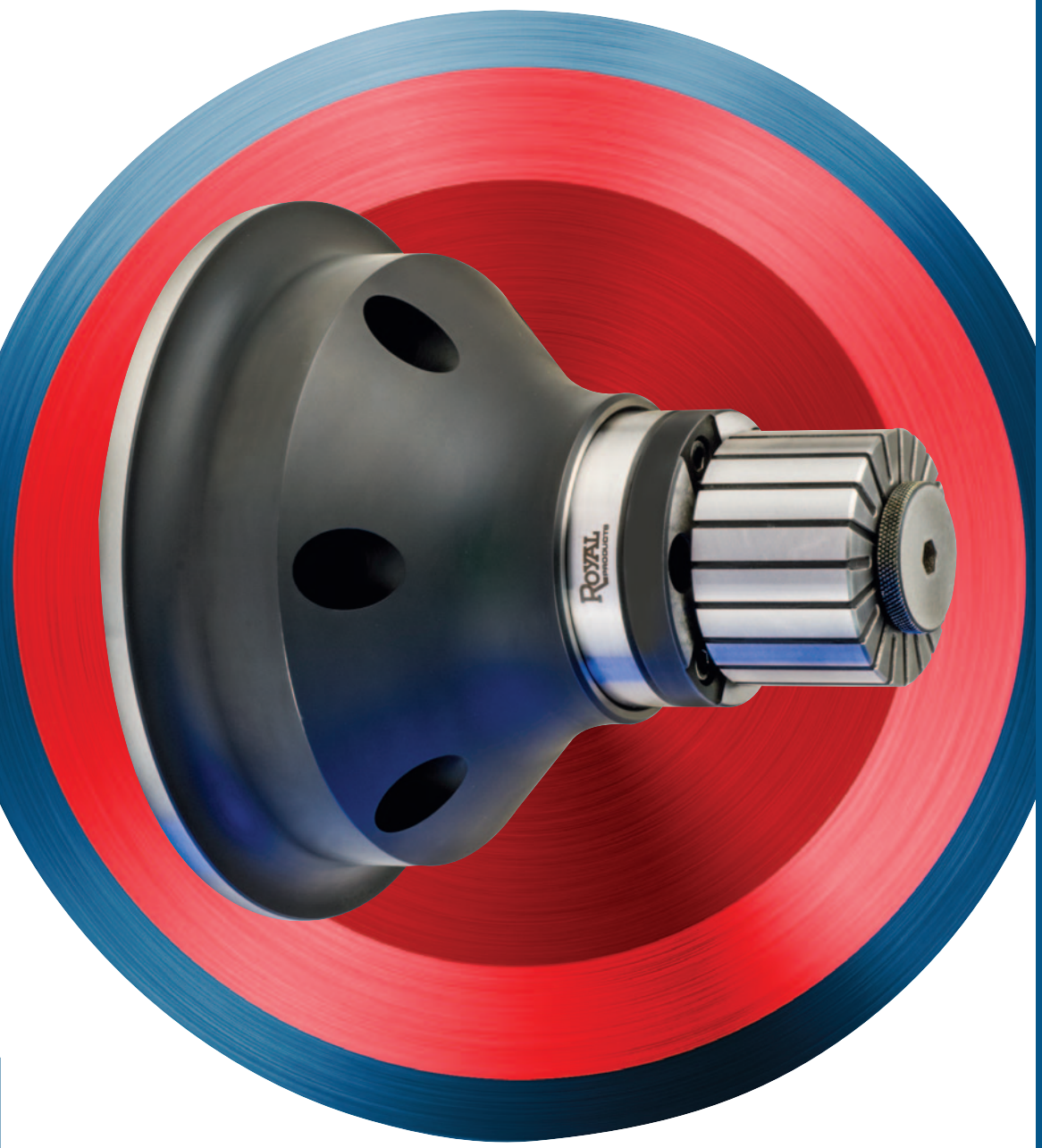
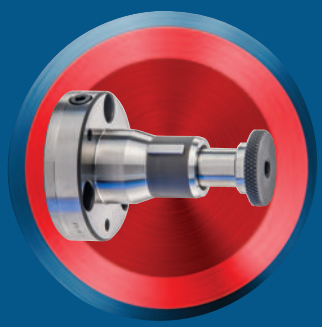
ROYAL PRODUCTS

# I.D. WORKHOLDING

– I.D. CLAMPING OFFERS FULL O.D. PART ACCESS
– PARALLEL EXPANSION FOR OPTIMUM ACCURACY AND GRIP FORCE
– LARGE RANGE IN STOCK FOR IMMEDIATE SHIPMENT





ROYAL PRODUCTS
Optimize everything.

