



Ball-Bearing Products

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Ball-Bearing Components

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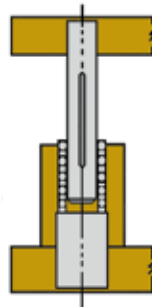
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Ball-Bearing Operating Data & Design Selection

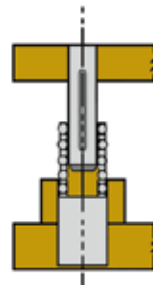
In component selection, varied characteristics must be taken into consideration when selecting length of guide post, bushing and ball-bearing retainer, such as stroke, shut height and type of operation. To help in your selection, we have supplied engineering data and instructions that should be used as a guide when making your component selection. The following conditions should be considered for the most effective performance in a specific application.

In this condition the guide post, bushing and ball-bearing retainer remain in full contact throughout the stroke cycle. This selection is beneficial and recommended for high speed, high production, short stroke dies.

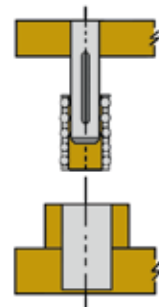
This may be accomplished by selecting the bushing length that allows the guide post to disengage the bushing at the beginning of the stroke or cycle. This will result in the loss of pre-load while the ball-bearing retainer is still within the bushing.



**FULL CONTACT
PRE-LOAD**



**PRE-LOAD RELIEVED
AT TOP OF STROKE**

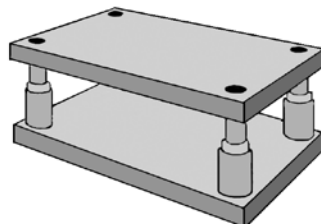


**FULL
DISENGAGEMENT**

This condition may be utilized with long stroke dies. It also provides safe operation by eliminating pinch points and prevents foreign materials from entering the bushing. A further benefit is it allows for registration of the ball-bearing retainer on each stroke. Removal of the punch holder or die holder from press is possible without total removal of dies.

This condition is permissible when the ball retainer must totally disengage the bushing on applications requiring long strokes. Safety precautions (as outlined on page 16) should always be taken when employing this method.

It should also be noted that the above illustration depicts the proper way to assemble (insert) the guide post and ball-bearing retainer into the bushing.



When in a pre-loaded (rolling press fit) condition, the ball-bearing retainer will travel half the distance of movement. In a die set application it would be half the distance of the press stroke.

Ball-Bearing Component Installation Instructions

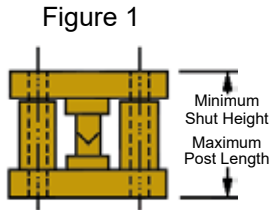


Figure 1
Punch Holder in contact with Bushing
Punch and die life depleted

Figure 1 (Minimum Shut Height) determines maximum guide post length and maximum bushing height. This will prevent post bottoming on bolster at minimum shut height if nominal post length is same as minimum shut height.

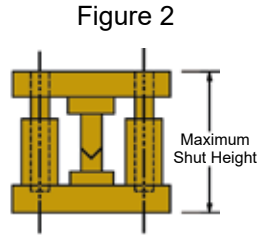
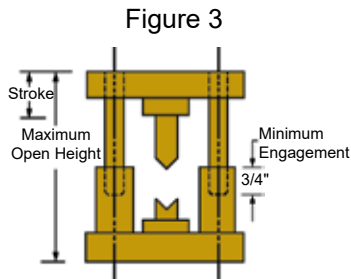


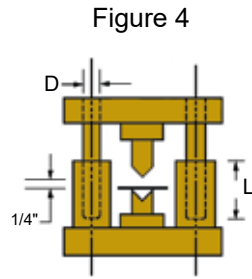
Figure 2
New Punch and Die

The maximum shut height added to the stroke equals the maximum open height (Figure 3) indicating the minimum engagement for the guide post in the required bushing. It is considered ideal for the minimum engagement to be at least 3/4". If it is less than 3/4", however, the arrangement shown in Figure 4 is recommended.

Keeping in mind that only a small part of the stroke on most dies actually does the work, when conditions shown in Figure 4 are acceptable, together with conditions shown in Figures 1 and 2, there is no need to be concerned with the full length of the stroke and maximum open height.



When required strokes are longer than normal, guide post and retainer, if necessary, may be totally disengaged from bushing on the upward travel, provided (A) operation is vertical, (B) operation is limited to no more than 150 strokes per minute, (C) the ram and gib alignment of the press are accurate.



The bushing must always be engaged by the guide post minimum of 3/4" if the operation is included or if speed surpasses 150 strokes per minute. The guide post bushing must engage the retainer during the entire operation, or what is known as full contact pre-load operation.

GENERAL INFORMATION SPECIFICATIONS

1. The ball-bearing retainer travels half the distance the pin travels or one-half the stroke length.
2. The maximum post length equals(=) minimum shut height minus (-) 1/4" Figure 1. If post length should be greater than minimum shut height it will be necessary to provide clearance for projecting post when press is at bottom of stroke.
3. Maximum straight sleeve length Figure 1 equals (=) minimum shut height minus (-) punch holder thickness minus (-) 1/4". Select nearest standard length.
4. Maximum retainer length equals (=) bushing length minus (-) 1/2".

Post slot lengths available upon request.

Ball-Bearing Assembly Lubrication Recommendation

In operation of ball assembly, add lubricant once each 8-hour shift by spray or brush application. Use a lightweight spindle oil like Lamina BALL-LUBE™. **NEVER USE GREASE.**

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.



| BALL-LUBE™ & BALL-SCRUBB™ | | | |
|---------------------------|-------------------------------|-------------|---------------------------------|
| PART NUMBER | DESCRIPTION | PART NUMBER | DESCRIPTION |
| ARL016 | 1 Pint BALL-LUBE™ spray | ARS016 | 1 Pint BALL-SCRUBB™ Spray |
| ARL384 | 1 Case (24) 1 Pint BALL-LUBE™ | ARS384 | 1 Case (24) 1 Pint BALL-SCRUBB™ |
| ARL128 | 1 Gallon BALL-LUBE™ | ARS128 | 1 Gallon BALL-SCRUBB™ |
| ARL640 | 5 Gallons BALL-LUBE™ | ARS640 | 5 Gallons BALL-SCRUBB™ |

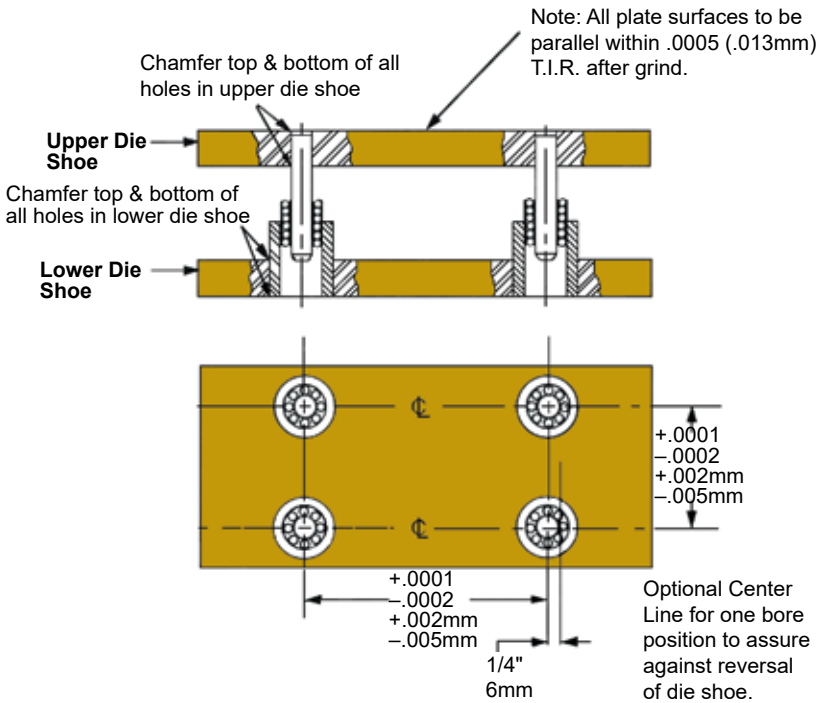
| BALL-BEARING DEMOUNTABLE COMPONENT CLAMP ARRANGEMENTS | | | | BOLT CIRCLE DIAMETERS | |
|---|--------------------------|---|------------|-----------------------------------|----------------------|
| Nom. Pin Dia. | Standard Left-Right Feed | Front to Back Feed (Center Post die Sets) | Round Dies | DEMOUNTABLE BALL-BEARING BUSHINGS | |
| | | | | Nom. Bushing Diameter | Bolt Circle Diameter |
| 1, 1¼ & 1½ | | | | 1 | 2.438 |
| | | | | 1-1/4 | 2.813 |
| | | | | 1-1/2 | 3.125 |
| | | | | 1-3/4 | 3.438 |
| 1¾, 2, 2½ & 3 | | | | 2 | 4.000 |
| | | | | 2-1/2 | 4.500 |
| | | | | 3 | 5.000 |
| 1¾, 2, 2½ & 3 | | | | DEMOUNTABLE BALL-BEARING PINS | |
| | | | | Nom. Pin Diameter | Bolt Circle Diameter |
| | | | | 1 | 1.750 |
| | | | | 1-1/4 | 2.000 |
| | | | | 1-1/2 | 2.250 |
| 1¾, 2, 2½ & 3 | | | | 1-3/4 | 2.625 |
| | | | | 2 | 2.875 |
| | | | | 2-1/2 | 3.375 |
| 3 | 3.875 | | | | |

