Manufacturing With The Highest Precision Level Available
LEMPCO is proud to introduce our new all-inclusive premium product catalog! This new catalog incorporates numerous upgrades to the brand, specifically product improvements, superior appearance and a new logo. With a bold and modern statement created for the brand, this catalog has been color-coded to easily locate product information.

As an internationally recognized manufacturer of guidance systems, LEMPCO has been servicing major industries, including canning, electronics, automotive, appliance, plastics, computer and specialty items, since 1918. Long recognized as the standard for excellence in the industry, and known by our extremely high quality and reliability, LEMPCO products are in demand worldwide.

PRODUCT IMPROVEMENTS
Always working hard to bring new solutions to customers, LEMPCO Ball Cages have been completely redesigned with several product improvements. The newly improved orbital staking enhances the reliability of ball bearing retention and prevents the loss of ball bearings during use. The Ball Cages are now black anodized to provide a protective hard coating which improves function and helps eliminate material flaking during operation. We have also added additional bearings on each retainer which increases bearing surface. These improved Ball Cages allow metal stampers to achieve high-speed press production with less frequent replacements, thus avoiding costly downtime. Overall, the orbital staking lowers the Ball Cage stress levels during production and improves the operational life cycle performance.

SAME INDUSTRY TRADITIONS
Although we have a new look, LEMPCO uses the same traditions we have always had. We pledge that all LEMPCO products, innovative or conventional, will be manufactured to the same high level of accuracy you have always known. To ensure you are receiving the high quality you expect from us, we stamp the LEMPCO name on every part we manufacture, which means satisfaction in terms of quality, dependability and service. The pride we have in our ability to perform and provide you with profitable production with our die sets and components is the foundation of our business.

CUSTOMER SATISFACTION
Backed by years of experience and a renewed commitment to our customers, LEMPCO understands customer needs and ensures cost-effective products and complete satisfaction. We recognize the value of maintaining relationships and can help meet the needs of quick deliveries, competitive prices and high quality parts. Our extensive LEMPCO distribution network, sales personnel and technical engineers will work closely with you to make sure your specifications are met.

CAD FILES
LEMPCO component product line is now available on-line in 2D/3D CAD formats. To download the templates, visit our website at www.daytonlamina.com.
THE LEMPCO VALUE PROPOSITION

♦ LEMPCO is a recognized leader in providing quality ball bearing components:

1. Rotainer® designed ball cage that minimizes tracking.
2. Precision Rotainer® and retainer that provides accuracy and repeatability in high speed applications.
3. Quality pins and bushings are made from 52100 tool steel and are precision ground.

♦ LEMPCO has a strong distribution network located around the world to service our valued customers.
For Ball Bearing applications

ROTaINeRs®

NOTES:
♦ Diameters and lengths not listed are available by special order.
♦ The LAST length for each diameter shown in the table at right should be used for general die set applications. Other lengths are for limited space and special applications.
♦ Under a preloaded condition, the ROTAINER® will only move vertically.

Designed to rotate on the post, as well as maintain its vertical motion, LEMPCO ROTAINERS® were developed to greatly reduce the amount of tracking. The disengagement of the guide post from the bushing by 1/4” at the top of the stroke will allow the ROTAINER® to rotate 360° on the guide post. The ROTAINER®, while still designed to track, (assuring a measurable amount of preload) will enable stampers to achieve high press production by reducing expensive replacement costs.

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Rotainer® Slide Replacement With Screw Assembly

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NOTES:
♦ Diameters and lengths not listed are available by special order.
♦ The LAST length for each diameter shown in the table at right should be used for general die set applications. Other lengths are for limited space and special applications.
♦ Under a preloaded condition, the ROTAINER® will only move vertically.
LEMPCO Precision Ball Bearing Retainers possess resistance to normal wear and to lateral motion, are smooth in high speed operation and offer precise die register. They are keyed to the guide post slot with a set screw.

Radial bearing placement reduces wear and tracking.

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**NOTE:**
- The LAST length for each diameter shown in the above table should be used for general die set applications. Other lengths are for limited space and special applications.
**Demountable Steel Guide Post Bushings**

For Ball Bearing Applications

Demountable Guide Post Bushings are manufactured from 52100 tool steel and precision machined. Diameters and lengths not listed are available by special order.

Required clamps and screws are included.

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**NOTE:**
- The “C” dimension measurement is from the outside edge of the flange to the opposite outside edge.
Shoulder Guide Post Bushings are manufactured from 52100 tool steel and precision ground. They are similar to LEMPCO Steel Demountable Bushings but are a minimum of .008” larger on the mounting diameter, corresponding to the additional material on the Shoulder Guide Post. They may be installed either by tap or press fitting. These bushings are interchangeable. See pages 13–15 for mounting instructions.