# ROYAL I.D. WORKHOLDING SYSTEMS

## Royal Offers Three Standard Off-the-Shelf I.D. Workholding Systems Designed to Suit a Wide Range of Applications:

### CNC

- For use on all CNC Lathes.
- Actuated via machine's drawtube.
- Accu-Length™ design makes this system a great sub-spindle workholding option.
- Includes a custom-machined drawtube connector to fit your specific lathe.

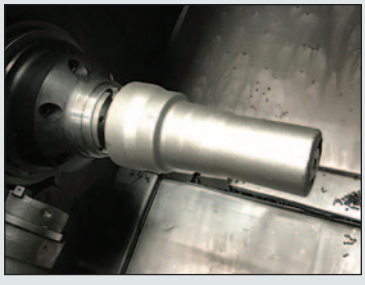
### Power-Block™

- For use on all Machining Centers.
- Can be used in both stationary and 4th/5th -axis applications.
- Hydraulic or pneumatic actuation.
- Well suited to auto-load applications.

### Key-Operated

- Universal – can be used in virtually any turning, milling, or grinding application.
- 1-1/2" dia. shank is quickly and easily gripped in a chuck or collet.
- Manual actuation makes this model best suited to non-production applications.

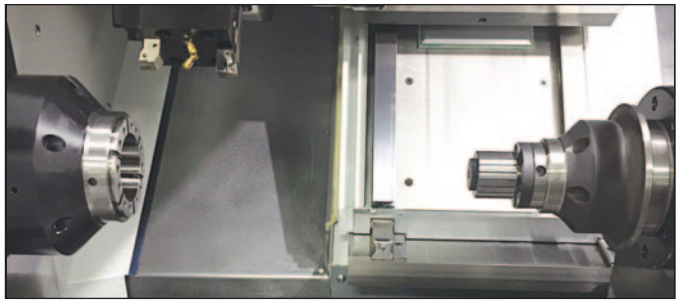
## I.D. Gripping is Often Overlooked as a Workholding Option, Yet in Many Situations it is the Best Choice



Shown here, a long casting is gripped via the I.D. bore so the full O.D. can be machined in a single operation.

- ✔ A part's full length can be turned in a single operation, guaranteeing perfect concentricity of all O.D. features.
- ✔ I.D. gripping offers an alternative to gripping on a finished O.D. surface, reducing the risk of part damage.
- ✔ For many parts, the engagement-length of an internal bore can be greater than what is available for external gripping, resulting in superior rigidity and torque transmission.
- ✔ I.D. systems provide optimal tool clearance, making them a great option for lathes with live tooling.

**Perfect Combination** – A Royal Quick-Grip™ CNC Collet Chuck on the main spindle and a Royal CNC I.D. Workholding System on the sub.



