  |
|               |            |                | 7.50           | 5-2430-826     |            |         |         |      |                  |
|               |            |                | 8.50           | 5-2434-826     |            |         |         |      |                  |
|               |            |                | 9.50           | 5-2438-826     |            |         |         |      |                  |
|               |            |                | 10.50          | 5-2442-826     |            |         |         |      |                  |
|               |            |                | 11.50          | 5-2446-826     |            |         |         |      |                  |
|               |            |                | 14.50          | 5-2458-826     |            |         |         |      |                  |
| 17.50         | 5-2470-826 |                |                |                |            |         |         |      |                  |



F<sub>1</sub> (To find F<sub>1</sub> see pages 16 and 18)

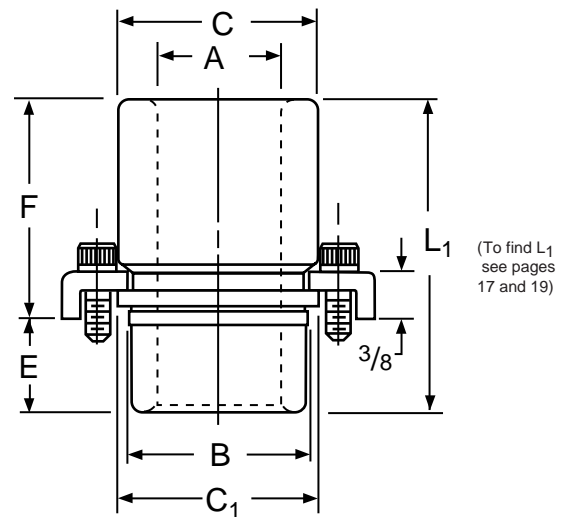
**Clamp Arrangements**  
For Demountable Guide Post



# Demountable Ball Bearing Bushings



| NOM. POST DIA. | NOM. BUSHING I.D. | B     | C     | C <sub>1</sub> | E       | F     | L <sub>1</sub> | CATALOG NUMBER |
|----------------|-------------------|-------|-------|----------------|---------|-------|----------------|----------------|
|                | A                 |       |       |                |         |       |                |                |
| 1              | 1 3/8             | 1 7/8 | 2 1/8 | 2.283          | 1 3/16  | 1 1/4 | 2 7/16         | 6-0805-85      |
|                |                   |       |       |                |         | 1 3/4 | 2 15/16        | 6-0807-85      |
|                |                   |       |       |                |         | 2 1/4 | 3 7/16         | 6-0809-85      |
|                |                   |       |       |                |         | 2 3/4 | 3 15/16        | 6-0811-85      |
| 1 1/4          | 1 5/8             | 2 1/8 | 2 3/8 | 2.533          | 1 3/16  | 1 3/4 | 2 15/16        | 6-1007-85      |
|                |                   |       |       |                |         | 2 1/4 | 3 7/16         | 6-1009-85      |
|                |                   |       |       |                |         | 2 3/4 | 3 15/16        | 6-1011-85      |
| 1 1/2          | 1 7/8             | 2 1/2 | 2 7/8 | 3.033          | 1 7/16  | 1 1/2 | 2 15/16        | 6-1206-85      |
|                |                   |       |       |                |         | 2 1/4 | 3 11/16        | 6-1209-85      |
|                |                   |       |       |                |         | 3     | 4 7/16         | 6-1212-85      |
|                |                   |       |       |                |         | 3 1/2 | 4 15/16        | 6-1214-85      |
| 1 3/4          | 2 1/8             | 2 3/4 | 3 1/8 | 3.283          | 1 11/16 | 1 3/4 | 3 7/16         | 6-1407-85      |
|                |                   |       |       |                |         | 2 1/2 | 4 3/16         | 6-1410-85      |
|                |                   |       |       |                |         | 3 1/4 | 4 15/16        | 6-1413-85      |
| 2              | 2 1/2             | 3 1/4 | 3 5/8 | 3.783          | 1 15/16 | 2     | 3 15/16        | 6-1608-85      |
|                |                   |       |       |                |         | 2 3/4 | 4 11/16        | 6-1611-85      |
|                |                   |       |       |                |         | 3 1/2 | 5 7/16         | 6-1614-85      |
|                |                   |       |       |                |         | 4 1/4 | 6 3/16         | 6-1617-85      |
|                |                   |       |       |                |         | 5     | 6 15/16        | 6-1620-85      |
| 2 1/2          | 3                 | 3 3/4 | 4 1/8 | 4.283          | 1 15/16 | 4     | 5 15/16        | 6-2016-85      |
|                |                   |       |       |                |         | 4 3/4 | 6 11/16        | 6-2019-85      |
|                |                   |       |       |                |         | 5 1/2 | 7 7/16         | 6-2022-85      |
| 3              | 3 1/2             | 4 1/4 | 4 3/4 | 4.908          | 1 15/16 | 4     | 5 15/16        | 6-2416-85      |
|                |                   |       |       |                |         | 4 3/4 | 6 11/16        | 6-2419-85      |
|                |                   |       |       |                |         | 5 1/2 | 7 7/16         | 6-2422-85      |