Required clamps and screws are included.

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### Shoulder Guide Post Bushings

#### For Ball Bearing Applications

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**Note:**
- The 963 Series product line is not stocked, but is available as a special order.

---

**Diagram:**
- C1: Nominal Post Diameter
- B: Bore Diameter
- C: Post Diameter
- M: Radius
- N: Length
- L: Catalog Number

**Dimensions:**
- B: 2.755
- C: 3
- C1: 2.875
- E: 1 1/4
- F: 1.754
- M: 2.176
- L: 963-1412

---

**Diagram:**
- C1: Nominal Post Diameter
- B: Bore Diameter
- C: Post Diameter
- M: Radius
- N: Length
- L: Catalog Number

**Dimensions:**
- B: 3.170
- C: 3 9/16
- C1: 3.375
- E: 1 1/4
- F: 2.035
- M: 2.457
- L: 963-1612

---

**Diagram:**
- C1: Nominal Post Diameter
- B: Bore Diameter
- C: Post Diameter
- M: Radius
- N: Length
- L: Catalog Number

**Dimensions:**
- B: 3.690
- C: 4 1/16
- C1: 4.063
- E: 1 1/4
- F: 2.259
- M: 2.681
- L: 963-2020
**Lemco Transitional Fit Steel Sleeve Bushings**

Bushings are manufactured from 52100 tool steel and precision machined. The I.D. is ground and honed to an 8-12 RMS finish to minimize resistance to free action of the retainer/Rotainer® bearings. See pages 13–15 for mounting instructions.

### Nom. Post Diameter B | L | Catalog Number
---|---|---
3/4 | 1.387 | 1 961-0607  
 |  | 1 1/4 961-0608  
 |  | 2 961-0609  
 |  | 2 1/2 961-0610  
 |  | 2 3/4 961-0611  
 |  | 3 961-0612  
 |  | 3 1/2 961-0614  
 |  | 3 3/4 961-0615  
 |  | 4 961-0616  
 |  | 4 1/2 961-0618  
 |  | 5 961-0620  
 |  | 6 961-0624  
1 | 1.717 | 2 961-0808  
 |  | 2 1/4 961-0809  
 |  | 2 1/2 961-0810  
 |  | 2 3/4 961-0811  
 |  | 3 961-0812  
 |  | 3 1/4 961-0813  
 |  | 3 1/2 961-0814  
 |  | 3 3/4 961-0815  
 |  | 4 961-0816  
 |  | 4 1/4 961-0817  
 |  | 4 1/2 961-0818  
 |  | 4 3/4 961-0819  
 |  | 5 961-0820  
 |  | 5 1/2 961-0822  
 |  | 6 961-0824  
 |  | 6 1/2 961-0826  
 |  | 7 961-0828  
1 1/4 | 2.107 | 2 1/2 961-1010  
 |  | 2 3/4 961-1011  
 |  | 3 961-1012  
 |  | 3 1/4 961-1013  
 |  | 3 1/2 961-1014  
 |  | 3 3/4 961-1015  
 |  | 4 961-1016  
 |  | 4 1/4 961-1017  
 |  | 4 1/2 961-1018  
 |  | 5 961-1020  
 |  | 5 1/2 961-1022  
 |  | 6 961-1024  
 |  | 6 1/2 961-1026  
 |  | 7 961-1028  
 |  | 8 961-1032  
 |  | 9 961-1036  
### Nom. Post Diameter B | L | Catalog Number
---|---|---
1 1/2 | 2.437 | 3 961-1212  
 |  | 3 1/4 961-1213  
 |  | 3 1/2 961-1214  
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 |  | 7 1/2 961-1230  
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 |  | 9 961-1236  
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 |  | 12 961-1248  
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 |  | 13 961-1452  
### Nom. Post Diameter B | L | Catalog Number
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 |  | 11 961-1644  
 |  | 12 961-1648  
 |  | 13 961-1652  
 |  | 14 961-1656  
### Nom. Post Diameter B | L | Catalog Number
---|---|---
2 1/2 | 3.682 | 6 961-2024  
 |  | 6 1/2 961-2026  
 |  | 7 961-2028  
 |  | 7 1/2 961-2030  
 |  | 8 961-2032  
 |  | 8 1/2 961-2034  
 |  | 9 961-2036  
 |  | 9 1/2 961-2038  
 |  | 10 961-2040  
 |  | 11 961-2044  
 |  | 12 961-2048  
 |  | 13 961-2052  
 |  | 14 961-2056  
### Nom. Post Diameter B | L | Catalog Number
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3 | 4.182 | 6 961-2424  
 |  | 6 1/2 961-2426  
 |  | 7 961-2428  
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 |  | 8 1/2 961-2434  
 |  | 9 961-2436  
 |  | 10 961-2440  
 |  | 11 961-2444  
 |  | 12 961-2448  
 |  | 13 961-2452  
 |  | 14 961-2456

For Ball Bearing Applications
# Straight Guide Posts

For Ball Bearing Applications

**LEMPCO** Straight Guide Posts for ball bearing assemblies are manufactured from 52100 tool steel and precision ground. See pages 13–15 for mounting instructions.