# ROYAL CNC I.D. WORKHOLDING
## For Turning Applications

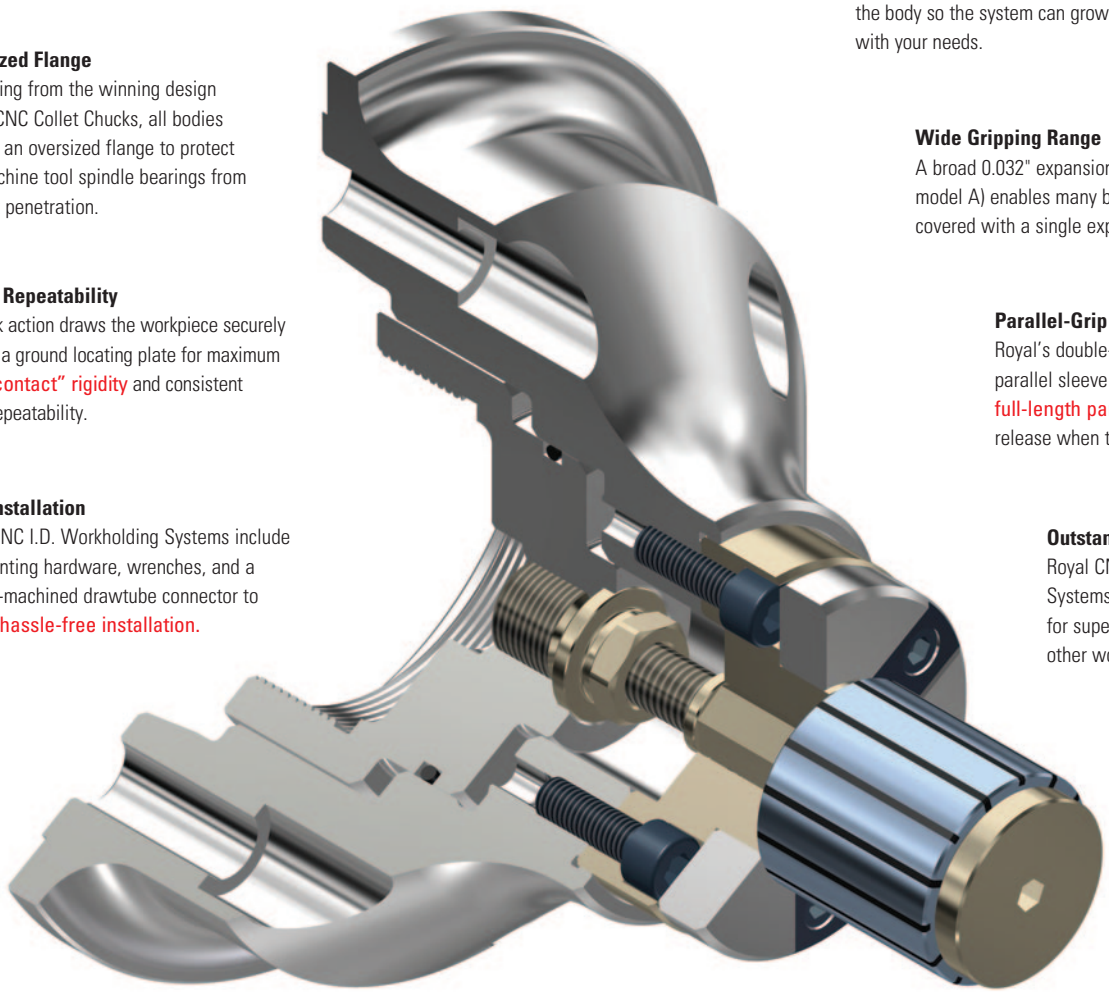
**Bolt & Go™**
Royal's exclusive Bolt & Go™ mounting feature ensures maximum accuracy and rigidity with no adjusting required. Other systems require the mandrel to be trammed in – a hassle that wastes valuable machining time.

**Same-Day Shipping**
Royal maintains a huge inventory of standard bodies, mandrels, and sleeves to help us achieve our goal of same-day shipping on all orders.

**Ultra-Precision Accuracy**
System runout guaranteed to be 0.0005" TIR or better.

**Modular Design**
Mandrel models A-E all have a common mounting interface with the body so the system can grow with your needs.

**Oversized Flange**
Borrowing from the winning design of our CNC Collet Chucks, all bodies feature an oversized flange to protect the machine tool spindle bearings from coolant penetration.



**Wide Gripping Range**
A broad 0.032" expansion range (0.020" for model A) enables many bore sizes to be covered with a single expanding sleeve.

**Z-Axis Repeatability**
Pullback action draws the workpiece securely against a ground locating plate for maximum "dual-contact" rigidity and consistent z-axis repeatability.

**Parallel-Grip**
Royal's double-angle design provides parallel sleeve expansion, ensuring full-length part contact and positive release when the part is unclamped.