TOE CLAMP DIMENSIONS

| | | |
|--------------------------------|--|-------------------------------------|
| INCH | METRIC | |
| | | |
| .688 | 17.48 | |
| | | |
| .771 | 19.58 | |
| .320 | 8.13 | |
| .367 | 9.32 | |
| .188 | 4.78 | |
| x-40-Clamp & 5/16-18x3/4 Screw | X-40-Clamp & F010810 Metric Screw (M8 x 1.25-20mm) | |
| | | Bolt Circle Diameter |
| | | Drawing above refers to X-40 Clamps |

| REPLACEMENT KITS CLAMPS & SCREWS – X40-CLAMPS | | | | | | | |
|---|--------------------|---------------------------|--------------------|-------------|--------------------|---------------------------|--------------------|
| PART NUMBER | Nom. Pin Diameters | # Clamps & Screws per Kit | No. of Kits Needed | PART NUMBER | Nom. Pin Diameters | # Clamps & Screws per Kit | No. of Kits Needed |
| CSK200002 | 5/8 - 7/8 | 2 | 1 | CSK20052 | 18 - 19 | 2 | 1 |
| CSK200003 | 1 - 1-3/4 | 3 | 1 | CSK20053 | 24 - 42 | 3 | 1 |
| CSK200002 | 2 - 2-1/2 | 2 | 2 | CSK20052 | 50 - 80 | 2 | 2 |
| CSK200003 | 3 - 4-1/2 | 3 | 2 | | | | |

Ball-Bearing Boring Procedures & Dimensions for Precision Dies



1. Grind die shoe plates parallel within .0005 per foot (.013mm). Then deburr and thoroughly clean plates.

2. Clamp upper and lower shoes together and mount in boring machine.

3. Sweep and strip top surface of plate in boring machine. Shim as required to achieve "0" indicator reading of $(\begin{smallmatrix} +.0001 & +.002\text{mm} \\ -.0002 & -.005\text{mm} \end{smallmatrix})$ T.I.R. All bores to the square to plate surfaces within $(\begin{smallmatrix} +.0001 & +.002\text{mm} \\ -.0002 & -.005\text{mm} \end{smallmatrix})$ T.I.R.

4. Step bore in line with hole patterns to dimensions show on chart. All bores to be square to plate surfaces within $(\begin{smallmatrix} +.0001 & +.002\text{mm} \\ -.0002 & -.005\text{mm} \end{smallmatrix})$ T.I.R.

5. Chamfer both ends of bore.

Complete interchangeability of Lamina ball-bearing guide pins, bushings and retainers makes select fitting unnecessary. No modifications, such as grinding, honing or lapping will be required if mounting and boring instructions which are shown on this page are carefully followed.

BORE SIZE CHART FOR BALL-BEARING BUSHINGS & PINS

| Nominal Guide Pin Diameter | BORE SIZE for Tap Fit of Steel Sleeve Bushings AB1 & ABM | BORE SIZE for WRING FIT of Demountable Steel Guide Bushings ABG | BORE SIZE for PRESS FIT of Straight Guide Pins AP1 & APM | BORE SIZE for Tap Fit of Demountable Flanged Guide Pins APG |
|----------------------------|--|---|--|---|
| 3/4 | 1.3872 / 1.3867 | N/A | .7515 / .7510 | N/A |
| 1 | 1.7172 / 1.7167 | 1.7168 / 1.7163 | 1.0015 / 1.0010 | 1.0016 / 1.0011 |
| 1-1/4 | 2.1072 / 2.1067 | 2.1068 / 2.1063 | 1.2510 / 1.2505 | 1.2516 / 1.2511 |
| 1-1/2 | 2.4372 / 2.4367 | 2.4368 / 2.4363 | 1.5010 / 1.5005 | 1.5016 / 1.5011 |
| 1-3/4 | 2.7472 / 2.7467 | 2.7468 / 2.7463 | 1.7510 / 1.7505 | 1.7516 / 1.7511 |
| 2 | 3.1622 / 3.1617 | 3.1618 / 3.1613 | 2.0006 / 2.0001 | 2.0016 / 2.0011 |
| 2-1/2 | 3.6822 / 3.6817 | 3.6818 / 3.6813 | 2.5006 / 2.5001 | 2.5016 / 2.5011 |
| 3 | 4.1822 / 4.1817 | 4.1818 / 4.1813 | 3.0006 / 3.0001 | 3.0016 / 3.0011 |
| 32mm | 54.005 / 53.995 | 53.972 / 53.960 | 31.959 / 31.945 | 31.965 / 31.953 |
| 40mm | 65.005 / 64.995 | 64.972 / 64.956 | 39.959 / 39.945 | 39.964 / 39.952 |
| 50mm | 81.005 / 80.995 | 80.971 / 80.959 | 49.949 / 49.932 | 49.964 / 49.952 |
| 63mm | 95.005 / 94.995 | 94.972 / 94.960 | 62.949 / 62.932 | 62.964 / 62.952 |
| 80mm | 112.005 / 111.995 | 111.972 / 111.960 | 79.949 / 79.932 | 79.964 / 79.952 |

Straight Sleeve Bushing Installation Instructions

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

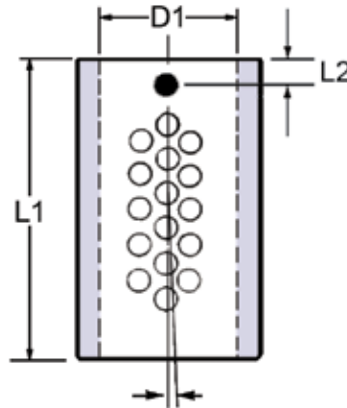
APPLICATION OF BUSHING MOUNT

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 a 4-hour cure at 72° F. Do not disturb bushing until cure is complete.

BUSHING MOUNT:
Part number 9-60-82

Ball-Bearing – Retainers



Radial placement reduces wear and tracking

Lamina ball-bearing retainers (AR1) are made of a heat-treated aluminum alloy that combines lightness and strength.

Each retainer is quality inspected for dimensional tolerance and all burrs are removed prior to ball insertion.

Ball bearings are of the highest quality ISO 3290 Grade 24, continually inspected to meet our exacting tolerance.

After the ball bearings have been inserted into the retainer, they are then staked using Lamina's unique method that allows free movement with maximum security.

After staking, the retainers are then scrubbed to remove all metal particles that could cause accelerated tracking and grooving in the post and bushing.

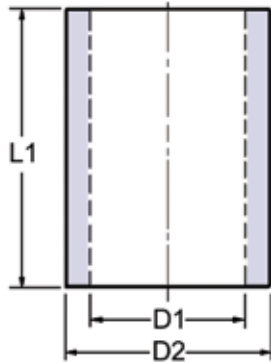
Ball bearings are placed in retainers in an off-line radial pattern that offers optimum life in high or low speed presses.

Ball-bearing retainers are fastened to the guide post by means of a set screw and slot in guide post and are interchangeable with other manufacturers using this method.

| BALL-BEARING RETAINER | | | |
|-----------------------|--------|------|--------------|
| (STANDARD) | | | |
| PART NUMBER | D1 | L1 | L2 SET SCREW |
| AR1-0606 | 3/4" | 1.50 | .250 |
| AR1-0607 | | 1.75 | |
| AR1-0608 | | 2.00 | |
| AR1-0609 | | 2.25 | |
| AR1-0610 | | 2.50 | |
| AR1-0806 | 1" | 1.50 | |
| AR1-0807 | | 1.75 | |
| AR1-0808 | | 2.00 | |
| AR1-0809 | | 2.25 | |
| AR1-0810 | | 2.50 | |
| AR1-1008 | 1-1/4" | 2.00 | |
| AR1-1009 | | 2.25 | |
| AR1-1010 | | 2.50 | |
| AR1-1011 | | 2.75 | |
| AR1-1012 | | 3.00 | |
| AR1-1013 | 3.25 | | |
| AR1-1210 | 1-1/2" | 2.50 | |
| A41-1211 | | 2.75 | |
| AR1-1212 | | 3.00 | |
| AR1-1213 | | 3.25 | |
| AR1-1214 | | 3.50 | |
| AR1-1215 | 3.75 | | |
| AR1-1411 | 1-3/4" | 2.75 | |
| AR1-1412 | | 3.00 | |
| AR1-1413 | | 3.25 | |
| AR1-1414 | | 3.50 | |
| AR1-1415 | | 3.75 | |
| AR1-1416 | 4.00 | | |
| AR1-1417 | 4.25 | | |
| AR1-1613 | 2" | 3.25 | |
| AR1-1614 | | 3.50 | |
| AR1-1615 | | 3.75 | |
| AR1-1616 | | 4.00 | |
| AR1-1617 | | 4.25 | |
| AR1-1618 | 4.50 | | |
| AR1-1622 | 5.50 | | |
| AR1-2018 | 2-1/2" | 4.50 | .313 |
| AR1-2020 | | 5.00 | |
| AR1-2022 | | 5.50 | |
| AR1-2024 | | 6.00 | |
| AR1-2025 | | 6.25 | |
| AR1-2026 | 6.50 | | |
| AR1-2028 | 7.00 | | |
| AR1-2420 | 3" | 5.00 | |
| AR1-2424 | | 6.00 | |
| AR1-2428 | | 7.00 | |

Part numbers highlighted in blue designate that the retainer length is recommended for general die set applications. Lengths not highlighted are for limited space use and special applications.

Ball-Bearing Sleeve Bushings – Press Fit



Lamina's Ball-Bearing Guide Assembly Bushings (AB1) are made from vacuum degassed chrome alloy steel, hardened to precise Rockwell limits to give minimum tracking, grooving and downtime.

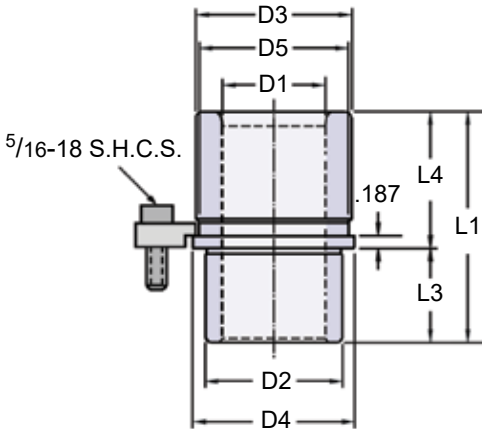
Lamina's ball-bearing bushings are ground and honed to exacting tolerance limits. Using electronic and air checking instruments on the I.D. and O.D. make them interchangeable and do not require select fitting.

The top is chamfered on the I.D. to minimize wear and aid alignment when disengagement is required.