## Specifications

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### Diagrams

- **Diagram A**
- **Diagram B**
- **Diagram C**

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FLANGED DEMOUNTABLE GUIDE POSTS
FOR BALL BEARING APPLICATIONS

LEMPCO
Flanged Demountable Guide Posts for ball bearing assemblies are designed for those who prefer the convenience of a removable post to expedite die repairs. The post is tap fitted into the pin plate bore with the flange flush to the ground surface. See page 13 for bore size data.

These Demountable Guide Posts are manufactured from 52100 tool steel.

Required clamps and screws are included.
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4 clamps & screws provided
**SHOULDER GUIDE POSTS**

**FOR BALL BEARING APPLICATIONS**

**NOTE:**
- The 953 Series product line is not stocked, but is available as a special order.

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Mounting diameters of the LEMPCO Shoulder Guide Posts are a minimum of .008” over the sizes of Press Fit Steel Sleeve Bushings and .008” over the Demountable Steel Bushings to allow grind stock for precision fitting in new set construction and to allow reboring as necessary in replacing posts and bushings in used sets. These posts also may be used with Press Fit Sleeve Bushings and Demountable Bushings providing the through bore size accords with mounting diameters.

The Shoulder Guide Posts are manufactured from 52100 tool steel and precision ground. See pages 13–15 for mounting instructions.
Holes for LEMPCO Ball Bearing Guide Posts and Bushings should be jig bored for best results. The punch holder and die holder should be clamped together and bored in one setup in order to maintain dead center alignment between the upper and lower bores. If it is not possible to bore in this manner, a tolerance of ±0.0005” between centers (see illustration) must be held. Bores should be smooth and free from tool marks to provide proper bearing area for the guide post and bushing.

Die holder bores must be perpendicular to the surface of the die holder which will back up the die. The bottom surface of the die holder must be parallel to the die backup surface. The punch holder bores also must be perpendicular to the surface which will back up the punches, and the top surface parallel to the punch back-up surface.

Break the corners of the bored holes to a generous chamfer. On sets with a symmetrical profile one pin and bushing should be offset to prevent accidental reversing of the punch holder during assembly.

All of the LEMPCO Ball Bearing Guide Posts, Bushings Retainers and Rotainers® are completely interchangeable without the need for select fitting, and if mounted in accordance with boring and assembly instructions given on this and the following page do not require any grinding, honing, lapping, or any other modifications of any kind. Please note the dimensions given in the following table. Our experience over many years proves that these are optimum dimensions. Variations must be avoided.

### BORE CHART – BALL BEARING COMPONENTS (INCH)

<table>
<thead>
<tr>
<th>Nominal Guide Post Diameter</th>
<th>#951-SERIES STRAIGHT GUIDE PIN (PRESS FIT)</th>
<th>#956-SERIES DEMOUNTABLE GUIDE PIN (TAP FIT)</th>
<th>#953-SERIES SHOULDER GUIDE PIN (PRESS FIT)</th>
<th>#961-SERIES STRAIGHT SLEEVE BUSHING (TRANSITIONAL FIT)</th>
<th>#962-SERIES DEMOUNTABLE SHOULDER BUSHING (TAP FIT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>0.7515 / 0.7510</td>
<td>N/A</td>
<td>N/A</td>
<td>1.3872 / 1.3867</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>1.0015 / 1.0010</td>
<td>1.0016 / 1.0009</td>
<td>BORE HOLE .0009” TO .0019” SMALLER THAN SHOULDER DIAMETER OF GUIDE POST</td>
<td>1.7172 / 1.7167</td>
<td>1.7159 / 1.7154</td>
</tr>
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<td>1.2510 / 1.2505</td>
<td>1.2516 / 1.2509</td>
<td></td>
<td>2.1072 / 2.1067</td>
<td>2.1059 / 2.1054</td>
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<tr>
<td>1 1/2</td>
<td>1.5010 / 1.5005</td>
<td>1.5016 / 1.5009</td>
<td></td>
<td>2.4372 / 2.4367</td>
<td>2.4359 / 2.4354</td>
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<td>1 3/4</td>
<td>1.7510 / 1.7505</td>
<td>1.7516 / 1.7509</td>
<td></td>
<td>2.7472 / 2.7467</td>
<td>2.7459 / 2.7454</td>
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<tr>
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<td>2.0006 / 2.0001</td>
<td>2.0016 / 2.0009</td>
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<td>3.1622 / 3.1617</td>
<td>3.1608 / 3.1603</td>
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<td>2.5006 / 2.5001</td>
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<td></td>
<td>3.6822 / 3.6817</td>
<td>3.6809 / 3.6804</td>
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</table>
In order to maintain the die and punch alignment, it is essential that the guide posts and bushings be at absolute right angles with the punch and die backup surfaces. Figure 1 represents a typical guide post and ROTAINER®. Please note that the end of the guide post with the small radius is press fit into the punch shoe, and that the ROTAINER® is assembled with the ROTAINER® slide assembly toward the same end of the guide post.