**Easy Installation**
Royal CNC I.D. Workholding Systems include all mounting hardware, wrenches, and a custom-machined drawtube connector to ensure hassle-free installation.

**Outstanding Tool Clearance**
Royal CNC I.D. Workholding Systems have been optimized for superior tool clearance over other workholding systems.

**Heavy-Duty Construction**
Royal consistently builds products that outlast the competition, especially in the most demanding environments. Bodies, mandrels, and expanding rods are all hardened to Rc 61-63 for maximum durability.

**Custom Systems**
If our standard line doesn't meet your needs, give us a call to discuss your special requirements. Capabilities include:

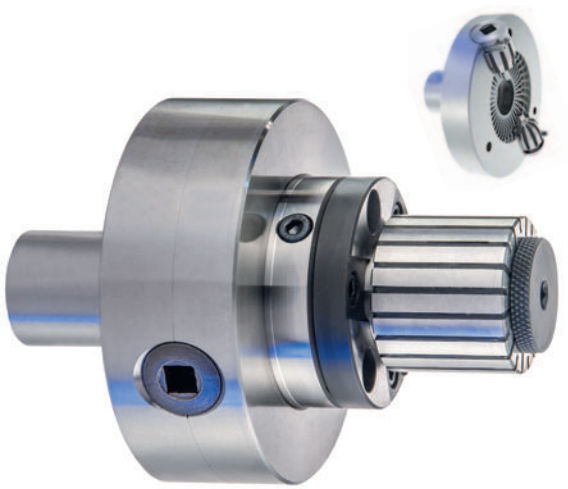
- Larger sizes – up to 25" diameter
- Extended-length systems
- Multi-step systems for locating on multiple bore diameters
- Automation enhancements such as ejector rings, part confirmation, etc.

**Completely Sealed**
All expanding sleeve slots are sealed to prevent contaminants from accumulating on the mandrel surface – ensuring years of trouble-free service. An internal O-ring on the drawtube connector offers additional protection.

# ROYAL POWER-BLOCK™ I.D. WORKHOLDING
## For Milling Applications


- The Royal Power-Block™ I.D. Workholding System enables secure gripping on the internal bore of a workpiece for full external machining access.
- Pullback action draws workpiece securely against a ground locator for precise, consistent z-axis positioning.
- Unit can be mounted to a traditional machining center table and can also be used in 4th and 5th -axis applications.
- Fixture is designed to be actuated via hydraulic pressure and may also be actuated pneumatically for lighter-duty applications (contact Royal for details).
- For use with all Royal precision mandrels, stops, and sleeves. These items are sold separately – please see pages 84-85.
- Heavy-duty all steel construction with a large double-acting piston provides high clamping force.
- Configured with both side and bottom ports for plumbing flexibility.
- Multiple units can be plumbed in series for single-source actuation.
- Ideal for high-production applications on vertical, horizontal, and five-axis machining centers.
- Tombstone and angle plate compatible.

# ROYAL KEY-OPERATED I.D. WORKHOLDING
## For Turning, Milling and Grinding Applications



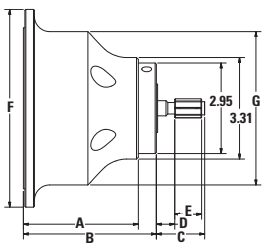
- Royal's Key-Operated I.D. Workholding System incorporates a precision-ground 1-1/2" diameter straight shank that enables the unit to be held in any collet or jaw chuck, reducing setup times by eliminating the need to change out the machine's workholding device.
- For use with all Royal precision mandrels, stops, and sleeves. These items are sold separately – please see pages 84-85.
- Side-actuated with an included square-drive key means that this unit can accommodate parts with blind bores.
- Precision-ground square and concentric within 0.0005". If higher accuracy is needed the mandrel can be clocked-in once the unit is gripped in a chuck.
- Universal straight shank mount enables this I.D. workholding system to be easily moved from machine to machine as jobs require.
- A great option for low-volume I.D. gripping.
- When ordering, be sure to also order the appropriate threaded expanding rod adapters sold separately.