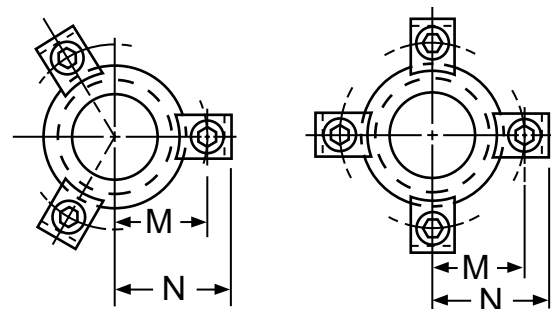


Danly Demountable Bushings feature vacuum degassed, bearing quality, electric furnace alloy steel. They are designed for a tap fit installation and are assembled to the die holder by easily mounted clamps and screws which provide four times the holding power of pressed-in bushings. By simply removing clamps, bushings are easily demounted from die holder for die grinding or repair.

## Clamp Dimensions

| NOM. POST DIA. | M       | N       | CLAMPS PER BUSHING | CLAMP CAT. NO. | SCREW SIZE            |
|----------------|---------|---------|--------------------|----------------|-----------------------|
| 1              | 1 5/16  | 1 11/16 | 3                  | 6-91-1         | 5/16 - 18 NC X 3/4 LG |
| 1 1/4          | 1 7/16  | 1 13/16 |                    |                |                       |
| 1 1/2          | 1 11/16 | 2 1/16  |                    |                |                       |
| 1 3/4          | 1 13/16 | 2 3/16  | 4                  |                |                       |
| 2              | 2 1/16  | 2 7/16  |                    |                |                       |
| 2 1/2          | 2 5/16  | 2 11/16 |                    |                |                       |
| 3              | 2 5/8   | 3       |                    |                |                       |

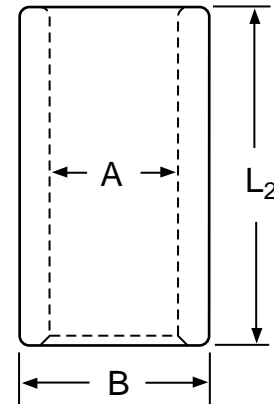
## Clamp Arrangements



# Straight Sleeve Ball Bearing Bushings



| NOM. POST DIA. | NOM. BUSHING I.D. | NOM. BUSHING O.D. | LENGTH L <sub>2</sub> | CATALOG NUMBER |
|----------------|-------------------|-------------------|-----------------------|----------------|
|                | A                 | B                 |                       |                |
| 1              | 1 3/8             | 1 7/8             | 2 1/2                 | 6-0810-86      |
|                |                   |                   | 3                     | 6-0812-86      |
|                |                   |                   | 3 1/2                 | 6-0814-86      |
|                |                   |                   | 4                     | 6-0816-86      |
|                |                   |                   | 4 1/2                 | 6-0818-86      |
|                | 5                 | 6-0820-86         |                       |                |
| 1 1/4          | 1 5/8             | 2 1/8             | 3                     | 6-1012-86      |
|                |                   |                   | 3 1/2                 | 6-1014-86      |
|                |                   |                   | 4                     | 6-1016-86      |
|                |                   |                   | 4 1/2                 | 6-1018-86      |
|                |                   |                   | 5                     | 6-1020-86      |
|                | 6                 | 6-1024-86         |                       |                |
| 1 1/2          | 1 7/8             | 2 1/2             | 3                     | 6-1212-86      |
|                |                   |                   | 3 3/4                 | 6-1215-86      |
|                |                   |                   | 4 1/2                 | 6-1218-86      |
|                |                   |                   | 5                     | 6-1220-86      |
|                |                   |                   | 5 1/2                 | 6-1222-86      |
|                |                   |                   | 6                     | 6-1224-86      |
|                |                   |                   | 7                     | 6-1228-86      |
|                | 8                 | 6-1232-86         |                       |                |
| 1 3/4          | 2 1/8             | 2 3/4             | 3 1/2                 | 6-1414-86      |
|                |                   |                   | 4 1/4                 | 6-1417-86      |
|                |                   |                   | 5                     | 6-1420-86      |
|                |                   |                   | 5 1/2                 | 6-1422-86      |
|                |                   |                   | 6                     | 6-1424-86      |
|                |                   |                   | 7                     | 6-1428-86      |
|                |                   |                   | 8                     | 6-1432-86      |
|                | 9                 | 6-1436-86         |                       |                |
| 2              | 2 1/2             | 3 1/4             | 4                     | 6-1616-86      |
|                |                   |                   | 4 3/4                 | 6-1619-86      |
|                |                   |                   | 5 1/2                 | 6-1622-86      |
|                |                   |                   | 6 1/4                 | 6-1625-86      |
|                |                   |                   | 7                     | 6-1628-86      |
|                |                   |                   | 8                     | 6-1632-86      |
|                |                   |                   | 9                     | 6-1636-86      |
|                | 10                | 6-1640-86         |                       |                |
| 2 1/2          | 3                 | 3 3/4             | 6                     | 6-2024-86      |
|                |                   |                   | 6 3/4                 | 6-2027-86      |
|                |                   |                   | 7 1/2                 | 6-2030-86      |
|                |                   |                   | 8 1/2                 | 6-2034-86      |
|                |                   |                   | 9 1/2                 | 6-2038-86      |
|                | 10 1/2            | 6-2042-86         |                       |                |
| 3              | 3 1/2             | 4 1/4             | 6                     | 6-2424-86      |
|                |                   |                   | 6 3/4                 | 6-2427-86      |
|                |                   |                   | 7 1/2                 | 6-2430-86      |
|                |                   |                   | 8 1/2                 | 6-2434-86      |
|                |                   |                   | 9 1/2                 | 6-2438-86      |
|                |                   |                   | 10 1/2                | 6-2442-86      |