**NOTE:** LEMPCO Demountable Bushings and Flanged Demountable Guide Posts are tap fitted. Bores should be to specifications, and both bushings and guide posts should be seated flush to ground surface of support shoe and held securely by clamps and cap screws. These bushings and guide posts are removable; on installation the die will register accurately.

Check the squareness of the guide post or bushing with a precision square. Tap the sides slightly with a soft hammer until the guide post or bushing is perpendicular.

Press fit about 1/4” (6.35mm) and check with the precision square again, tapping the sides with a soft hammer as necessary, to ensure squareness. A bronze, babbitt or fiber hammer is recommended.

**NOTE:** With Demountable Boss Bushings, be sure to press against the hardened liner and not against the casting.

Press fit by small increments – not over 1/2” (12.70mm) each – checking with the precision square after each press. Do not allow guide post or bushing to protrude through the lower side of the plate. It is advisable to place a 1/64” (.3968mm) shim under the guide post or bushing as a stop.

For Demountable Boss Bushings and Demountable Bushings, after the bushing is tap fit to the shoulder, the shoe may be drilled with the bushing in place. Tighten screws gradually, moving from one to another until all are tight.

After complete assembly of the bushings, check the ID top and bottom for taper. Should taper be found, hone the ID until original size is obtained.

**NOTE:** This should not be necessary if boring instructions were strictly adhered to.

Assemble ROTAINER® to guide post (Figure 1) by screwing the set screw in until flush with the special ROTAINER® slide. Vertical and the rotational movement should now be tested to insure freedom of movement. After testing is completed, stake set screw. Lubricate only with a light spindle oil.

**NOTE:** The only tool necessary to assemble the ROTAINER® is a screw driver.

Assemble the punch and die holder. Be sure to allow the ROTAINERS® to hang free (see Figure 2) supported by the special ROTAINER® slide when assembling the die set. Work the punch holder up and down a few times to assure there is no binding.

**NOTE:** Ball Bearing Engineering Data: Installation and Assembly Instructions
SPECIFICATIONS:

1. Maximum Shut Height – See Figure 2, below.
2. Minimum Shut Height – See Figure 1.
4. Maximum Open Height – See Figures 2 and 3.

A. Lay out die as in Figure 1 (Minimum Shut Height). This determines maximum guide post length and maximum bushing height.

B. Lay out die as in Figure 2 (Maximum Shut Height).

C. Maximum Open Height (Maximum Shut Height plus Stroke) as in Figure 3 shows minimum guide post engagement in bushing that is required. If this is at least 3/4” then conditions are ideal. However, if this dimension is less than 3/4” then Figure 4 should be considered. Actual work is done for only a fraction of the total stroke on most dies and if conditions shown in Figure 4 are satisfied in conjunction with Figure 1 and Figure 2, then full length of stroke and maximum open height can be disregarded.

ALSO NOTE, HOWEVER, THAT LONGER THAN NORMAL STROKES MAY BE UTILIZED BY DISENGAGING GUIDE POST AND, IF ABSOLUTELY NECESSARY, THE ROTAINER® FROM THE BUSHING ON THE UPWARD TRAVEL PROVIDED:

1 – THE OPERATION IS VERTICAL
2 – THE OPERATION IS NOT FASTER THAN 150 STROKES PER MINUTE, AND
3 – THE INSIDE DIAMETER OF THE BUSHING IS BELL MOUTHED MINIMUM 1/4”.

ON INCLINED OPERATIONS, OR AT SPEEDS IN EXCESS OF 150 STROKES PER MINUTE, THE GUIDE POST MUST ENGAGE THE BUSHING AT ALL TIMES AT LEAST 3/4” (THE ROTAINER® MUST BE ENGAGED BY THE GUIDE POST AND BUSHINGS AT ALL TIMES).
Component maintenance is a serious business...