## How to Order:

1. Choose the appropriate body assembly based upon your application.
2. Choose the appropriate mandrel (models A-E) based upon the diameter you need to grip. All mandrels and bodies share a common mounting interface for full interchangeability.
3. If required, choose the appropriate part locator to provide a ground banking surface for the workpiece.
4. Choose the appropriate expanding sleeve based upon the mandrel and diameter you need to grip.

# Step 1 - Choose Body Assembly

### CNC BODY – For CNC Lathes


## Dimensions

Note – dimensions shown without optional part locator.

| SPINDLE MOUNT | A | B | C D E | F | G |
|---|---|---|---|---|---|
| A2-5 | 3.75 | 4.34 | See Mandrel Chart | 6.45 | 5.00 |
| A2-6 | 4.00 | 4.59 | | 7.45 | 6.25 |
| 140mm | 3.90 | 4.49 | | 7.45 | 6.25 |
| A2-8 | 5.00 | 5.59 | | 9.45 | 8.00 |

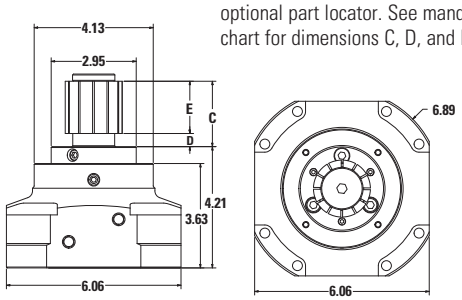
- This body provides a precision interface for mounting the system to a CNC lathe spindle.
- CNC body assembly incudes the hardened steel body, a custom-machined drawtube connector for hassle-free installation, and all mounting hardware.
- Order mandrels, locators, and sleeves separately.

## Royal CNC I.D. Body Assemblies

| SPINDLE TYPE | PART NUMBER | PRICE |
|---|---|---|
| A2-5 | 47060 | **$1,970** |
| A2-6 | 47064 | **2,390** |
| 140mm | 47068 | **2,550** |
| A2-8 | 47072 | **3,190** |

### POWER-BLOCK™ BODY – For Machining Centers


Note – dimensions shown without optional part locator. See mandrel chart for dimensions C, D, and E.

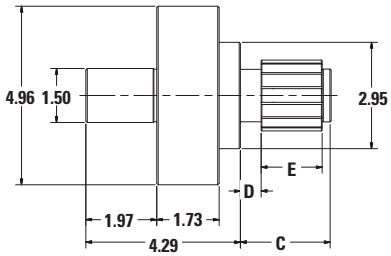



- This body can be mounted to any machining center table, 4th/5th-axis rotary tables, angle plates, tombstones, etc.
- Body weight is 22 lbs.
- Order mandrels, locators, and sleeves separately.

## Royal Power-Block™ I.D. Assembly

| DESCRIPTION | PART NUMBER | PRICE |
|---|---|---|
| Power-Block™ I.D. Body Assembly | 47080 | **$3,870** |

### KEY-OPERATED BODY – Universal




Note – dimensions shown without optional part locator. See mandrel chart for dimensions C, D, and E.

- This unit has a precision-ground shaft that can be held in any jaw chuck or 1.5" dia. collet, eliminating the need to change out the workholding and enabling the system to be moved from machine to machine as jobs require.
- Order mandrels, expanding rod adapters, locators, and sleeves separately.

## Royal Key-Operated I.D. Body Assemblies

| DESCRIPTION | PART NUMBER | PRICE |
|---|---|---|
| Key-Operated I.D. Body Assembly | 47300 | **$6,010** |
| Expanding Rod Adapter – Fits Model A Mandrels | 47310 | **450** |
| Expanding Rod Adapter – Fits Models B&C Mandrels | 47315 | **450** |
| Expanding Rod Adapter – Fits Model D Mandrels | 47325 | **450** |
| Expanding Rod Adapter – Fits Model E Mandrels | 47330 | **450** |

# Step 2 - Choose Mandrel

- Choose appropriate mandrel model according to gripping range.
- All Royal mandrels have a common precision ground interface for complete compatibility with all Royal I.D. body assemblies.
- Order body assembly, locators, and sleeves separately.