To minimize bushing close-in which is a result of press fit and to eliminate any additional grinding or honing, boring instructions are provided in this catalog.

| BALL-BEARING BUSHINGS – STRAIGHT SLEEVE | | | | | | | | | | | | | | | |
|---|-------------|------------------|------------------|----------|-------------|-------------|------------------|------------------|--------|-------------|-------------|------------------|------------------|----------|--------|
| PART NUMBER | NOM PIN DIA | D1 | D2 | L1 | PART NUMBER | NOM PIN DIA | D1 | D2 | L1 | PART NUMBER | NOM PIN DIA | D1 | D2 | L1 | |
| AB1-0607 | 3/4" | 1.1272 1.1269 | 1.3872 1.3867 | 1.625 | AB1-1214 | 1-1/2" | 1.8771 1.8768 | 2.4372 2.4367 | 3.375 | AB1-1618 | 2" | 2.5021 2.5018 | 3.1622 3.1617 | 4.375 | |
| AB1-0608 | | | | 1.875 | AB1-1215 | | | | | 3.625 | | | | AB1-1619 | 4.625 |
| AB1-0609 | | | | 2.125 | AB1-1216 | | | | | 3.875 | | | | AB1-1620 | 4.875 |
| AB1-0610 | | | | 2.375 | AB1-1217 | | | | | 4.125 | | | | AB1-1621 | 5.125 |
| AB1-0611 | | | | 2.625 | AB1-1218 | | | | | 4.375 | | | | AB1-1622 | 5.375 |
| AB1-0612 | | | | 2.875 | AB1-1219 | | | | | 4.625 | | | | AB1-1624 | 5.875 |
| AB1-0613 | | | | 3.125 | AB1-1220 | | | | | 4.875 | | | | AB1-1626 | 6.375 |
| AB1-0614 | | | | 3.375 | AB1-1221 | | | | | 5.125 | | | | AB1-1628 | 6.875 |
| AB1-0615 | | | | 3.625 | AB1-1222 | | | | | 5.375 | | | | AB1-1630 | 7.375 |
| AB1-0616 | | | | 3.875 | AB1-1224 | | | | | 5.875 | | | | AB1-1632 | 7.875 |
| AB1-0618 | | | | 4.375 | AB1-1226 | | | | | 6.375 | | | | AB1-1634 | 8.375 |
| AB1-0624 | | | | 5.875 | AB1-1228 | | | | | 6.875 | | | | AB1-1636 | 8.875 |
| AB1-0808 | 1" | 1.3772 1.3769 | 1.7172 1.7167 | 1.875 | AB1-1230 | 1-3/4" | 2.1270 2.1267 | 2.7472 2.7467 | 7.375 | AB1-1640 | 2-1/2" | 3.0021 3.0018 | 3.6822 3.6817 | 9.875 | |
| AB1-0809 | | | | 2.125 | AB1-1232 | | | | | 7.875 | | | | AB1-1642 | 10.375 |
| AB1-0810 | | | | 2.375 | AB1-1234 | | | | | 8.375 | | | | AB1-1644 | 10.875 |
| AB1-0811 | | | | 2.625 | AB1-1236 | | | | | 8.875 | | | | AB1-1648 | 11.875 |
| AB1-0812 | | | | 2.875 | AB1-1240 | | | | | 9.875 | | | | AB1-1652 | 12.875 |
| AB1-0813 | | | | 3.125 | AB1-1242 | | | | | 10.375 | | | | AB1-1656 | 13.875 |
| AB1-0814 | | | | 3.375 | AB1-1244 | | | | | 10.875 | | | | AB1-2022 | 5.375 |
| AB1-0815 | | | | 3.625 | AB1-1248 | | | | | 11.875 | | | | AB1-2024 | 5.875 |
| AB1-0816 | | | | 3.875 | AB1-1412 | | | | | 2.875 | | | | AB1-2026 | 6.375 |
| AB1-0817 | | | | 4.125 | AB1-1414 | | | | | 3.375 | | | | AB1-2028 | 6.875 |
| AB1-0818 | | | | 4.375 | AB1-1415 | | | | | 3.625 | | | | AB1-2030 | 7.375 |
| AB1-0819 | | | | 4.625 | AB1-1416 | | | | | 3.875 | | | | AB1-2032 | 7.875 |
| AB1-0820 | 4.875 | AB1-1417 | 4.125 | AB1-2034 | 8.375 | | | | | | | | | | |
| AB1-0822 | 5.375 | AB1-1418 | 4.375 | AB1-2036 | 8.875 | | | | | | | | | | |
| AB1-0824 | 5.875 | AB1-1419 | 4.625 | AB1-2038 | 9.375 | | | | | | | | | | |
| AB1-0826 | 6.375 | AB1-1420 | 4.875 | AB1-2040 | 9.875 | | | | | | | | | | |
| AB1-0828 | 6.875 | AB1-1421 | 5.125 | AB1-2042 | 10.375 | | | | | | | | | | |
| AB1-1010 | 1-1/4" | 1.6271 1.6268 | 2.1072 2.1067 | 2.375 | AB1-1422 | 2" | 2.5021 2.5018 | 3.1622 3.1617 | 5.375 | AB1-2044 | 3" | 3.5020 3.5017 | 4.1822 4.1817 | 10.875 | |
| AB1-1011 | | | | 2.625 | AB1-1424 | | | | 5.875 | AB1-2048 | | | | 11.875 | |
| AB1-1012 | | | | 2.875 | AB1-1426 | | | | 6.375 | AB1-2052 | | | | 12.875 | |
| AB1-1013 | | | | 3.125 | AB1-1428 | | | | 6.875 | AB1-2056 | | | | 13.875 | |
| AB1-1014 | | | | 3.375 | AB1-1430 | | | | 7.375 | AB1-2424 | | | | 5.875 | |
| AB1-1015 | | | | 3.625 | AB1-1432 | | | | 7.875 | AB1-2426 | | | | 6.375 | |
| AB1-1016 | | | | 3.875 | AB1-1434 | | | | 8.375 | AB1-2428 | | | | 6.875 | |
| AB1-1017 | | | | 4.125 | AB1-1436 | | | | 8.875 | AB1-2430 | | | | 7.375 | |
| AB1-1018 | | | | 4.375 | AB1-1438 | | | | 9.375 | AB1-2432 | | | | 7.875 | |
| AB1-1019 | | | | 4.625 | AB1-1440 | | | | 9.875 | AB1-2434 | | | | 8.375 | |
| AB1-1020 | | | | 4.875 | AB1-1442 | | | | 10.375 | AB1-2436 | | | | 8.875 | |
| AB1-1022 | | | | 5.375 | AB1-1444 | | | | 10.875 | AB1-2438 | | | | 9.375 | |
| AB1-1024 | 5.875 | AB1-1448 | 11.875 | AB1-2440 | 9.875 | | | | | | | | | | |
| AB1-1026 | 6.375 | AB1-1452 | 12.875 | AB1-2442 | 10.375 | | | | | | | | | | |
| AB1-1028 | 6.875 | AB1-1612 | 2.875 | AB1-2444 | 10.875 | | | | | | | | | | |
| AB1-1032 | 7.875 | AB1-1614 | 3.375 | AB1-2448 | 11.875 | | | | | | | | | | |
| AB1-1036 | 8.875 | AB1-1615 | 3.625 | AB1-2452 | 12.875 | | | | | | | | | | |
| AB1-1212 | 1-1/2" | 1.8771 1.8768 | 2.4372 2.4367 | 2.875 | AB1-1616 | 2" | 2.5021 2.5018 | 3.1622 3.1617 | 3.875 | AB1-2456 | 3" | 3.5020 3.5017 | 4.1822 4.1817 | 13.875 | |
| AB1-1213 | | | | 3.125 | AB1-1617 | | | | 4.125 | | | | | | |

Ball-Bearing – Bushings – Tap Fit



Demountable shoulder bushings offer all the advantages of straight sleeve bushings and combine them with the convenience of easy assembly and disassembly.

These clamp type bushings are meant to be wring fit into the die shoe and should never be forced or inserted by hammering.

X-40-Clamps and socket head screws are provided to hold the bushings in place.

**Clamping information is on page 4.
See page 5 for bore size information.**

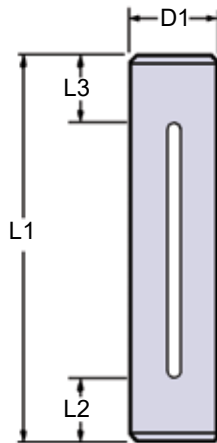
Unground demountable bushings are available by special order only.