BALL-SCRUBB® removes heavy soils, dirt or grease from ball-bearing guide pin assemblies.

Just spray it on...wait 3 minutes... and spray again. Then blow off excess with compressed air.

BALL-SCRUBB® is an industrial strength cleaner with rust inhibitors, specially formulated to clean debris and grease from all types of ball-bearing assemblies.

BALL-LUBE®, when applied after BALL-SCRUBB®, locks out wear by chemically bonding to precision surfaces. It provides a tough, long-lasting shield that protects against oxidation and rust.

BALL-LUBE® lubricates assemblies and gives them longtime protection against wear, oxidation and heat.

Spray liberally on ball-bearing assemblies.

Always use Ball-Lube® and Ball-Scrubb® to keep ball-bearing components clean and running smooth.
BACKGROUND

Fatigue failures begin with a small crack in the material. The crack will develop at a point of discontinuity in the material, such as a change in cross section, a keyway, or a hole. Once a crack has developed, the stress-concentration effect becomes greater and the crack progresses more rapidly. As the stressed area decreases in size, the stress increases in magnitude until, finally, the remaining area fails suddenly.

The original LEMPCO ball staking design consisted of small rectangular indentations opposing each other at 180° degrees around the ball (two-point staking); see Figure 1. This staking design consists of no/minimal radii, two full corners, and numerous material discontinuities, all allowing opportunities for crack propagation.

SOLUTION

We developed an improved ball staking method that consists of a complete circular indentation around the entire ball (orbital staking); see Figure 2. This design utilizes a uniform circular metal forming technique, with no sharp discontinuities in the material. The new method is intended to improve performance in regards to operational life cycle.

CONCLUSION

After an independent third party* ran a Finite Element Analysis, the following can be concluded:

♦ The peak stress and stress levels in general are much higher for the two-point stake than for the orbital stake. Figure 3 shows stress contours for the two-point stake, Figure 4 shows stress contours for the orbital stake.

♦ Due to the smaller volume of material in the two-point stake, high stresses exist in a significant portion of the indented material.

♦ The differences in stress levels and distribution imply that the fatigue life for the two-point stake will be much less than for the orbital stake, and with the lower stresses the orbital stake should improve the fatigue life.

♦ The differences in stress levels of the orbital stake design also imply that press speed can be increased with the orbital stake compared to the two-point stake.

These unique hard coated aluminum bushings have the surface hardness of case hardened steel. An electrochemical process is used to increase the corrosion resistance of the bushings. As a result of this Hard Anodized process, they are also non-conductive, so they may be used for electrical discharge machining. They have a hard surface that is highly resistant to wear and not subject to magnetization. These bushings are for clean room and EDM applications and should not be used in any stamping operation wherein a lot of contaminants are generated.

Lempeoloy® bushings do not require lubrication and therefore are not provided with the conventional figure-eight oil grooves and fittings. While these bushings do not require lubrication, we recommend you apply a light mist of spindle oil prior to assembly and spray lightly prior to each press run.

Lempeoloy® bushings are designed to be installed by tap fitting to seat flush with the ground surface of the punch holder. They are assembled with toe clamps and screws. These bushings must not be pressed in or honed. These Lempeoloy® bushings will work well when used with Lamina plain bearing guide posts.
## Shoulder - Lempcoloy®

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<th>C</th>
<th>E</th>
<th>F</th>
<th>L</th>
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## Short Shoulder - Lempcoloy®

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## Clamps for Assembly

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<td>4</td>
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</table>

**NOTE:**
- For bushings with .002 over nominal ID to be used with a discontinued LEMP® plain bearing guide post, remove the “–LAM” suffix from the part number.
Designed to rotate on the post, as well as maintain its vertical motion, LEMPCO ROTAINERS® were developed to greatly reduce the amount of tracking. The disengagement of the guide post from the bushing by 6.35mm at the top of the stroke will allow the ROTAINER® to rotate 360° on the guide post. The ROTAINER®, while still designed to track, (assuring a measurable amount of preload) will enable stampers to achieve high press production by reducing expensive replacement costs.

### Rotainer® Slide Replacement With Screw Assembly

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<th>Assembly Part Number</th>
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### Chart

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### NOTES:

- Diameters and lengths not listed are available by special order.
- The LAST length for each diameter shown in the table above should be used for general die set applications. Other lengths are for limited space and special applications.
- Under a preloaded condition, the ROTAINER® will only move vertically.
**Precision Ball Bearing Retainers**

For Metric Ball Bearing Applications

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**NOTE:**

- The LAST length for each diameter shown in the table above should be used for general die set applications. Other lengths are for limited space and special applications.