## Royal Mandrels

| MANDREL MODEL | GRIPPING RANGE | C | D | E | MAX AXIAL FORCE (lbs.) | MAX CLAMPING FORCE (lbs.) | PART NUMBER | PRICE |
|---|---|---|---|---|---|---|---|---|
| A | 0.479–0.640 | 1.57 | 0.57 | 0.87 | 1570 | 2670 | 47100 | **$2,140** |
| B | 0.620 –0.901 | 1.81 | 0.59 | 1.06 | 2245 | 3820 | 47101 | **2,140** |
| C | 0.870 –1.151 | 2.05 | 0.61 | 1.26 | 2695 | 4580 | 47102 | **2,140** |
| D | 1.120 –1.651 | 2.32 | 0.60 | 1.50 | 4045 | 6875 | 47103 | **2,140** |
| E | 1.620 –3.276 | 2.52 | 0.58 | 1.69 | 5170 | 8785 | 47104 | **2,140** |

# Step 3 - Choose Part Locator

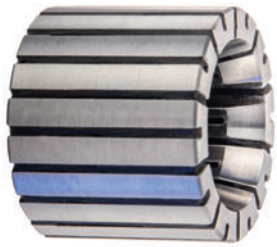
- Optional part locator bolts to the front of the mandrel and provides a precision banking surface for the workpiece to locate against.
- Order body assembly, mandrels, and sleeves separately.

## Royal Part Locators

| FITS MANDREL MODEL | WIDTH | OUTER DIAMETER | PART NUMBER | PRICE |
|---|---|---|---|---|
| A | 0.47 | 1.57 | 47110 | **$432** |
| B | 0.47 | 1.57 | 47111 | **432** |
| C | 0.47 | 2.95 | 47112 | **497** |
| D | 0.47 | 2.95 | 47113 | **497** |
| E | 0.47 | 2.95 | 47114 | **497** |

# Step 4 - Choose Expanding Sleeve

- Order expanding sleeves according to mandrel models A thru E.
- Royal expanding sleeves are fully sealed against coolant and chip penetration.
- Parallel grip ensures full-length part contact for optimum accuracy and grip force.
- All sleeves collapse 0.005" below nominal ground size to ensure easy part loading and unloading.
- Order body assembly, mandrels, and locators separately.



## Royal Expanding Sleeves

### MODEL A

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 31/64" | 0.479–0.499 | 47120* | $627 |
| 1/2" | 0.495–0.515 | 47121* | 627 |
| 33/64" | 0.510–0.530 | 47122 | 627 |
| 17/32" | 0.526–0.546 | 47123 | 627 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 35/64" | 0.542–0.562 | 47124 | $627 |
| 9/16" | 0.558–0.578 | 47125 | 627 |
| 37/64" | 0.573–0.593 | 47119 | 627 |
| 19/32" | 0.589–0.601 | 47127 | 627 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 39/64" | 0.604–0.624 | 47126 | $627 |
| 5/8" | 0.620–0.640 | 47129 | 627 |
| 41/64" | 0.636–0.656 | 47128 | 627 |

### MODEL B

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 5/8" | 0.620–0.651 | 47130* | $683 |
| 21/32" | 0.651–0.682 | 47131 | 683 |
| 11/16" | 0.683–0.714 | 47132 | 683 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 23/32" | 0.714–0.745 | 47133 | $683 |
| 3/4" | 0.745–0.776 | 47134 | 683 |
| 25/32" | 0.776–0.807 | 47135 | 683 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 13/16" | 0.808–0.839 | 47136 | $683 |
| 27/32" | 0.830–0.870 | 47137 | 683 |
| 7/8" | 0.870–0.901 | 47138 | 683 |

### MODEL C

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 7/8" | 0.870–0.901 | 47140 | $683 |
| 29/32" | 0.901–0.932 | 47141 | 683 |
| 15/16" | 0.933–0.964 | 47142 | 683 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 31/32" | 0.964–0.995 | 47143 | $683 |
| 1" | 0.995–1.026 | 47144 | 683 |
| 1 1/32" | 1.026–1.057 | 47145 | 683 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 1 1/16" | 1.058–1.089 | 47146 | $683 |
| 1 3/32" | 1.089–1.120 | 47147 | 683 |
| 1 1/8" | 1.120–1.151 | 47148 | 683 |