| BALL-BEARING BUSHINGS – DEMOUNTABLE | | | | | | | | | |
|-------------------------------------|-------------|------------------|------------------|-------|-------|-------|--------|-------|------------------|
| PART NUMBER | NOM PIN DIA | D1 | D2 | D3 | D4 | D5 | L1 | L3 | L4 |
| ABG0808 | 1" | 1.3772 1.3769 | 1.7163 1.7160 | 1.920 | 1.995 | 1.775 | 1.875 | 1.000 | 0.875 |
| ABG0809 | | | | | | | 2.125 | | 1.125 |
| ABG0811 | | | | | | | 2.625 | | 1.625 |
| ABG0812 | | | | | | | 2.875 | | 1.875 |
| ABG0813 | | | | | | | 3.125 | | 2.125 |
| ABG0814 | | | | | | | 3.375 | | 2.375 |
| ABG0815 | 3.625 | 2.625 | | | | | | | |
| ABG1010 | 1-1/4" | 1.6271 1.6268 | 2.1063 2.1060 | 2.200 | 2.355 | 2.125 | 2.375 | 1.000 | 1.375 |
| ABG1011 | | | | | | | 2.625 | | 1.625 |
| ABG1012 | | | | | | | 2.875 | | 1.875 |
| ABG1013 | | | | | | | 3.125 | | 2.125 |
| ABG1014 | | | | | | | 3.375 | | 2.375 |
| ABG1015 | | | | | | | 3.625 | | 2.625 |
| ABG1016 | | | | | | | 3.875 | | 2.875 |
| ABG1017 | | | | | | | 4.125 | | 3.125 |
| ABG1018 | | | | | | | 4.375 | | 3.375 |
| ABG1020 | | | | | | | 4.875 | | 3.875 |
| ABG1022 | 5.375 | 4.375 | | | | | | | |
| ABG1024 | 5.875 | 4.875 | | | | | | | |
| ABG1212 | 1-1/2" | 1.8771 1.8768 | 2.4363 2.4360 | 2.500 | 2.675 | 2.425 | 2.875 | 1.250 | 1.625 |
| ABG1213 | | | | | | | 3.125 | | 1.875 |
| ABG1214 | | | | | | | 3.375 | | 2.125 |
| ABG1215 | | | | | | | 3.625 | | 2.375 |
| ABG1216 | | | | | | | 3.875 | | 2.625 |
| ABG1217 | | | | | | | 4.125 | | 2.875 |
| ABG1218 | | | | | | | 4.375 | | 3.125 |
| ABG1219 | | | | | | | 4.625 | | 3.375 |
| ABG1220 | | | | | | | 4.875 | | 3.625 |
| ABG1222 | | | | | | | 5.375 | | 4.125 |
| ABG1224 | | | | | | | 5.875 | | 4.625 |
| ABG1412 | | | | | | | 1-3/4" | | 2.1270 2.1267 |
| ABG1414 | 3.375 | 2.125 | | | | | | | |
| ABG1416 | 3.875 | 2.625 | | | | | | | |
| ABG1417 | 4.125 | 2.875 | | | | | | | |
| ABG1418 | 4.375 | 3.125 | | | | | | | |
| ABG1419 | 4.625 | 3.375 | | | | | | | |
| ABG1420 | 4.875 | 3.625 | | | | | | | |
| ABG1421 | 5.125 | 3.875 | | | | | | | |
| ABG1422 | 5.375 | 4.125 | | | | | | | |
| ABG1424 | 5.875 | 4.625 | | | | | | | |
| ABG1426 | 6.375 | 5.125 | | | | | | | |
| ABG1428 | 6.875 | 5.625 | | | | | | | |
| ABG1430 | 7.375 | 6.125 | | | | | | | |
| ABG1612 | 2" | 2.5021 2.5018 | 3.1613 3.1610 | 3.375 | 3.565 | 3.295 | 2.875 | 1.250 | 1.625 |
| ABG1614 | | | | | | | 3.375 | | 2.125 |
| ABG1615 | | | | | | | 3.625 | | 2.375 |
| ABG1616 | | | | | | | 3.875 | | 2.625 |
| ABG1617 | | | | | | | 4.125 | | 2.875 |
| ABG1618 | | | | | | | 4.375 | | 3.125 |
| ABG1619 | | | | | | | 4.625 | | 3.375 |
| ABG1620 | | | | | | | 4.875 | | 3.625 |
| ABG1621 | | | | | | | 5.125 | | 3.875 |
| ABG1622 | | | | | | | 5.375 | | 4.125 |
| ABG1624 | | | | | | | 5.875 | | 4.625 |
| ABG1626 | | | | | | | 6.375 | | 5.125 |
| ABG1628 | 6.875 | 5.625 | | | | | | | |
| ABG1630 | 7.375 | 6.125 | | | | | | | |
| ABG2011 | 2-1/2" | 3.0021 3.0018 | 3.6813 3.6810 | 3.875 | 4.075 | 3.765 | 2.625 | 1.250 | 1.375 |
| ABG2020 | | | | | | | 4.875 | | 3.625 |
| ABG2022 | | | | | | | 5.375 | | 4.125 |
| ABG2024 | | | | | | | 5.875 | | 4.625 |
| ABG2026 | | | | | | | 6.375 | | 5.125 |
| ABG2028 | | | | | | | 6.875 | | 5.625 |
| ABG2030 | 7.375 | 6.125 | | | | | | | |
| ABG2420 | 3" | 3.5020 3.5017 | 4.1813 4.1810 | 4.500 | 4.575 | 4.275 | 4.875 | 1.250 | 3.625 |
| ABG2422 | | | | | | | 5.375 | | 4.125 |
| ABG2424 | | | | | | | 5.875 | | 4.625 |
| ABG2426 | | | | | | | 6.375 | | 5.125 |
| ABG2428 | | | | | | | 6.875 | | 5.625 |
| ABG2430 | | | | | | | 7.375 | | 6.125 |

Ball-Bearing Guide Posts – Press Fit

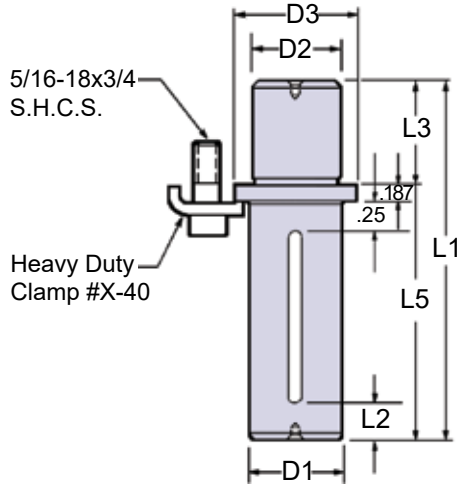
Lamina's Precision Guide Post (AP1) for ball-bearing assemblies are made from chrome alloy steel, hardened to provide maximum protection against tracking and accelerated wear.

Ground to a high degree of tolerance accuracy that also provides a smooth hard wearing surface to assure free rolling of balls to maintain constant, predictable preload and complete interchangeability, not only with our own but other manufacturers' also.