(To find L<sub>2</sub> see pages 17 and 19)

Precision Straight Sleeve Bushings feature vacuum degassed, bearing quality, electric furnace alloy steel. Like all components of the Danly Ball Bearing Bushing Assembly, these straight sleeve bushings are completely interchangeable.

## INSTALLATION INSTRUCTIONS

In order to avoid the bushing close-in which occurs as a result of press-fit, these bushings, should be retained with Danly Bushing Mount. When so installed, it is not necessary to hone the bushing bore after installation, and the bushing fit will be correct.

Application of Danly Bushing Mount

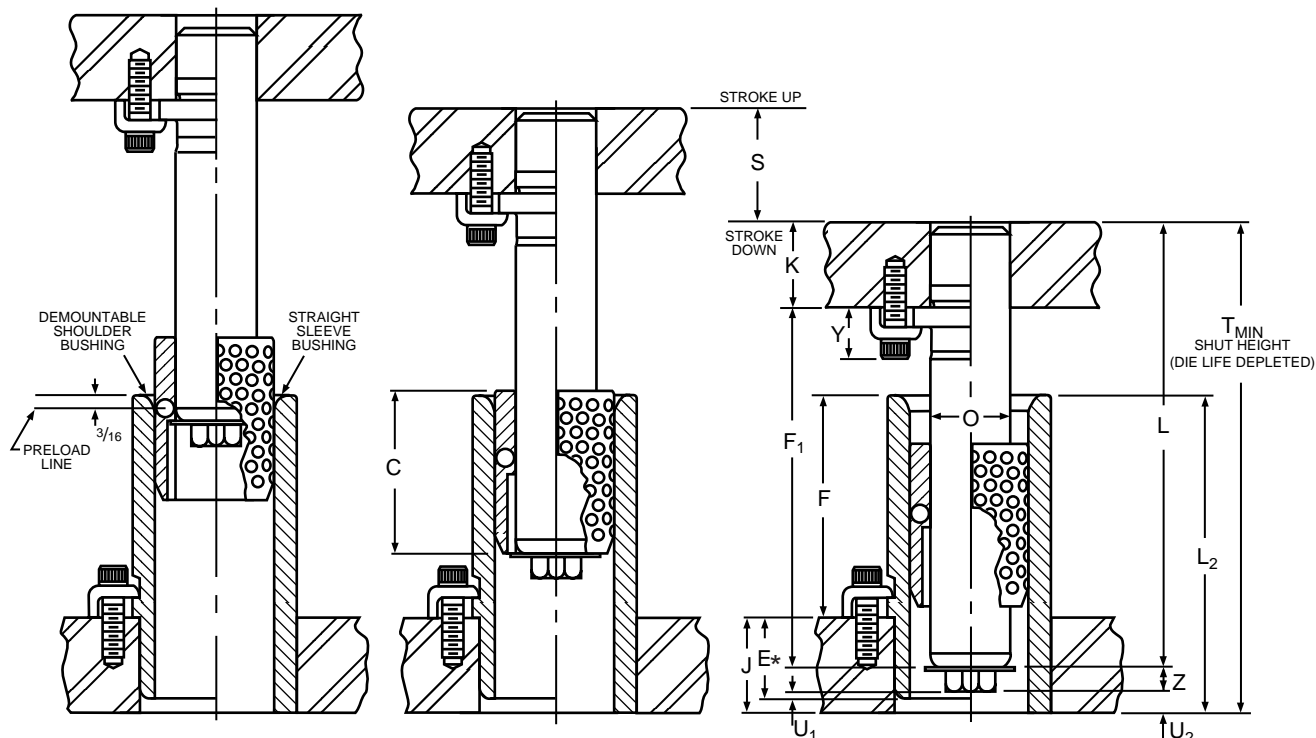
1. Degrease bushing OD and die shoe bore with alcohol, acetone or other volatile solvent and wipe dry.
2. Apply Bushing Mount sparingly and wring bushing into die shoe.
3. Allow 4 hour cure at 72° F. Do not disturb bushing until cure is complete.