### MODEL D

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 1 1/8" | 1.120–1.151 | 47150 | $745 |
| 1 5/32" | 1.151–1.182 | 47151 | 745 |
| 1 3/16" | 1.183–1.214 | 47152 | 745 |
| 1 7/32" | 1.214–1.245 | 47153 | 745 |
| 1 1/4" | 1.145–1.276 | 47154 | 745 |
| 1 9/32" | 1.276–1.317 | 47155 | 745 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 1 5/16" | 1.308–1.339 | 47156 | $745 |
| 1 11/32" | 1.339–1.370 | 47157 | 745 |
| 1 3/8" | 1.370–1.401 | 47158 | 745 |
| 1 13/32" | 1.401–1.432 | 47159 | 745 |
| 1 7/16" | 1.433–1.464 | 47160 | 745 |
| 1 15/32" | 1.464–1.495 | 47161 | 745 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 1 1/2" | 1.495–1.526 | 47162 | $745 |
| 1 17/32" | 1.526–1.557 | 47163 | 745 |
| 1 9/16" | 1.558–1.589 | 47164 | 745 |
| 1 19/32" | 1.589–1.620 | 47165 | 745 |
| 1 5/8" | 1.620–1.651 | 47166 | 745 |

### MODEL E

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 1 5/8" | 1.620–1.651 | 47170 | $908 |
| 1 21/32" | 1.651–1.682 | 47171 | 908 |
| 1 11/16" | 1.683–1.714 | 47172 | 908 |
| 1 23/32" | 1.714–1.745 | 47173 | 908 |
| 1 3/4" | 1.745–1.776 | 47174 | 908 |
| 1 25/32" | 1.776–1.807 | 47175 | 908 |
| 1 13/16" | 1.808–1.839 | 47176 | 908 |
| 1 27/32" | 1.839–1.870 | 47177 | 908 |
| 1 7/8" | 1.870–1.901 | 47178 | 908 |
| 1 29/32" | 1.901–1.932 | 47179 | 908 |
| 1 15/16" | 1.933–1.964 | 47180 | 908 |
| 1 31/32" | 1.964–1.995 | 47181 | 908 |
| 2" | 1.995–2.026 | 47182 | 908 |
| 2 1/32" | 2.026–2.057 | 47183 | 908 |
| 2 1/16" | 2.058–2.089 | 47184 | 908 |
| 2 3/32" | 2.089–2.120 | 47185 | 908 |
| 2 1/8" | 2.120–2.151 | 47186 | 908 |
| 2 5/32" | 2.151–2.182 | 47187 | 908 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 2 3/16" | 2.183–2.214 | 47188 | $908 |
| 2 7/32" | 2.214–2.245 | 47189 | 908 |
| 2 1/4" | 2.245–2.276 | 47190 | 908 |
| 2 9/32" | 2.276–2.307 | 47191 | 908 |
| 2 5/16" | 2.308–2.339 | 47192 | 908 |
| 2 11/32" | 2.339–2.370 | 47193 | 908 |
| 2 3/8" | 2.370–2.401 | 47194 | 908 |
| 2 13/32" | 2.401–2.432 | 47195 | 908 |
| 2 7/16" | 2.433–2.464 | 47196 | 908 |
| 2 15/32" | 2.464–2.495 | 47197 | 908 |
| 2 1/2" | 2.495–2.526 | 47198 | 908 |
| 2 17/32" | 2.526–2.557 | 47199 | 1,030 |
| 2 9/16" | 2.558–2.589 | 47200 | 1,030 |
| 2 19/32" | 2.589–2.620 | 47201 | 1,030 |
| 2 5/8" | 2.620–2.651 | 47202 | 1,030 |
| 2 21/32" | 2.651–2.682 | 47203 | 1,030 |
| 2 11/16" | 2.683–2.714 | 47204 | 1,030 |
| 2 23/32" | 2.714–2.745 | 47205 | 1,030 |