| BALL-BEARING GUIDE POSTS – STRAIGHT | | | | | | | | | | | |
|-------------------------------------|-------------|------------------|-------|----------|--------|-------------|-------------|------------------|--------|-------|-------|
| PART NUMBER | NOM PIN DIA | D1 | L1 | L2 | L3 | PART NUMBER | NOM PIN DIA | D1 | L1 | L2 | L3 |
| AP1-0612 | 3/4" | .7530 .7527 | 2.875 | 0.625 | 0.813 | AP1-1422 | 1-3/4" | 1.7530 1.7525 | 5.375 | 1.313 | 1.313 |
| AP1-0613 | | | 3.125 | 0.625 | 0.813 | AP1-1423 | | | 5.625 | 1.500 | 1.500 |
| AP1-0614 | | | 3.375 | 0.625 | 0.813 | AP1-1424 | | | 5.875 | 1.500 | 1.500 |
| AP1-0615 | | | 3.625 | 0.625 | 0.813 | AP1-1425 | | | 6.125 | 1.500 | 1.500 |
| AP1-0616 | | | 3.875 | 0.625 | 0.813 | AP1-1426 | | | 6.375 | 1.625 | 1.750 |
| AP1-0617 | | | 4.125 | 0.625 | 0.813 | AP1-1428 | | | 6.875 | 1.625 | 1.750 |
| AP1-0618 | | | 4.375 | 0.625 | 0.813 | AP1-1430 | | | 7.375 | 1.625 | 1.750 |
| AP1-0619 | | | 4.625 | 0.875 | 1.000 | AP1-1432 | | | 7.875 | 1.625 | 1.750 |
| AP1-0620 | | | 4.875 | 0.875 | 1.000 | AP1-1434 | | | 8.375 | 1.625 | 1.750 |
| AP1-0622 | | | 5.375 | 0.875 | 1.000 | AP1-1436 | | | 8.875 | 1.625 | 2.250 |
| AP1-0624 | 5.875 | 0.875 | 1.000 | AP1-1438 | 9.375 | 1.625 | 2.250 | | | | |
| AP1-0815 | 1" | 1.0030 1.0027 | 3.625 | 0.875 | 1.000 | AP1-1440 | 2" | 2.0031 2.0026 | 9.875 | 1.625 | 2.250 |
| AP1-0816 | | | 3.875 | 0.875 | 1.000 | AP1-1442 | | | 10.375 | 1.625 | 2.250 |
| AP1-0817 | | | 4.125 | 0.875 | 1.000 | AP1-1444 | | | 10.875 | 1.625 | 2.250 |
| AP1-0818 | | | 4.375 | 0.875 | 1.000 | AP1-1446 | | | 11.375 | 1.625 | 2.250 |
| AP1-0819 | | | 4.625 | 0.875 | 1.250 | AP1-1448 | | | 11.875 | 1.625 | 2.250 |
| AP1-0820 | | | 4.875 | 0.875 | 1.250 | AP1-1450 | | | 12.375 | 1.625 | 2.250 |
| AP1-0821 | | | 5.125 | 0.875 | 1.250 | AP1-1452 | | | 12.875 | 1.625 | 2.875 |
| AP1-0822 | | | 5.375 | 0.875 | 1.250 | AP1-1456 | | | 13.875 | 1.625 | 2.875 |
| AP1-0823 | | | 5.625 | 0.875 | 1.250 | AP1-1460 | | | 14.875 | 1.625 | 2.875 |
| AP1-0824 | | | 5.875 | 0.875 | 1.250 | AP1-1468 | | | 16.875 | 1.625 | 2.875 |
| AP1-0826 | 6.375 | 0.875 | 1.500 | AP1-1622 | 5.375 | 1.375 | 1.500 | | | | |
| AP1-0828 | 6.875 | 0.875 | 1.500 | AP1-1623 | 5.625 | 1.375 | 1.500 | | | | |
| AP1-0830 | 7.375 | 0.875 | 1.500 | AP1-1624 | 5.875 | 1.375 | 1.500 | | | | |
| AP1-0832 | 7.875 | 0.875 | 1.500 | AP1-1625 | 6.125 | 1.375 | 1.500 | | | | |
| AP1-0834 | 8.375 | 0.875 | 2.000 | AP1-1626 | 6.375 | 1.750 | 1.875 | | | | |
| AP1-0836 | 8.875 | 0.875 | 2.000 | AP1-1627 | 6.625 | 1.750 | 1.875 | | | | |
| AP1-1018 | 1-1/4" | 1.2530 1.2526 | 4.375 | 1.000 | 1.375 | AP1-1628 | 2-1/2" | 2.5031 2.5026 | 6.875 | 1.750 | 1.875 |
| AP1-1019 | | | 4.625 | 1.000 | 1.375 | AP1-1629 | | | 7.125 | 1.750 | 1.875 |
| AP1-1020 | | | 4.875 | 1.000 | 1.375 | AP1-1630 | | | 7.375 | 1.750 | 1.875 |
| AP1-1021 | | | 5.125 | 1.000 | 1.375 | AP1-1631 | | | 7.625 | 1.750 | 1.875 |
| AP1-1022 | | | 5.375 | 1.000 | 1.375 | AP1-1632 | | | 7.875 | 1.750 | 1.875 |
| AP1-1023 | | | 5.625 | 1.000 | 1.375 | AP1-1634 | | | 8.375 | 1.875 | 2.250 |
| AP1-1024 | | | 5.875 | 1.000 | 1.375 | AP1-1636 | | | 8.875 | 1.875 | 2.250 |
| AP1-1026 | | | 6.375 | 1.125 | 1.750 | AP1-1638 | | | 9.375 | 1.875 | 2.250 |
| AP1-1028 | | | 6.875 | 1.125 | 1.750 | AP1-1640 | | | 9.875 | 1.875 | 2.250 |
| AP1-1030 | | | 7.375 | 1.125 | 1.750 | AP1-1642 | | | 10.375 | 1.875 | 2.250 |
| AP1-1032 | 7.875 | 1.125 | 1.750 | AP1-1644 | 10.875 | 1.875 | 2.250 | | | | |
| AP1-1034 | 8.375 | 1.125 | 1.750 | AP1-1646 | 11.375 | 1.875 | 3.000 | | | | |
| AP1-1036 | 8.875 | 1.125 | 1.750 | AP1-1648 | 11.875 | 1.875 | 3.000 | | | | |
| AP1-1040 | 9.875 | 1.125 | 2.250 | AP1-1650 | 12.375 | 1.875 | 3.000 | | | | |
| AP1-1044 | 10.875 | 1.125 | 2.250 | AP1-1652 | 12.875 | 1.875 | 3.000 | | | | |
| AP1-1048 | 11.875 | 1.175 | 2.250 | AP1-1656 | 13.875 | 1.875 | 3.000 | | | | |
| AP1-1218 | 1-1/2" | 1.5030 1.5026 | 4.375 | 1.375 | 1.313 | AP1-1660 | 3" | 3.0031 3.0025 | 14.875 | 1.875 | 3.000 |
| AP1-1219 | | | 4.625 | 1.375 | 1.313 | AP1-1664 | | | 15.875 | 1.875 | 3.000 |
| AP1-1220 | | | 4.875 | 1.375 | 1.313 | AP1-1668 | | | 16.875 | 1.875 | 3.000 |
| AP1-1221 | | | 5.125 | 1.375 | 1.313 | AP1-1672 | | | 17.875 | 1.875 | 3.000 |
| AP1-1222 | | | 5.375 | 1.375 | 1.313 | AP1-2032 | | | 7.875 | 1.625 | 2.500 |
| AP1-1223 | | | 5.625 | 1.250 | 1.563 | AP1-2034 | | | 8.375 | 1.625 | 2.500 |
| AP1-1224 | | | 5.875 | 1.250 | 1.563 | AP1-2036 | | | 8.875 | 2.375 | 2.750 |
| AP1-1226 | | | 6.375 | 1.250 | 1.563 | AP1-2040 | | | 9.875 | 2.375 | 3.000 |
| AP1-1228 | | | 6.875 | 1.375 | 2.000 | AP1-2044 | | | 10.875 | 2.375 | 3.000 |
| AP1-1230 | | | 7.375 | 1.375 | 2.000 | AP1-2048 | | | 11.875 | 2.375 | 3.000 |
| AP1-1232 | 7.875 | 1.375 | 2.000 | AP1-2052 | 12.875 | 2.375 | 3.000 | | | | |
| AP1-1234 | 8.375 | 1.375 | 2.000 | AP1-2056 | 13.875 | 2.375 | 3.000 | | | | |
| AP1-1236 | 8.875 | 1.625 | 2.500 | AP1-2068 | 16.875 | 2.625 | 4.000 | | | | |
| AP1-1238 | 9.375 | 1.625 | 2.500 | AP1-2080 | 19.875 | 2.625 | 4.000 | | | | |
| AP1-1240 | 9.875 | 1.625 | 2.500 | AP1-2432 | 7.875 | 1.875 | 2.500 | | | | |
| AP1-1242 | 10.375 | 1.625 | 2.500 | AP1-2434 | 8.375 | 1.875 | 2.500 | | | | |
| AP1-1244 | 10.875 | 1.625 | 2.500 | AP1-2436 | 8.875 | 1.875 | 2.500 | | | | |
| AP1-1246 | 11.375 | 1.625 | 2.500 | AP1-2440 | 9.875 | 2.875 | 3.000 | | | | |
| AP1-1248 | 11.875 | 1.625 | 2.500 | AP1-2444 | 10.875 | 2.875 | 3.000 | | | | |
| AP1-1250 | 12.375 | 1.625 | 2.500 | AP1-2448 | 11.875 | 2.875 | 3.000 | | | | |
| AP1-1252 | 12.875 | 1.625 | 2.500 | AP1-2452 | 12.875 | 2.875 | 3.000 | | | | |
| AP1-1256 | 13.875 | 1.625 | 2.500 | AP1-2456 | 13.875 | 2.875 | 3.000 | | | | |
| AP1-1420 | 1-3/4" | 1.7530 1.7525 | 4.875 | 1.313 | 1.313 | AP1-2468 | 3" | 3.0031 3.0025 | 16.875 | 2.875 | 4.000 |
| AP1-1421 | | | 5.125 | 1.313 | 1.313 | AP1-2480 | | | 19.875 | 2.875 | 4.000 |

Ball-Bearing Guide Posts – Tap Fit



Designed to expedite die repair, these Ball-Bearing flanged guide posts offer:

- Large savings in maintenance, repair costs and downtime
- Wide variety of sizes
- Long, trouble-free production runs
- Highest quality workmanship and materials
- “D2” dimension is finished ground

Clamps & Screws included

Pins with unground D2 dimensions are available as specials.

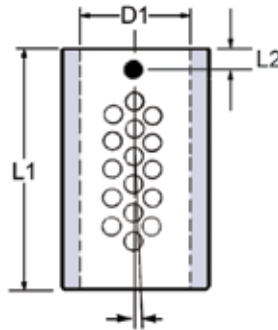
| BALL-BEARING GUIDE POSTS – DEMOUNTABLE | | | | | | | | | | | | | | | | | | |
|--|-------------|------------------|------------------|---------|--------|--------|--------|------------------|------------------|-------------|------------------|------------------|--------|--------|------------------|------------------|--------|--------|
| PART NUMBER | NOM PIN DIA | D1 | D2 | D3 | L1 | L2 | L3 | L5 | PART NUMBER | NOM PIN DIA | D1 | D2 | D3 | L1 | L2 | L3 | L5 | |
| APG0815 | 1" | 1.0030 1.0027 | 1.0011 1.0006 | 1.312 | 3.625 | 0.875 | 1.188 | 2.437 | APG1626 | 2" | 2.0031 2.0026 | 2.0011 2.0006 | 2.500 | 6.375 | 1.375 | 1.938 | 4.437 | |
| APG0819 | | | | | 4.625 | | | 3.437 | APG1627 | | | | | 6.625 | 1.375 | | 4.687 | |
| APG0820 | | | | | 4.875 | | | 3.687 | APG1628 | | | | | 6.875 | 1.625 | | 4.937 | |
| APG0821 | | | | | 5.125 | | | 3.937 | APG1629 | | | | | 7.125 | 1.625 | | 5.187 | |
| APG0824 | | | | | 5.875 | | | 4.687 | APG1630 | | | | | 7.375 | 1.625 | | 5.437 | |
| APG0826 | | | | | 6.375 | | | 5.187 | APG1632 | | | | | 7.875 | 1.625 | | 5.937 | |
| APG0828 | | | | | 6.875 | | | 5.687 | APG1634 | | | | | 8.375 | 1.625 | | 6.437 | |
| APG0830 | | | | | 7.375 | | | 6.187 | APG1636 | | | | | 8.875 | 1.625 | | 6.937 | |
| APG0836 | | | | | 8.875 | | | 7.687 | APG1638 | | | | | 9.375 | 1.875 | | 7.437 | |
| APG1021 | | | | | 1-1/4" | | | 1.2530 1.2526 | 1.2511 1.2506 | | | | | 1.562 | 5.125 | | 0.875 | 1.188 |
| APG1022 | 5.375 | 0.875 | 4.187 | APG1642 | | 10.375 | 1.875 | | | 8.437 | | | | | | | | |
| APG1023 | 5.625 | 0.875 | 4.437 | APG1644 | | 10.875 | 1.875 | | | 8.937 | | | | | | | | |
| APG1026 | 6.375 | 0.875 | 5.187 | APG1648 | | 11.875 | 1.875 | | | 9.937 | | | | | | | | |
| APG1028 | 6.875 | 0.875 | 5.687 | APG1650 | | 12.375 | 1.875 | | | 10.437 | | | | | | | | |
| APG1030 | 7.375 | 0.875 | 6.187 | APG1652 | | 12.875 | 1.875 | | | 10.937 | | | | | | | | |
| APG1032 | 7.875 | 1.125 | 6.687 | APG1656 | | 13.875 | 1.875 | | | 11.937 | | | | | | | | |
| APG1034 | 8.375 | 1.125 | 7.187 | APG1660 | | 14.875 | 1.875 | | | 12.937 | | | | | | | | |
| APG1036 | 8.875 | 1.125 | 7.687 | APG1664 | | 15.875 | 1.875 | | | 13.937 | | | | | | | | |
| APG1218 | 1-1/2" | 1.5030 1.5026 | 1.5011 1.5006 | 1.875 | | 4.375 | 1.125 | | | 1.438 | 2.937 | APG1668 | 2-1/2" | | 2.5031 2.5026 | 2.5011 2.5006 | 3.000 | |
| APG1222 | | | | | 5.375 | 1.125 | 3.937 | APG1672 | 17.875 | | 1.875 | 15.937 | | | | | | |
| APG1223 | | | | | 5.625 | 1.125 | 4.187 | APG2032 | 7.875 | | 2.375 | 5.937 | | | | | | |
| APG1224 | | | | | 5.875 | 1.125 | 4.437 | APG2034 | 8.375 | | 2.375 | 6.437 | | | | | | |
| APG1226 | | | | | 6.375 | 1.125 | 4.937 | APG2036 | 8.875 | | 2.375 | 6.937 | | | | | | |
| APG1228 | | | | | 6.875 | 1.375 | 5.437 | APG2040 | 9.875 | | 2.375 | 7.937 | | | | | | |
| APG1230 | | | | | 7.375 | 1.375 | 5.937 | APG2044 | 10.875 | | 2.375 | 8.937 | | | | | | |
| APG1234 | | | | | 8.375 | 1.375 | 6.937 | APG2048 | 11.875 | | 2.375 | 9.937 | | | | | | |
| APG1236 | | | | | 8.875 | 1.375 | 7.437 | APG2052 | 12.875 | | 2.375 | 10.937 | | | | | | |
| APG1238 | | | | | 9.375 | 1.375 | 7.937 | APG2056 | 13.875 | | 2.375 | 11.937 | | | | | | |
| APG1242 | 10.375 | 1.375 | 8.937 | APG2068 | 16.875 | 2.375 | 14.937 | | | | | | | | | | | |
| APG1424 | 1-3/4" | 1.7530 1.7525 | 1.7511 1.7506 | 2.250 | 5.875 | 1.375 | 1.688 | 4.187 | APG2080 | 3" | 3.0031 3.0025 | 3.0011 3.0006 | 3.500 | 19.875 | 2.375 | 2.438 | 17.937 | |
| APG1428 | | | | | 6.875 | 1.375 | | 5.187 | APG2432 | | | | | 7.875 | 1.875 | | 5.437 | |
| APG1430 | | | | | 7.375 | 1.375 | | 5.687 | APG2434 | | | | | 8.375 | 1.875 | | 5.937 | |
| APG1432 | | | | | 7.875 | 1.375 | | 6.187 | APG2436 | | | | | 8.875 | 1.875 | | 6.437 | |
| APG1434 | | | | | 8.375 | 1.375 | | 6.687 | APG2440 | | | | | 9.875 | 2.375 | | 7.437 | |
| APG1436 | | | | | 8.875 | 1.625 | | 7.187 | APG2444 | | | | | 10.875 | 2.375 | | 8.437 | |
| APG1438 | | | | | 9.375 | 1.625 | | 7.687 | APG2448 | | | | | 11.875 | 2.375 | | 9.437 | |
| APG1440 | | | | | 9.875 | 1.625 | | 8.187 | APG2452 | | | | | 12.875 | 2.875 | | 10.437 | |
| APG1442 | | | | | 10.375 | 1.625 | | 8.687 | APG2456 | | | | | 13.875 | 2.875 | | 11.437 | |
| APG1448 | | | | | 11.875 | 1.625 | | 10.187 | APG2468 | | | | | 16.875 | 2.875 | | 14.437 | |
| See page 4 for toe clamp placement instructions. | | | | | | | | | APG2480 | | | | | | | 19.875 | 2.875 | 17.437 |