## DANLY BUSHING MOUNT

CATALOG NO. 9-0060-82

| NOM. GUIDE POST DIA. | BORE SIZES                   |  |
|----------------------|------------------------------|--|
|                      | PUNCH HOLDER FOR GUIDE POSTS | DIE SHOE FOR SHOULDER OR STRAIGHT SLEEVE BALL BUSHINGS |
| 1                    | .9988<br>.9980               | 1.8755<br>1.8748                                       |
| 1 1/4                | 1.2488<br>1.2480             | 2.1255<br>2.1248                                       |
| 1 1/2                | 1.4983<br>1.4975             | 2.5005<br>2.4998                                       |
| 1 3/4                | 1.7483<br>1.7475             | 2.7505<br>2.7498                                       |
| 2                    | 1.9983<br>1.9975             | 3.2505<br>3.2498                                       |
| 2 1/2                | 2.4978<br>2.4970             | 3.7505<br>3.7498                                       |
| 3                    | 2.9978<br>2.9970             | 4.2505<br>4.2498                                       |

## Data for Finding Guide Post Length Type I - Full Pre-Load Throughout Stroke



**Assembly Condition** - Ball Cage Must Hang On Washer Tangs

| TYPE OF GUIDE POST | TYPE OF BUSHING  |  |
|--------------------|--|--|
|                    | DEMOUNTABLE SHOULDER BUSHING   | STRAIGHT SLEEVE BUSHING  |
| STRAIGHT POST      | $L = T - U_1 - Z - J + E$  | $L = T - U_2 - Z$  |
| DEMOUNTABLE POST   | $F_1 = T - U_1 - Z - J + E - K$<br><b>CAUTION</b><br>$F + J + K + Y < T$ | $F_1 = T - U_2 - Z - K$<br><b>CAUTION</b><br>$L_2 + K + Y < T$ |

| POST DIA. O | TYPE I Z | E       | U <sub>1</sub> | U <sub>2</sub> |
|-------------|----------|---------|----------------|----------------|
| 1           | 5/16     | 1 3/16  | 1/16           | 1/8            |
| 1 1/4       | 5/16     | 1 3/16  |                |                |
| 1 1/2       | 3/8      | 1 7/16  |                |                |
| 1 3/4       | 3/8      | 1 11/16 |                |                |
| 2           | 3/8      | 1 15/16 |                |                |
| 2 1/2       | 1/2      | 1 15/16 |                |                |
| 3           | 1/2      | 1 15/16 |                |                |

\*Die shoe thickness must be greater than the "E" dimension when shoulder bushing is used.

**Note:** If calculated guide post length is not listed on page 11, 12, or 13:

1. Select next longer length and cut off to required length,  
**(Caution: Demountable Guide Post may not be cut off; choose next shorter length.)**

2. Or, select shorter length and recess post in punch holder to obtain correct L dimension.

Press fit length should be equal to or greater than the diameter of the guide post, if possible.

**Note:** On Type I Assemblies, a die set designed for a particular stroke may be used in any press of lesser stroke, but never in any press where the stroke is greater than originally chosen.

**Caution:** Be sure bushing does not strike punch holder at minimum shutoff height. If this condition exists, use shorter bushing and corresponding ball cage.

### Instructions For Using Chart On Page 17

Selection of a Type I Ball Bearing Bushing Assembly is based on the required stroke and the guide post diameter. With these two factors established, refer to the Selection Chart:

- Under the heading Stroke "S", find the column for the desired stroke.
- Move down this column to colored square on horizontal line opposite required Post diameter.
- For required bushing length, move to left from colored square on horizontal line to Bushing Length column. (See "Caution" Note at bottom of page.)
- Select cage length from Ball Cage column. Select length shown within colored area matching the colored square in which stroke and bushing length selections intersect. Increased life is provided when longest cage length is selected, shutoff height permitting.