| NOMINAL SLEEVE DIAMETER | GRIPPING RANGE | PART NUMBER | PRICE |
|---|---|---|---|
| 2 3/4" | 2.745–2.776 | 47206 | $1,030 |
| 2 25/32" | 2.776–2.807 | 47207 | 1,030 |
| 2 13/16" | 2.808–2.839 | 47208 | 1,030 |
| 2 27/32" | 2.839–2.870 | 47209 | 1,030 |
| 2 7/8" | 2.870–2.901 | 47210 | 1,030 |
| 2 29/32" | 2.901–2.932 | 47211 | 1,030 |
| 2 15/16" | 2.933–2.964 | 47212 | 1,030 |
| 2 31/32" | 2.964–2.995 | 47213 | 1,030 |
| 3" | 2.995–3.026 | 47214 | 1,030 |
| 3 1/32" | 3.026–3.057 | 47215 | 1,030 |
| 3 1/16" | 3.058–3.089 | 47216 | 1,030 |
| 3 3/32" | 3.089–3.120 | 47217 | 1,030 |
| 3 1/8" | 3.120–3.151 | 47218 | 1,030 |
| 3 5/32" | 3.151–3.182 | 47219 | 1,030 |
| 3 3/16" | 3.183–3.214 | 47220 | 1,030 |
| 3 7/32" | 3.214–3.245 | 47221 | 1,030 |
| 3 1/4" | 3.245–3.276 | 47222 | 1,030 |

*Not sealed due to limited wall thickness.

Note – sleeves larger than 2-1/2" dia. are 0.28" longer than dimension E and terminate flush with the face of the expanding rod.

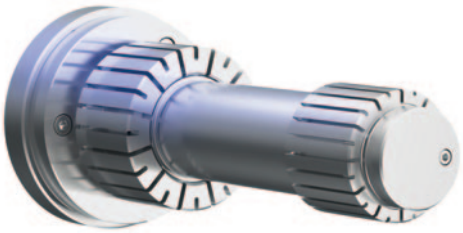
# ROYAL CUSTOM I.D. WORKHOLDING

When a standard off-the-shelf I.D. workholding system won't quite work for your application, Royal has the expertise to design and build custom systems that are optimized for your requirements.

Below are some examples of some of the more common custom systems that we regularly supply.

## Dual-Sleeve

Typically starting at $15,000

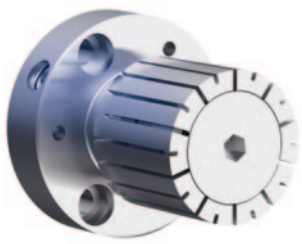


**Commonly used for:**

- ❑ Long parts that need extra support.
- ❑ Very aggressive machining – sometimes incorporates knurled sleeves for castings and forgings.
- ❑ Large diameter-to-length ratios.

## "Pressure Angle" Design

Typically starting at $8,500

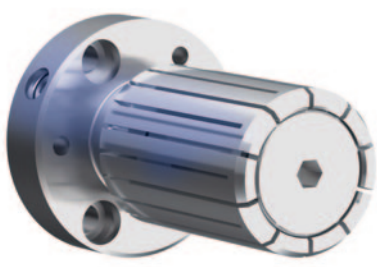


**Commonly used for:**

- ❑ Parts with short or blind bores.
- ❑ Very aggressive machining.
- ❑ Note that with this design, the head of expanding rod is recessed behind sleeve face to maximize grip-length.
- ❑ This design applies extra gripping torque along its length to keep the workpiece firmly seated.

## Extended Sleeve

Typically starting at $8,900



**Commonly used for:**

- ❑ Long parts that need extra support.
- ❑ Large diameter-to-length ratios.
- ❑ Great for thin-wall cylinder applications - load is distributed over a larger area to reduce risk of distortion.

**Please keep in mind that in addition to the above systems, many other custom solutions/features are also available, including:**

- Part ejectors
- Part confirmation
- Non-round bores
- Splined sleeves
- Radial orientation
- Positive-drive pins
- Center hole for tailstock support
- Custom locators
- Large diameters – up to 24"
- Surface-treated sleeves
- Knurled sleeves for castings and forgings
- Wide-range sleeves – to clear a small bore and expand into a larger bore