**Radial bearing placement reduces wear and tracking.**

**LEMPCO** Precision Ball Bearing Retainers possess resistance to normal wear and to lateral motion, are smooth in high speed operation and offer precise die register. They are keyed to the guide post slot with a set screw.

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**Demountable Steel Guide Post Bushings**

*For Metric Ball Bearing Applications*

Demountable Guide Post Bushings are manufactured from 52100 tool steel and precision machined. See pages 14 & 28 for mounting instructions.

Diameters and lengths not listed are available by special order. Required clamps and screws are included.

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**NOTES:**
- The 966 Series product line is not stocked, but is available as a special order.
- The “C” dimension measurement is from the outside edge of the flange to the opposite outside edge.
**LEMPCO** Transitional Fit Steel Sleeve Bushings are manufactured from 52100 tool steel and precision machined. The I.D. is ground and honed to an 8-12 RMS finish to minimize resistance to free action of the retainer/Rotainer® bearings.

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**STRAIGHT GUIDE POSTS**

**FOR METRIC BALL BEARING APPLICATIONS**

LEMPCO Straight Guide Posts for ball bearing assemblies are manufactured from 52100 tool steel and precision ground. See pages 14 & 28 for mounting instructions.

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**FLANGED DEMOUNTABLE GUIDE POSTS**
**FOR METRIC BALL BEARING APPLICATIONS**

LEMPCO Flanged Demountable Guide Posts for ball bearing assemblies are designed for those who prefer the convenience of a removable post to expedite die repairs. The post is tap fitted into the pin plate bore with the flange flush to the ground surface. See pages 14 & 28 for mounting instructions. These Demountable Guide Posts are manufactured from 52100 tool steel. Required clamps and screws are included.

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**FLANGED DEMOUNTABLE GUIDE POSTS**

*For metric Ball Bearing applications*
Holes for LEMPCO Ball Bearing Guide Posts and Bushings should be jig bored for best results. The punch holder and die holder should be clamped together and bored in one setup in order to maintain dead center alignment between the upper and lower bores. If it is not possible to bore in this manner, a tolerance of ±.0127mm between centers [see illustration] must be held. Bores should be smooth and free from tool marks to provide proper bearing area for the guide post and bushing.

Die holder bores must be perpendicular to the surface of the die holder which will back up the die. The bottom surface of the die holder must be parallel to the die backup surface. The punch holder bores also must be perpendicular to the surface which will back up the punches, and the top surface parallel to the punch backup surface.

Break the corners of the bored holes to a generous chamfer. On sets with a symmetrical profile one pin and bushing should be offset to prevent accidental reversing of the punch holder during assembly.

All of the LEMPCO Ball Bearing Guide Posts, Bushings, Retainers and Rotainers® are completely interchangeable without the need for select fitting, and if mounted in accordance with boring and assembly instructions given on this and on page 14 do not require any grinding, honing, lapping, or any other modifications of any kind. Please note the dimensions given in the following table. Our experience over many years proves that these are optimum dimensions. Variations must be avoided.

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<th>Nominal Guide Post Diameter</th>
<th>#957-SERIES STRAIGHT GUIDE PIN (PRESS FIT)</th>
<th>#958-SERIES DEMOUNTABLE GUIDE PIN (TAP FIT)</th>
<th>#967-SERIES STRAIGHT SLEEVE BUSHING (TRANSITIONAL FIT)</th>
<th>#966-SERIES DEMOUNTABLE SHOULDER BUSHING (TAP FIT)</th>
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(UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN MILLIMETERS)
DIE SPRINGS
INCH AND CUSTOM

DIE SPRINGS PRODUCT FEATURES

♦ Same day shipments – we stock them so you don’t have to
♦ Inch sizes manufactured to industry standard colors
♦ Reliable, trouble-free performance
♦ Manufactured in an ISO 9001:2008 certified facility
♦ Manufactured from spring-quality Chromium Silicon alloy, high-tensile strength steel in accordance with ASTMA A1000-99 specifications
♦ Optimal rectangular wire design

CUSTOM SPRINGS

A custom spring is any spring that has:
♦ Unique physical attributes
  ■ Special wire material, plating or paint
  ■ Custom free lengths, diameters, solid heights, rates, number of coils or custom loads at a given deflection
♦ Critical tolerances
♦ Specific inspection or certification requirements
  ■ Military specifications
  ■ 100% inspection of critical characteristics
♦ Statistical reports
♦ Computer controlled multi-point tests
### MEDIUM DUTY DIE SPRINGS