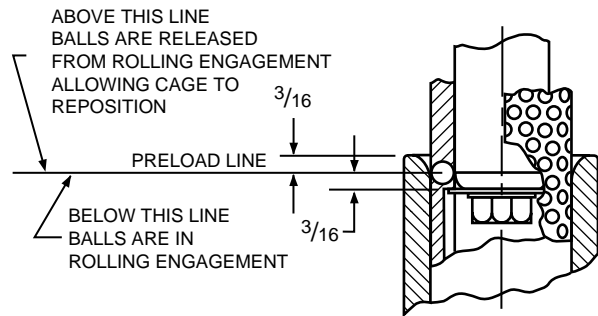
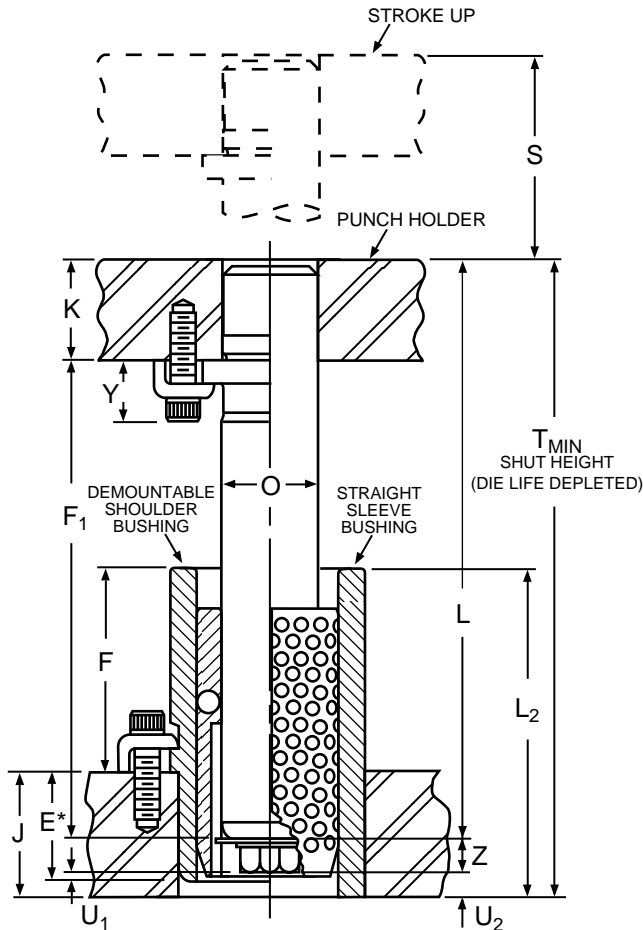
\***Note:** If die grind is not required, stroke may be increased by the amount of die grind allowance shown in "X" column. If die grind is greater than the amount shown, stroke will shorten by the additional amount added.



# Type I Bushing & Ball Cage Selection Chart



| NOM. POST DIA. | BALL BUSHING                    |       |        |                            |                |                | BALL CAGE<br>Page 10 | STROKE "S" INCLUDING DIE GRIND ALLOWANCE |                |       |       |       |       |       |       |       |       |       | Maximum Die Grind Allowance<br>X |       |       |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   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|                | DEMOUNTABLE SHOULDER<br>Page 14 |       |        | STRAIGHT SLEEVE<br>Page 15 |                |                |                      | C  | 1/2            | 1     | 1 1/2 | 2     | 2 1/2 | 3     | 3 1/2 | 4     | 4 1/2 | 5     |                                  | 5 1/2 | 6     | Z |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    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  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
|                | O                               | E     | F      | L <sub>1</sub>             | U <sub>1</sub> | L <sub>2</sub> |                      |  | U <sub>2</sub> | 1/2   | 1     | 1 1/2 | 2     | 2 1/2 | 3     | 3 1/2 | 4     | 4 1/2 |                                  | 5     | 5 1/2 | 6 | Z |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
| 1              | 1 1/16                          | 1 3/4 | 2 1/16 | 1/16                       | 3              | 1/8            | 1 1/2                | 1/2                                      | 1              | 1 1/2 | 2     | 2 1/2 | 3     | 3 1/2 | 4     | 4 1/2 | 5     | 5 1/2 | 6                                | 6 1/2 | 7     | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 | 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 | 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 | 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 | 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 | 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 | 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 | 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 | 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 | 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 | 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 | 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 | 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 | 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 | 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 |
|                |                                 | 2 1/4 | 3 1/16 | 1/16                       | 3 1/2          | 1/8            |                      | 2  | 1/2            | 1     | 1 1/2 | 2     | 2 1/2 | 3     | 3 1/2 | 4     | 4 1/2 | 5     | 5 1/2                            | 6     | 6 1/2 | 7 | 8 | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99  | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |



### Data For Finding Guide Post Length

| TYPE OF GUIDE POST | TYPE OF BUSHING  |  |
|--------------------|--|--|
|                    | DEMOUNTABLE SHOULDER BUSHING   | STRAIGHT SLEEVE BUSHING  |
| STRAIGHT POST      | $L = T - U_1 - Z - J + E$  | $L = T - U_2 - Z$  |
| DEMOUNTABLE POST   | $F_1 = T - U_1 - Z - J + E - K$<br><b>CAUTION</b><br>$F + J + K + Y < T$ | $F_1 = T - U_2 - Z - K$<br><b>CAUTION</b><br>$L_2 + K + Y < T$ |

| POST DIA. O | Z       | E          | U <sub>1</sub> | U <sub>2</sub> |
|-------------|---------|------------|----------------|----------------|
| 1           | $15/32$ | $1\ 3/16$  | $1/16$         | $1/8$          |
| $1\ 1/4$    | $15/32$ | $1\ 3/16$  |                |                |
| $1\ 1/2$    | $1/2$   | $1\ 7/16$  |                |                |
| $1\ 3/4$    | $1/2$   | $1\ 11/16$ |                |                |
| 2           | $1/2$   | $1\ 15/16$ |                |                |
| $2\ 1/2$    | $9/16$  | $1\ 15/16$ |                |                |
| 3           | $9/16$  | $1\ 15/16$ |                |                |

\*Die shoe thickness must be greater than the "E" dimension when shoulder bushing is used.

**Note:** If calculated guide post length is not listed on page 11, 12 and 13:  
 1. Select next longer length and cut off to required length,  
 (Caution: Demountable Guide Post may not be cut off; choose next shorter length.)

2. Or, select shorter length and recess post in punch holder to obtain correct "L" dimension.

Press fit length should be equal to or greater than the diameter of the guide post, if possible.

### Instructions For Using Types II and III Bushing and Ball Cage Selection Chart

To select a Type II or Type III Ball Bearing Bushing Assembly:

1. Determine the desired stroke,
2. Determine the required guide post diameter,
3. Determine the desired operating condition, or the extent to which the cage leaves the bushing,
4. Last, determine whether a Demountable or Straight Sleeve Bushing is preferred.

Once these four factors: (1) stroke, (2) guide post diameter, (3) operating condition and (4) type of bushing, are established, refer to the Selection Chart on pages 19 and 20.

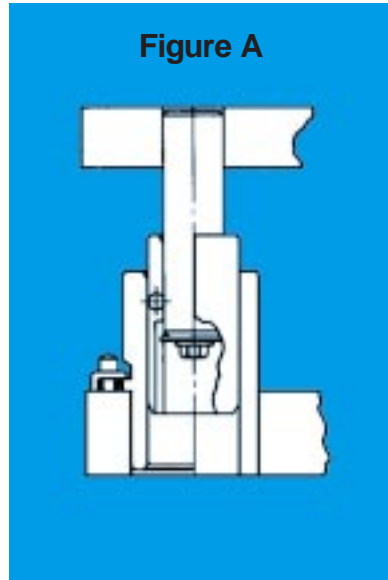
First find the column headed by the desired stroke (S). Moving down this column, opposite the required guide post diameter, find the color square in the desired operating condition

(Salmon for condition shown in Figure A; Red for condition shown in Figure B; Yellow for condition shown in Figure C.) Selection of the longest bushing-cage combination, shutheight permitting, will provide increased life.

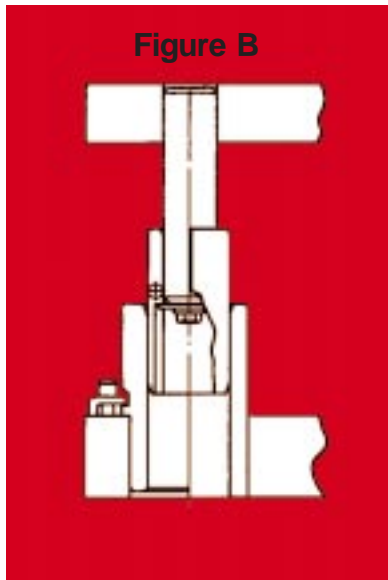
Once the square has been determined, follow the horizontal line to the left for selection of bushing and ball cage lengths. Refer to chart above to select guide post length. When these have been selected, refer back to the pages giving full dimensions and catalog numbers of these assembly components.

**Note:** If stroking rate is under 150 SPM, Figure B is recommended, which allows the ball cage to reposition at each stroke.