Lamina offers a generous range of Metric Ball-Bearing Components to suit your needs.

- Retainers
- Sleeve Bushings
- Tap-Fit Bushings (Demountable)
- Straight Pins
- Tap-Fit Pins (Demountable)

Specials are available.

Ball-Bearing Retainers – Metric



- Heat-Treated Aluminum
- ISO 3290 Grade 24 Bearings
- Off-line radial pattern
- Set-screw and slot fastening

| BALL-BEARING RETAINERS – METRIC | | | |
|-------------------------------------|-------------------------|-------------------|--------------------|
| PART NUMBER | D1 Nom Pin Dia | L1 Length | L2 SET SCREW |
| ARM032058 ARM032070 ARM032083 | 32 | 58 70 83 | 6.35 |
| ARM040065 ARM040077 ARM040096 | 40 | 65 77 96 | 6.35 |
| ARM050083 ARM050102 ARM050114 | 50 | 83 102 114 | 6.35 |
| ARM063100 ARM063140 ARM063178 | 63 | 100 140 178 | 7.94 |
| ARM080100 ARM080140 ARM080178 | 80 | 100 140 178 | 7.94 |

Lamina ball-bearing retainers (ARM) are made of a heat-treated aluminum alloy that combines lightness and strength.

Each retainer is quality inspected for dimensional tolerance and all burrs are removed prior to ball insertion.

Ball bearings are of the highest quality ISO 3290 Grade 24, continually inspected to meet our exacting tolerance.

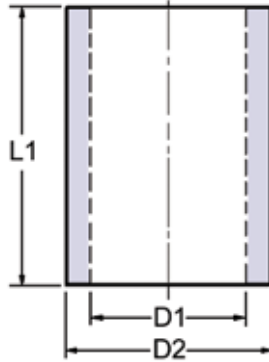
After the ball bearings have been inserted into the retainer, they are then staked using Lamina's unique method that allows free movement with maximum security.

After staking, the retainers are then scrubbed to remove all metal particles that could cause accelerated tracking and grooving in the post and bushing.

Ball bearings are placed in retainers in an off-line radial pattern that offers optimum life in high or low speed presses.

Ball-bearing retainers are fastened to the guide post by means of a set screw and slot in guide post and are interchangeable with other manufacturers using this method.

Ball-Bearing Sleeve Bushings – Metric



- Vacuum degassed chrome alloy steel
- Ground & honed to exact tolerance limits
- Top chamfered on I.D. to aid in alignment

Lengths up to 300mm – centerless ground
 Lengths over 300mm – ground on centers

| BALL-BEARING SLEEVE BUSHINGS – METRIC | | | | | | | | | | | | | | | |
|---------------------------------------|-------------|------------------|------------------|-----|------------------|-------------|------------------|--------------------|------------------|-----|-----------|----|------------------|------------------|-----|
| PART NUMBER | NOM PIN DIA | D1 | D2 | L1 | PART NUMBER | NOM PIN DIA | D1 | D2 | L1 | | | | | | |
| ABM032075 | 32 | 41.986 41.979 | 54.005 53.995 | 75 | ABM050175 | 50 | 63.986 63.978 | 81.005 80.995 | 175 | | | | | | |
| ABM032080 | | | | 80 | ABM050190 | | | | 190 | | | | | | |
| ABM032090 | | | | 90 | ABM050200 | | | | 200 | | | | | | |
| ABM032095 | | | | 95 | ABM050215 | | | | 215 | | | | | | |
| ABM032100 | | | | 100 | ABM050230 | | | | 230 | | | | | | |
| ABM032105 | | | | 105 | ABM050250 | | | | 250 | | | | | | |
| ABM032115 | | | | 115 | ABM050280 | | | | 280 | | | | | | |
| ABM032125 | | | | 125 | ABM050300 | | | | 300 | | | | | | |
| ABM032140 | | | | 140 | ABM050330 | | | | 330 | | | | | | |
| ABM032150 | | | | 150 | ABM050350 | | | | 350 | | | | | | |
| ABM032165 | | | | 165 | ABM063150 | | | | 150 | | | | | | |
| ABM032175 | | | | 175 | ABM063165 | | | | 165 | | | | | | |
| ABM032200 | | | | 220 | ABM063175 | | | | 175 | | | | | | |
| ABM032230 | | | | 230 | ABM063190 | | | | 190 | | | | | | |
| ABM040100 | | | | 40 | 49.986 49.979 | | | | 65.005 64.995 | 100 | ABM063200 | 63 | 76.985 76.977 | 95.005 94.995 | 200 |
| ABM040105 | | | | | | | | | | 105 | ABM063215 | | | | 215 |
| ABM040115 | 115 | ABM063230 | 230 | | | | | | | | | | | | |
| ABM040120 | 120 | ABM063250 | 250 | | | | | | | | | | | | |
| ABM040125 | 125 | ABM063280 | 280 | | | | | | | | | | | | |
| ABM040135 | 135 | ABM063300 | 300 | | | | | | | | | | | | |
| ABM040140 | 140 | ABM063330 | 330 | | | | | | | | | | | | |
| ABM040150 | 150 | ABM063350 | 350 | | | | | | | | | | | | |
| ABM040165 | 165 | ABM080150 | 150 | | | | | | | | | | | | |
| ABM040175 | 175 | ABM080165 | 165 | | | | | | | | | | | | |
| ABM040190 | 190 | ABM080175 | 175 | | | | | | | | | | | | |
| ABM040200 | 200 | ABM080190 | 190 | | | | | | | | | | | | |
| ABM040215 | 215 | ABM080200 | 200 | | | | | | | | | | | | |
| ABM040230 | 230 | ABM080215 | 215 | | | | | | | | | | | | |
| ABM040250 | 250 | ABM080230 | 230 | | | | | | | | | | | | |
| ABM040280 | 280 | ABM080250 | 250 | | | | | | | | | | | | |
| ABM040300 | 300 | ABM080280 | 280 | | | | | | | | | | | | |
| ABM050125 | 50 | 63.986 63.978 | 81.005 80.995 | 125 | ABM080300 | 80 | 93.985 93.977 | 112.005 111.995 | 300 | | | | | | |
| ABM050135 | | | | 135 | ABM080330 | | | | 330 | | | | | | |
| ABM050140 | | | | 140 | ABM080350 | | | | 350 | | | | | | |
| ABM050150 | | | | 150 | ABM080500 | | | | 500 | | | | | | |
| ABM050165 | | | | 165 | | | | | | | | | | | |

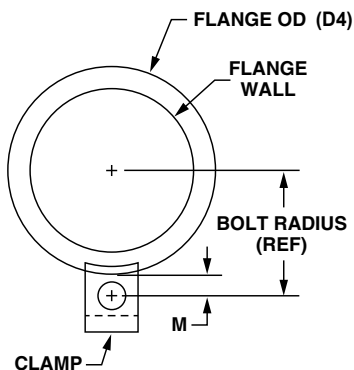
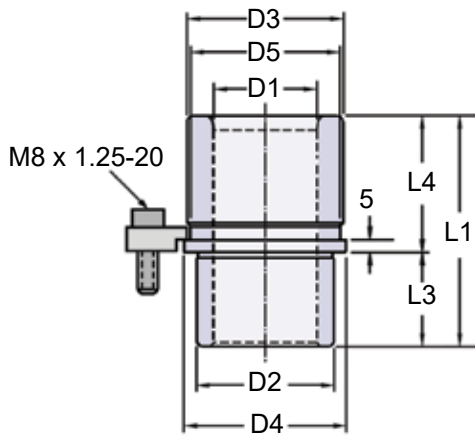
Ball-Bearing Bushings – Tap Fit – Metric



Demountable shoulder bushings offer all the advantages of straight sleeve bushings and combine them with the convenience of easy assembly and disassembly.