**COLOR CODED BLUE STRIPE**

---

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<th>Total Deflection Recommended for Long Life (25% of C)</th>
<th>Total Deflection Recommended for Avg. Life (35% of C)</th>
<th>Maximum Operating Deflection (40% of C)</th>
<th>Load lbs.</th>
<th>Defl. in.</th>
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*NOTE: For design purposes only. We do not recommend deflecting a spring to maximum deflection.*
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*NOTE:* For design purposes only. We do not recommend deflecting a spring to maximum deflection.
### MEDIUM HEAVY DUTY DIE SPRINGS

**COLOR CODED RED STRIPE**

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<th>Rod Diam. (in)</th>
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<th>CATALOG NUMBER</th>
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<th>Total Deflection Recommended for Avg. Life (25% of C)</th>
<th>Maximum Operating Deflection (35% of C)</th>
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### HEAVY DUTY DIE SPRINGS
**COLOR CODED GOLD STRIPE**

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*NOTE: For design purposes only. We do not recommend deflecting a spring to maximum deflection.*
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*NOTE: For design purposes only. We do not recommend deflecting a spring to maximum deflection.*
### EXTRA HEAVY DUTY DIE SPRINGS

**COLOR CODED GREEN STRIPE**

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**NOTE:** For design purposes only. We do not recommend deflecting a spring to maximum deflection.
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*NOTE: For design purposes only. We do not recommend deflecting a spring to maximum deflection.*
Our spring cages enhance die spring life by providing a flat, hardened die pocket for spring operation.

- Material: A513 tube steel
- Conforms to NAAMS standards

### Spring Diameter Accessories

<table>
<thead>
<tr>
<th>Spring Diameter (in)</th>
<th>Pocket Diameter (in)</th>
<th>Tube O.D. (in)</th>
<th>Diameter (H) (in)</th>
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**Our spring cages enhance die spring life by providing a flat, hardened die pocket for spring operation.**

**Material:** A513 tube steel

**Conforms to NAAMS standards.**

### Length L (in)

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<th>1 inch Diameter Springs</th>
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Our spring retainers hold individual springs firmly in position while the die is being assembled or disassembled. Pre-loading the spring is easy since the springs can be set individually, which avoids working against the combined force of the springs.

Available for springs 1 1/4” (32mm), 1 1/2” (38mm) and 2” (50mm) diameters and any free length where clearance permits.

Material: steel

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<th>B</th>
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SPECIALTY ITEMS
ACCUBEND™ ROTARY BENDERS

SIMPLIFYING YOUR BENDING PROCESS WITH ACCUBEND™ ROTARY BENDERS!

Accu-Bend™ units include a tool steel Rocker set into a steel Saddle with a graphite plugged Aluminum-Bronze liner. Available in standard inch and metric sizes with Rocker diameters of 20mm–115mm (0.75” – 4.5”) and lengths of 50mm–900mm (2.0” – 35.0”), these units transfer the vertical motion of the press into a smooth one-motion rotation. The smooth rotation provides a rotary bend process which requires less tonnage and less strain on the material. The Accu-Bend™ Rotary Bender can also include optional pre-configured mounting hole patterns.

The saddle liner is a bronze alloy chosen for the ability to hold up to a bearing load with little to no wear while the graphite plugs are included in the bronze liner to provide lubrication. Both Rockers and Saddles are machined for precision and interchangeability. Compact benders fit in tight places and are ideal for bending small tabs within a larger part. Specials can be manufactured for your custom needs as well when an off-the-shelf product doesn’t work for your application.

- Holds ± 1/2 degree angle tolerance
- Bends angles up to 120° for special part design and pre-hem applications
- Decreases forming tonnage by 40 – 80% over wipe tooling and “V” dies
- Forms channel bends in one hit by pairing two bends together
FORMATHANE® URETHANE

The Formathane® product line of urethane bars, rods, sheets, springs, film and strippers stands alone when compared to other urethane products offered in the market. Formathane® is formulated with the metalforming and fabricating user in mind to withstand the rigors of these difficult environments. Every day customers are putting it to the test and are finding double and triple life expectancies are more the norm than the exception with Formathane®. The higher than average performance is due to using premium grade urethane compounds, computer controlled production methods and stringent quality standards. Often used for springs, strippers, wear pads, vibration dampening, forming and part protection, Formathane® is offered in four durometers from 70 – 95A.