# Types II & III Bushing & Ball Cage Selection Chart



Partial Pre-load



Pre-load Relieved

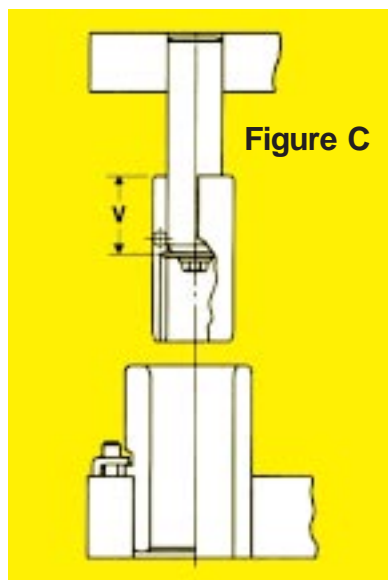


Figure C

Unlimited Stroke Cage Leaves Bushing

| NOM. POST DIA. | BALL BUSHING                    |        |                |                |                            |                | BALL CAGE | STROKE "S" AT MINIMUM SHUTHEIGHT (DIE LIFE DEPLETED) |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       | v     |       |       |       |       |       |       |         |         |        |        |        |
|----------------|---------------------------------|--------|----------------|----------------|----------------------------|----------------|-----------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|---------|--------|--------|--------|
|                | DEMOUNTABLE SHOULDER<br>Page 14 |        |                |                | STRAIGHT SLEEVE<br>Page 15 |                |           | C  | 1/2   | 1     | 1 1/2 | 2     | 2 1/2 | 3     | 3 1/2 | 4     | 4 1/2 | 5     | 5 1/2 | 6     | 6 1/2 | 7     | 7 1/2 | 8     |       | 9     | 10    | 11    | 12    | 13    | 14    | 15      | 16      |        |        |        |
| O              | E                               | F      | L <sub>1</sub> | U <sub>1</sub> | L <sub>2</sub>             | U <sub>2</sub> |           |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |         |         |        |        |        |
| 1              | 1 3/16                          | 1 1/4  | 2 7/16         | 1/16           | 2 1/2                      | 1/8            | 2         | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | 7/8     |         |        |        |        |
|                |                                 | 1 3/4  | 2 5/16         |                | 3                          |                | 2 1/2     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 1 1/8  |        |
|                |                                 | 2 1/4  | 3 7/16         |                | 3 1/2                      |                | 3         | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 1 3/8  |        |
|                |                                 | 2 3/4  | 3 5/16         |                | 4                          |                | 3 1/2     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 1 1/4  |        |
|                |                                 |        |                |                | 4 1/2                      |                | 4         | 3 1/2  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 1 1/2  |        |
| 1 1/4          | 1 3/16                          | 1 3/4  | 2 5/16         | 1/16           | 3                          | 1/8            | 2 3/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | 1 1/4   |         |        |        |        |
|                |                                 | 2 1/4  | 3 7/16         |                | 3 1/2                      |                | 3 1/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 1 1/2  |        |        |
|                |                                 | 2 3/4  | 3 5/16         |                | 4                          |                | 3 3/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 1 3/4  |        |        |
|                |                                 |        |                |                | 4 1/2                      |                | 4         | 4  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2      |        |
|                |                                 |        |                |                | 5                          |                | 4 1/2     | 5  | 5     | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2 1/4  |        |
|                |                                 |        |                |                | 6                          |                | 4 3/4     | 6  | 6     | 6     | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2 1/2  |        |
| 1 3/4          | 1 11/16                         | 1 3/4  | 3 7/16         | 1/16           | 3 1/2                      | 1/8            | 3 1/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | 1 1/2   |         |        |        |        |
|                |                                 | 2 1/2  | 4 3/16         |                | 4 1/4                      |                | 4         | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 1 7/8  |        |        |
|                |                                 | 3 1/4  | 4 5/16         |                | 5                          |                | 4 3/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 2 1/4  |        |        |
|                |                                 |        |                |                | 6                          |                | 5 1/4     | 6  | 6 1/4 | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2 1/2  |        |
|                |                                 |        |                |                | 7                          |                | 5 3/4     | 7  | 7     | 7     | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2 3/4  |        |
| 2              | 1 15/16                         | 2      | 3 5/16         | 1/16           | 4                          | 1/8            | 3 3/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | 1 3/4   |         |        |        |        |
|                |                                 | 2 3/4  | 4 11/16        |                | 4 3/4                      |                | 4 1/2     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 1 1/8  |        |        |
|                |                                 | 3 1/2  | 5 7/16         |                | 5 1/2                      |                | 5 1/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 2 1/2  |        |        |
|                |                                 | 4 1/4  | 6 3/16         |                | 6 1/4                      |                | 6         | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2 3/4  |        |
|                |                                 | 5      | 6 5/16         |                | 7                          |                | 7         | 7  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 2 1/2  |        |
| 2 1/2          | 1 5/16                          | 4      | 5 5/16         | 1/16           | 6                          | 1/8            | 5 3/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | 2 11/16 |         |        |        |        |
|                |                                 | 4 3/4  | 6 11/16        |                | 6 3/4                      |                | 6 1/2     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | 3 1/16 |        |        |
|                |                                 | 5 1/2  | 7 7/16         |                | 7 1/2                      |                | 7 1/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 3 7/16 |        |
|                |                                 |        |                |                | 8 1/2                      |                | 7 3/4     | 8  | 8 1/4 | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | Green  | 3 7/16 |
|                |                                 |        |                |                | 9 1/2                      |                | 8 1/4     | 9  | 9     | 9     | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | Green  | 3 7/16 |
| 3              | 1 5/16                          | 4      | 5 5/16         | 1/16           | 6                          | 1/8            | 5 3/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | 2 11/16 |        |        |        |
|                |                                 | 4 3/4  | 6 11/16        |                | 6 3/4                      |                | 6 1/2     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 3 1/16 |        |
|                |                                 | 5 1/2  | 7 7/16         |                | 7 1/2                      |                | 7 1/4     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | 3 7/16 |        |
|                |                                 |        |                |                | 8 1/2                      |                | 7 3/4     | 8  | 8 1/4 | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | Green  | 3 7/16 |
|                |                                 |        |                |                | 9 1/2                      |                | 8 1/4     | 9  | 9     | 9     | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green   | Green   | Green  | Green  | 3 7/16 |
|                |                                 | 10 1/2 | 8 3/4          | 10             | 10                         | 10             | Green     | Green  | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | Green | 3 7/16  |         |        |        |        |