These clamp type bushings are meant to be wring fit into the die shoe and should never be forced or inserted by hammering.

X-40-Clamps and socket head screws are provided to hold the bushings in place.

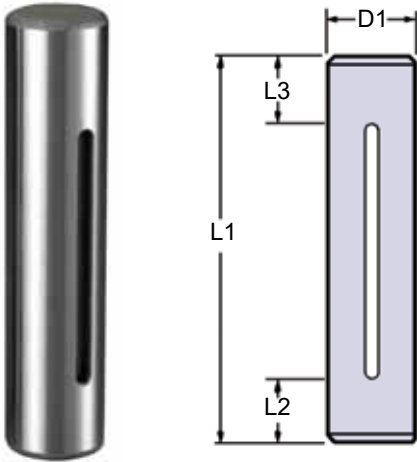


M = Flange OD to Clamp Bolt Center
Bolt Radius = (Flange OD ÷ 2) + M

BALL-BEARING BUSHINGS – DEMOUNTABLE – METRIC

| PART NUMBER | NOM PIN DIA | D1 | D2 | D3 | D4 | D5 | M | Bolt Radius (REF) | L1 | L3 | L4 |
|-------------|-------------|------------------|--------------------|--------|-----|--------|------|-------------------|-----|----|-----|
| ABGM032065 | | | | | | | | | 65 | | 35 |
| ABGM032070 | | | | | | | | | 70 | | 40 |
| ABGM032075 | | | | | | | | | 75 | | 45 |
| ABGM032080 | | | | | | | | | 80 | | 50 |
| ABGM032085 | | | | | | | | | 85 | | 55 |
| ABGM032090 | | | | | | | | | 90 | | 60 |
| ABGM032095 | 32 | 41.986 41.979 | 53.959 53.951 | 59.94 | 61 | 54.10 | 6.25 | 36.75 | 95 | 30 | 65 |
| ABGM032105 | | | | | | | | | 105 | | 75 |
| ABGM032110 | | | | | | | | | 110 | | 80 |
| ABGM032115 | | | | | | | | | 115 | | 85 |
| ABGM032130 | | | | | | | | | 130 | | 100 |
| ABGM032140 | | | | | | | | | 140 | | 110 |
| ABGM032155 | | | | | | | | | 155 | | 125 |
| ABGM040075 | | | | | | | | | 75 | | 40 |
| ABGM040080 | | | | | | | | | 80 | | 45 |
| ABGM040085 | | | | | | | | | 85 | | 50 |
| ABGM040090 | | | | | | | | | 90 | | 55 |
| ABGM040095 | | | | | | | | | 95 | | 60 |
| ABGM040100 | | | | | | | | | 100 | | 65 |
| ABGM040110 | 40 | 49.986 49.979 | 64.960 64.952 | 63.50 | 72 | 65.10 | 6 | 42 | 110 | 35 | 75 |
| ABGM040115 | | | | | | | | | 115 | | 80 |
| ABGM040120 | | | | | | | | | 120 | | 85 |
| ABGM040125 | | | | | | | | | 125 | | 90 |
| ABGM040135 | | | | | | | | | 135 | | 100 |
| ABGM040140 | | | | | | | | | 140 | | 105 |
| ABGM040155 | | | | | | | | | 155 | | 120 |
| ABGM050075 | | | | | | | | | 75 | | 40 |
| ABGM050090 | | | | | | | | | 90 | | 55 |
| ABGM050095 | | | | | | | | | 95 | | 60 |
| ABGM050100 | | | | | | | | | 100 | | 65 |
| ABGM050110 | | | | | | | | | 110 | | 75 |
| ABGM050115 | | | | | | | | | 115 | | 80 |
| ABGM050125 | 50 | 63.986 63.978 | 80.959 80.951 | 85.73 | 91 | 84.15 | 6 | 51.5 | 125 | 35 | 90 |
| ABGM050135 | | | | | | | | | 135 | | 100 |
| ABGM050140 | | | | | | | | | 140 | | 105 |
| ABGM050155 | | | | | | | | | 155 | | 120 |
| ABGM050165 | | | | | | | | | 165 | | 130 |
| ABGM050180 | | | | | | | | | 180 | | 145 |
| ABGM050190 | | | | | | | | | 190 | | 155 |
| ABGM063125 | | | | | | | | | 125 | | 90 |
| ABGM063140 | | | | | | | | | 140 | | 105 |
| ABGM063155 | 63 | 76.985 76.977 | 94.960 94.952 | 101.85 | 105 | 98.43 | 6 | 58.5 | 155 | 35 | 120 |
| ABGM063165 | | | | | | | | | 165 | | 130 |
| ABGM063180 | | | | | | | | | 180 | | 145 |
| ABGM063190 | | | | | | | | | 190 | | 155 |
| ABGM080125 | | | | | | | | | 125 | | 90 |
| ABGM080140 | | | | | | | | | 140 | | 105 |
| ABGM080155 | 80 | 93.985 93.977 | 111.960 111.952 | 114.30 | 122 | 113.00 | 6 | 67 | 155 | 35 | 120 |
| ABGM080165 | | | | | | | | | 165 | | 130 |
| ABGM080180 | | | | | | | | | 180 | | 145 |
| ABGM080190 | | | | | | | | | 190 | | 155 |

Ball-Bearing Guide Posts –Straight – Metric

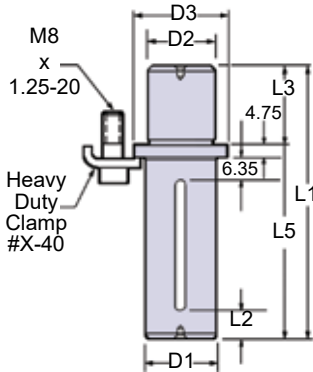


- Hardened chrome alloy steel
- Precision Ground

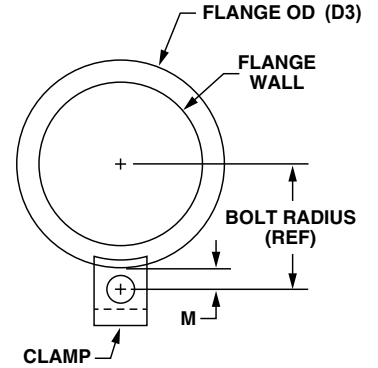
Lengths up to 300mm – centerless ground
 Lengths over 300mm – ground on centers

| BALL-BEARING GUIDE POSTS – METRIC | | | | | | | | | | | | | | |
|-----------------------------------|-------------|------------------|------|------------------|------|------------|-------------|-------------|------------------|------|------|-----------|------------|----|
| PART NUMBER | NOM PIN DIA | D1 | L1 | L2 | L3 | # of Slots | PART NUMBER | NOM PIN DIA | D1 | L1 | L2 | L3 | # of Slots | |
| APM032125 | 32 | 32.008 32.000 | 125 | 25.4 | 34.9 | 1 | APM050215 | 50 | 50.008 50.000 | 215 | 47.6 | 57.2 | 2 | |
| APM032135 | | | 135 | 25.4 | 34.9 | | APM050230 | | | 230 | 47.6 | 57.2 | | |
| APM032140 | | | 140 | 25.4 | 34.9 | | APM050240 | | | 240 | 47.6 | 57.2 | | |
| APM032145 | | | 145 | 25.4 | 34.9 | | APM050250 | | | 250 | 47.6 | 57.2 | | |
| APM032150 | | | 150 | 28.6 | 44.5 | | APM050265 | | | 265 | 47.6 | 57.2 | | |
| APM032165 | | | 165 | 28.6 | 44.5 | | APM050280 | | | 280 | 47.6 | 76.2 | | |
| APM032175 | | | 175 | 28.6 | 44.5 | | APM050290 | | | 290 | 47.6 | 76.2 | | |
| APM032190 | | | 190 | 28.6 | 44.5 | | APM050300 | | | 300 | 47.6 | 76.2 | | |
| APM032200 | | | 200 | 28.6 | 44.5 | | APM050315 | | | 315 | 47.6 | 76.2 | | |
| APM032215 | | | 215 | 28.6 | 44.5 | | APM050330 | | | 330 | 47.6 | 76.2 | | |
| APM032230 | | | 230 | 28.6 | 44.5 | | APM050360 | | | 360 | 47.6 | 76.2 | | |
| APM032250 | | | 250 | 28.6 | 57.2 | | APM050380 | | | 380 | 47.6 | 76.2 | | |
| APM032260 | | | 260 | 28.6 | 57.2 | | APM050400 | | | 400 | 47.6 | 76.2 | | |
| APM032280 | | | 280 | 28.6 | 57.2 | | APM050430 | | | 430 | 47.6 | 76.2 | | |
| APM032300 | | | 300 | 28.6 | 57.2 | | APM050460 | | | 460 | 47.6 | 76.2 | | |
| APM040125 | | | 40 | 40.008 40.000 | 125 | | 34.9 | | | 33.3 | 1 | APM063200 | | 63 |
| APM040135 | 135 | 34.9 | | | 33.3 | APM063215 | 215 | 41.3 | 63.5 | | | | | |
| APM040140 | 140 | 34.9 | | | 33.3 | APM063230 | 230 | 41.3 | 63.5 | | | | | |
| APM040145 | 145 | 31.8 | | | 39.7 | APM063240 | 240 | 60.3 | 76.2 | | | | | |
| APM040150 | 150 | 31.8 | | | 39.7 | APM063250 | 250 | 60.3 | 76.2 | | | | | |
| APM040165 | 165 | 34.9 | | | 39.7 | APM063265 | 265 | 60.3 | 76.2 | | | | | |
| APM040175 | 175 | 34.9 | | | 50.8 | APM063280 | 280 | 60.3 | 76.2 | | | | | |
| APM040190 | 190 | 34.9 | | | 50.8 | APM063300 | 300 | 60.3 | 76.2 | | | | | |
| APM040200 | 200 | 34.9 | | | 50.8 | APM063315 | 315 | 60.3 | 76.2 | | | | | |
| APM040215 | 215 | 34.9 | | | 50.8 | APM063330 | 330 | 60.3 | 76.2 | | | | | |
| APM040230 | 230 | 41.3 | | | 63.5 | APM063360 | 360 | 60.3 | 76.2 | | | | | |
| APM040240 | 240 | 41.3 | | | 63.5 | APM063380 | 380 | 60.3 | 76.2 | | | | | |
| APM040250 | 250 | 41.3 | | | 63.5 | APM063430 | 430 | 66.7 | 101.6 | | | | | |
| APM040265 | 265 | 41.3 | | | 63.5 | APM063500 | 500 | 66.7 | 101.6 | | | | | |
| APM040280 | 280 | 41.3 | | | 63.5 | APM080200 | 200 | 47.6 | 63.5 | 2 | | | | |
| APM040290 | 290 | 41.3 | | | 63.5 | APM080215 | 215 | 47.6 | 63.5 | | | | | |
| APM040300 | 300 | 41.3 | 63.5 | APM080230 | 230 | 47.6 | 63.5 | | | | | | | |
| APM040315 | 315 | 41.3 | 63.5 | APM080250 | 250 | 73.0 | 76.2 | | | | | | | |
| APM040330 | 330 | 41.3 | 63.5 | APM080280 | 280 | 73.0 | 76.2 | | | | | | | |
| APM040360 | 360 | 41.3 | 63.5 | APM080300 | 300 | 73.0 | 76.2 | | | | | | | |
| APM050150 | 50 | 50.008 50.000 | 150 | 34.9 | 38.1 | 2 | APM080330 | 80 | 80.008 80.000 | | 330 | 73.0 | 76.2 | |
| APM050165 | | | 165 | 44.5 | 47.6 | | APM080360 | | | | 360 | 73.0 | 76.2 | |
| APM050175 | | | 175 | 44.5 | 47.6 | | APM080430 | | | | 430 | 73.0 | 101.6 | |
| APM050190 | | | 190 | 44.5 | 47.6 | | APM080500 | | | | 500 | 73.0 | 101.6 | |
| APM050200 | | | 200 | 44.5 | 47.6 | | | | | | | | | |