JIS SPRINGS

As a manufacturer of high quality springs in all standard ISO sizes, we also have available a line of true metric springs, in all the standard JIS (Japanese Industrial Standards) sizes and color load ratings. This extension of the spring line gives more options to customers with exacting requirements, making them available from the same reliable source as the inch springs. Manufactured in an optimal rectangular design and from a high strength chromium alloy material, these springs provide stability between load deflection and cycle life. The JIS product offering includes over 1,000 part numbers divided into five duty groups (colors), with fourteen diameters available per diameter and free lengths from 20mm to 300mm.

PUNCHES

We offer a comprehensive range of standard punches and die buttons in the basic, ball lock and variable precision series. Each component is made of quality heat treated tool steel which meets or exceeds ANSI standards. They are available in A2 high performance tool steel for toughness and economy, and M2, high speed steel, triple-tempered for long runs where abrasion resistance is required. Also available as a special option is PM4 which offers improved wear and impact characteristics ideal for optimum performance at high operating speeds.
LEMPCO now offers a new low cost ball bearing component assembly alternative added to our die components guiding system product line. These new additions, Surface Mount Ball Bearing Assemblies, are mounted directly to the die holder and punch holder rather than the conventional method. These assemblies are available in 32mm, 38mm, 50mm and 60mm diameters, while lengths range from 100mm to 350mm, depending on diameter. Complete assemblies will include the necessary mounting bolts and dowel pins required for installation as well as optional tapped mounting holes to secure Stroke End Blocks. Surface Mount Ball Bearing Assemblies are available as stand-alone assemblies.

DIE ACCESSORIES

A complete line of inch and metric pressroom accessories, including fasteners, hoist rings, stripper bolts, punch holder shanks, roller stock guides, stock pushers, pry bars, ball bearing and die lubrication and pad retainers are available. With parts manufactured from heat-treated, high strength alloy steel and machined to precise tolerances, you can be sure they are inspected to assure uniform hardness, quality and dimensions.
LEMPCO customization services will go to virtually any length to satisfy your needs. Now, the full range of answers to your requirements is at your command. It could be a simple modification or something quite exotic. Whatever your need, LEMPCO will work closely with you to select, design and manufacture products to meet your demands, while providing cost-effective solutions.

**Components Manufacturing Capabilities:**

- Finished outside diameters from $\frac{5}{8}'' \times 15''$ (15.9mm x 381mm) length to $5'' \times 60''$ (127mm x 1524mm) length
- Finished inside diameters
  - Hardened Steel – $\frac{1}{2}'' \times 4''$ (12.7mm x 102mm) length to $3 \frac{5}{8}'' \times 14''$ (92mm x 356mm) length
  - Bronze Plated Steel – $\frac{1}{2}'' \times 4''$ (12.7mm X 102mm) length to $4 \frac{1}{2}'' \times 9''$ (114mm x 228mm) length
  - Solid Bronze (w/wo graphite plugs) – $\frac{5}{8}'' \times 4''$ (16mm x 102mm) length to $6 \frac{1}{8}'' \times 7 \frac{7}{8}''$ (156mm x 200mm) length
- 3-Axis milling with part lengths up to 48'' (1219mm)
- 5-Axis prismatic machining
- Surface grinding up to 96'' (2438mm) length x 17'' (431mm) wide
- Hard turning
  - Maximum outside diameter: 3 3/4'' (95mm)
  - Minimum inside diameter: 1/2'' (12.7mm)
- Heat treating – alloy and low carbon steels up to 62HRC (size and carbon content dependent)
- Induction hardening
  - 1050 steel, up to 5 1/4'' (133mm) diameter and hardened to 58/62 HRC
  - 52100 steel, up to 3 3/4'' (95mm) diameter and hardened to 58/62 HRC
- CMM Machine
  - Calypso programming software to quickly measure simple and complex parts, based on a CAD model or free form measurement
  - Part weight capacity up to 3520 lbs.
  - Measuring range (XYZ) – 39.4'' x 63'' x 23.6''
  - Clearance under bridge – 29''

**Plating Services Available:**

- Chrome Plating
- Copper Bronze Plating

**Springs Manufacturing Capabilities:**

- Outside diameters from $\frac{3}{16}''$ to 9 $\frac{1}{2}''$ (4.8mm to 241mm)
- Free lengths from $\frac{1}{2}''$ to 90' (12.7mm to 2286mm)
- Round spring wire from 0.014'' to 1.625'' (.36mm to 41.3mm)
- Standard rectangular wire up to 0.408'' x 0.469'' (10.4mm x 11.9mm)

**Spring Coatings Available:**

- Plain, no paint
- Oiled
- Electroless Nickel
- Chrome
- Zinc
- Powder or E-coat paint
- Mil-spec coatings
- Cadmium
- Dacromet®
- Others on request

High quality products, service and innovative development are key elements in our continued dedication to serving the needs of our customers.