**CAUTION:** Be sure bushing does not strike punch holder at minimum shutheight and if this condition exists, use shorter bushing and corresponding ball cage.

(Sleeve Bushing: L<sub>2</sub> + K must be less than T)  
(Shoulder Bushing: J + F + K must be less than T)

Demountable Bushing:  
Maximum F=T-J-K

Sleeve Bushing:  
Maximum L<sub>2</sub>=T-K

## Clamping Data

| DEMOUNTABLE SHOULDER BUSHING CLAMP ARRANGEMENT SELECTION DATA |              |                                    |                |
|---|--------------|------------------------------------|----------------|
| NOM. POST DIA.  | A (L-R FEED) | B (F-B FEED)<br>(CENTER POST SETS) | C (ROUND DIES) |
| 1<br>&<br>1 1/4   |              |                                    |                |
| 1 1/2<br>&<br>1 3/4   |              |                                    |                |
| 2   |              |                                    |                |
| 2 1/2<br>&<br>3   |              |                                    |                |

| BUSHING CLAMP DATA |         |         |           |
|--------------------|---------|---------|-----------|
|                    |         |         |           |
| NOM. POST DIA.     | M       | N       | PER BUSH. |
| 1                  | 1 5/16  | 1 11/16 | 3         |
| 1 1/4              | 1 7/16  | 1 13/16 |           |
| 1 1/2              | 1 11/16 | 2 1/16  | 4         |
| 1 3/4              | 1 13/16 | 2 3/16  |           |
| 2                  | 2 1/16  | 2 7/16  |           |
| 2 1/2              | 2 5/16  | 2 11/16 |           |
| 3                  | 2 5/8   | 3       |           |

**Note:** If not specified, clamp arrangement **A** will be furnished. Clamp arrangement **B** is furnished on Center Post Sets. AS-37BB sets with 1" and 1 1/4" diameter demountable bushings are furnished with four clamps on right front corner only.

## Miscellaneous Component Parts

| NOM. POST DIA. |                         |            |                     |                             |                |             |                              |  |
|----------------|-------------------------|------------|---------------------|-----------------------------|----------------|-------------|------------------------------|--|
|                | STOP WASHER-RETAINER    |            | BUSHING STOP WASHER |                             | HEX HEAD SCREW |             | SNAP RING-BALL BEARING CAGES |  |
|                | USED WITH ASSEMBLY TYPE |            |                     |                             |                |             |                              |  |
|                | I                       | II and III | II and III          | I, II, and III              | II and III     | I           | II                           |  |
| 1              | 5-0800-831              | 5-0800-832 | 5-0800-840          | 9-0506-730<br>5/16-18 x 3/4 | 6-0800-832     | 6-0008-82-1 | 6-0008-82-2                  |  |
| 1 1/4          | 5-1000-831              | 5-1000-832 |                     |                             | 6-1000-832     | 6-0010-82-1 | 6-0010-82-2                  |  |
| 1 1/2          | 5-1200-831              | 5-1200-832 | 5-1200-840          | 9-0607-730<br>3/8-16 x 7/8  | 6-1200-832     | 6-0012-82-1 | 6-0012-82-2                  |  |
| 1 3/4          | 5-1400-831              | 5-1400-832 |                     |                             | 6-1400-832     | 6-0014-82-1 | 6-0014-82-2                  |  |
| 2              | 5-1600-831              | 5-1600-832 |                     |                             | 6-1600-832     | 6-0016-82-1 | 6-0016-82-2                  |  |
| 2 1/2          | 5-2000-831              | 5-2000-832 | 5-2400-840          | 9-0808-730<br>1/2-13 x 1    | 6-2000-832     | 6-0020-82-1 | 6-0020-82-2                  |  |
| 3              | 5-2400-831              | 5-2400-832 |                     |                             | 6-2400-832     | 6-0024-82-1 | 6-0024-82-2                  |  |

### Ball Bearing Bushing Lubrication Recommendation

During operation of Ball Bearing Bushing Assembly, add lubricant once each 8-hour shift by spray or brush application. Use a refined mineral oil of viscosity 290/340 SSU @100° F. containing "EP" additives and rust inhibitors.





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