Ball-Bearing Guide Posts – Tap Fit – Metric



- Large savings in maintenance, repair costs and downtime
- Wide variety of sizes
- Long, trouble-free production runs
- Highest quality workmanship and materials
- "D2" dimension is finished ground



M = Flange OD to Clamp Bolt Center
 Bolt Radius = (Flange OD ÷ 2) + M

| BALL-BEARING GUIDE POSTS – METRIC – Tap Fit | | | | | | | | | | | | | | | | | | | | | |
|---|-------------|--------|--------|------------|-----|-------------------|-----|-------|----|-----|-------------|-------------|--------|--------|----|-----|-------------------|-----|-------|----|-----|
| PART NUMBER | NOM PIN DIA | D1 | D2 | D3 | M | Bolt Radius (REF) | L1 | L2 | L3 | L5 | PART NUMBER | NOM PIN DIA | D1 | D2 | D3 | M | Bolt Radius (REF) | L1 | L2 | L3 | L5 |
| APGM032115 | 32 | 32.008 | 31.953 | 40 | 5.5 | 25.5 | 115 | 25.4 | 30 | 85 | APGM050165 | 50 | 50.008 | 49.952 | 63 | 5.5 | 37 | 165 | 44.45 | 49 | 116 |
| APGM032120 | | | | | | | 120 | 25.4 | | 90 | APGM050170 | | | | | | | 170 | 44.45 | | 121 |
| APGM032125 | | | | | | | 125 | 25.4 | | 95 | APGM050175 | | | | | | | 175 | 44.45 | | 126 |
| APGM032135 | | | | | | | 135 | 25.4 | | 105 | APGM050180 | | | | | | | 180 | 44.45 | | 131 |
| APGM032140 | | | | | | | 140 | 25.4 | | 110 | APGM050190 | | | | | | | 190 | 44.45 | | 141 |
| APGM032145 | | | | | | | 145 | 25.4 | | 115 | APGM050195 | | | | | | | 195 | 44.45 | | 146 |
| APGM032150 | | | | | | | 150 | 28.58 | | 120 | APGM050200 | | | | | | | 200 | 44.45 | | 151 |
| APGM032165 | | | | | | | 165 | 28.58 | | 135 | APGM050215 | | | | | | | 215 | 47.63 | | 166 |
| APGM032175 | | | | | | | 175 | 28.58 | | 145 | APGM050230 | | | | | | | 230 | 47.63 | | 181 |
| APGM032190 | | | | | | | 190 | 28.58 | | 160 | APGM050240 | | | | | | | 240 | 47.63 | | 191 |
| APGM032200 | | | | | | | 200 | 28.58 | | 170 | APGM050250 | | | | | | | 250 | 47.63 | | 201 |
| APGM032215 | | | | | | | 215 | 28.58 | | 185 | APGM050260 | | | | | | | 260 | 47.63 | | 211 |
| APGM032230 | | | | | | | 230 | 28.58 | | 200 | APGM050280 | | | | | | | 280 | 47.63 | | 231 |
| APGM032250 | | | | | | | 250 | 28.58 | | 220 | APGM050290 | | | | | | | 290 | 47.63 | | 241 |
| APGM032280 | | | | | | | 280 | 28.58 | | 250 | APGM050300 | | | | | | | 300 | 47.63 | | 251 |
| APGM032300 | 300 | 28.58 | 270 | APGM050315 | 315 | 47.63 | 266 | | | | | | | | | | | | | | |
| APGM040115 | 40 | 40.008 | 39.952 | 48 | 5.5 | 29.5 | 115 | 34.93 | 36 | 79 | APGM050330 | 63 | 63.008 | 62.952 | 76 | 5.5 | 43.5 | 200 | 41.28 | 49 | 151 |
| APGM040120 | | | | | | | 120 | 34.93 | | 84 | APGM050360 | | | | | | | 215 | 41.28 | | 166 |
| APGM040125 | | | | | | | 125 | 34.93 | | 89 | APGM050380 | | | | | | | 230 | 41.28 | | 181 |
| APGM040135 | | | | | | | 135 | 34.93 | | 99 | APGM050400 | | | | | | | 250 | 60.33 | | 201 |
| APGM040140 | | | | | | | 140 | 31.75 | | 104 | APGM050430 | | | | | | | 280 | 60.33 | | 231 |
| APGM040145 | | | | | | | 145 | 31.75 | | 109 | APGM050460 | | | | | | | 300 | 60.33 | | 281 |
| APGM040150 | | | | | | | 150 | 31.75 | | 114 | APGM063200 | | | | | | | 330 | 60.33 | | 311 |
| APGM040165 | | | | | | | 165 | 34.93 | | 129 | APGM063215 | | | | | | | 360 | 60.33 | | 381 |
| APGM040175 | | | | | | | 175 | 34.93 | | 139 | APGM063230 | | | | | | | 430 | 66.68 | | 381 |
| APGM040190 | | | | | | | 190 | 34.93 | | 154 | APGM063250 | | | | | | | 460 | 66.68 | | 451 |
| APGM040200 | | | | | | | 200 | 34.93 | | 164 | APGM063280 | | | | | | | 500 | 66.68 | | 451 |
| APGM040215 | | | | | | | 215 | 41.28 | | 179 | APGM063300 | | | | | | | 200 | 47.6 | | 138 |
| APGM040230 | | | | | | | 230 | 41.28 | | 194 | APGM063330 | | | | | | | 215 | 47.6 | | 153 |
| APGM040240 | | | | | | | 240 | 41.28 | | 204 | APGM063360 | | | | | | | 230 | 47.6 | | 168 |
| APGM040250 | | | | | | | 250 | 41.28 | | 214 | APGM063430 | | | | | | | 250 | 73.02 | | 188 |
| APGM040260 | 260 | 41.28 | 224 | APGM063500 | 280 | 73.02 | 218 | | | | | | | | | | | | | | |
| APGM040280 | 280 | 41.28 | 244 | APGM080200 | 300 | 73.02 | 238 | | | | | | | | | | | | | | |
| APGM040290 | 290 | 41.28 | 254 | APGM080215 | 330 | 73.02 | 268 | | | | | | | | | | | | | | |
| APGM040300 | 300 | 41.28 | 264 | APGM080230 | 360 | 73.02 | 298 | | | | | | | | | | | | | | |
| APGM040315 | 315 | 41.28 | 279 | APGM080250 | 430 | 73.02 | 368 | | | | | | | | | | | | | | |
| APGM040330 | 330 | 41.28 | 294 | APGM080280 | 500 | 73.02 | 438 | | | | | | | | | | | | | | |
| APGM040360 | 360 | 41.28 | 324 | APGM080300 | | | | | | | | | | | | | | | | | |
| APGM050140 | 50 | 50.008 | 49.952 | 63 | 5.5 | 37 | 140 | 34.93 | 49 | 91 | APGM080330 | 80 | 80.008 | 79.952 | 93 | 5.5 | 52 | 330 | 73.02 | 62 | 268 |
| APGM050145 | | | | | | | 145 | 34.93 | | 96 | APGM080360 | | | | | | | 360 | 73.02 | | 298 |
| APGM050150 | | | | | | | 150 | 34.93 | | 101 | APGM080430 | | | | | | | 430 | 73.02 | | 368 |
| APGM050155 | | | | | | | 155 | 44.95 | | 106 | APGM080500 | | | | | | | 500 | 73.02 | | 438 |

Commitment to Quality & Customer Satisfaction

Dayton Lamina is a leading manufacturer of tool, die and mold components for the metal-working and plastics industries. As a customer-focused, world-class supplier of choice, we provide the brands, product breadth, distribution network and technical support for all your metal forming needs.

Our goal is to give our customers the most innovative and value-added products and services.



DAYTON Lamina™



IEM®



Lamina® LEMPCO

*Dayton Lamina's line of Danly products is available only to North America.

www.daytonlamina.com