

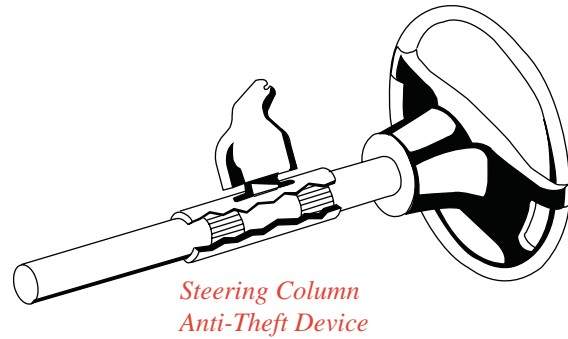
USA[®] TOLERANCE RINGS



*Toll Free 1-877-865-7464
www.usatolerancerings.com*

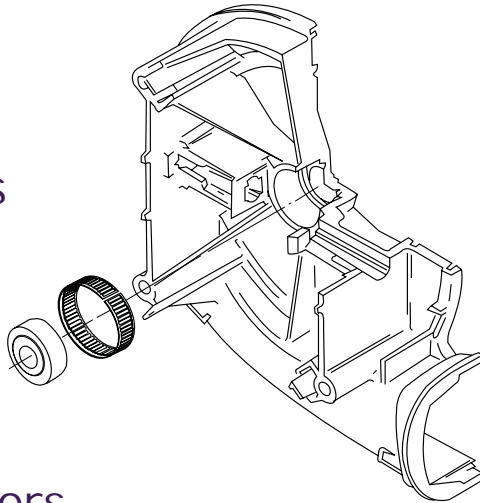
Automotive

- ABS Toner Rings
- Steering Column Anti-Theft Device
- Timing Sprocket Camshaft Connection
- Alternator Bearings
- Blower Motor Bearings



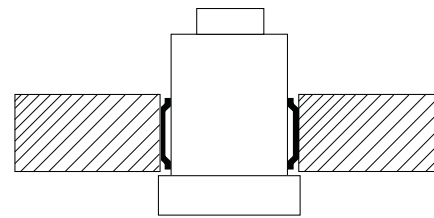
Power Tools

- Saws
- Sanders
- Routers



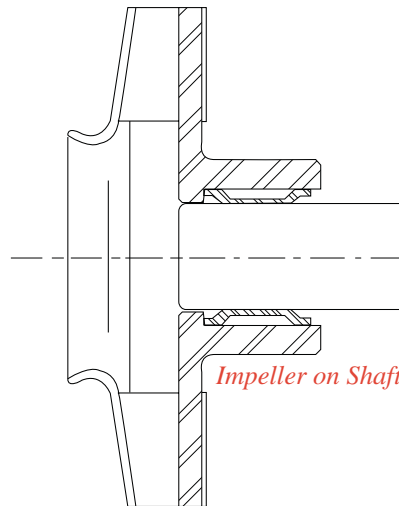
Electric Motors

- Bearings in Housings
- Bearings on Shafts
- Phenolic Brush Holder
- Rotor Tachometers on Shafts
- Fans



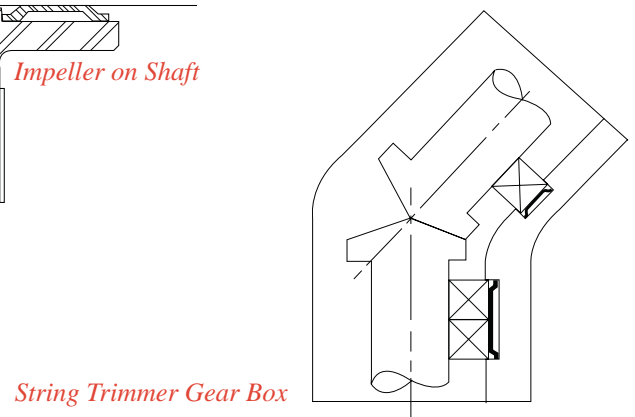
Pumps

- Ceramic Bearings and Sleeves
- Impellers
- Bearings



Lawn and Garden

- Rototiller Knob Mounts
- String Trimmer Bearing Mounts
- Lawn Mowers



USA[®] TOLERANCE RINGS

The Company

Met any good TOLERANCE RING companies lately? Never heard of a TOLERANCE RING? We're USA TOLERANCE RINGS—an exceptional company; an exceptional product! We've been meeting design needs for American industry since 1961. Our customers include manufacturers of automobiles, home appliances, power tools, electric motors, and computer disk drives as well as many others.

TOLERANCE RINGS are tough enough to be an anti theft device on a steering column, but delicate enough to center a miniature ball bearing in a disk drive.

Our company is as flexible as our product. We respond to customers, large and small, with efficient, courteous service; with reliable and cost-effective solutions to design needs; with rapid turnaround of sample parts and with development testing in customer components. Our facility in West Trenton, New Jersey, along with our European affiliate in the United Kingdom, offers parts produced in volume to levels of extraordinary accuracy and consistency. USA TOLERANCE RINGS is the singular source for TOLERANCE RINGS in North America.

Join the ranks of the hundreds of engineers, who, when confronted with a design problem made the happy discovery of USA TOLERANCE RINGS—an exceptional company; an exceptional product.



USA TOLERANCE RINGS

85 Route 31 North
Pennington, New Jersey 08534
Toll Free: 1-877-865-7464
Telephone: 609-745-5000
Fax: 609-745-5012

Table of Contents

| | |
|--|----|
| Introduction | 4 |
| Manufacturing Process | 5 |
| Common Uses of Tolerance Rings | 6 |
| Mounting Bearings | 6 |
| Torque Transfer | 6 |
| Differential Thermal Expansion | 7 |
| Component Fastening | 7 |
| Reclamation of Bad Parts | 7 |
| Types of Tolerance Rings | 8 |
| AN Style | 8 |
| ANL Style | 8 |
| BN Style | 9 |
| Types of Mounting | 10 |
| Centered Arrangement | 10 |
| Piloted (Half-Centered) Arrangement | 10 |
| Free Arrangement | 10 |
| Design of Mating Parts | 9 |
| Assembly Procedure Considerations | 9 |
| Operating Principle | 11 |
| Part Identification | 12 |
| Application Examples | 17 |
| AN Series Data | 13 |
| Bearing and ANL Series Data | 14 |
| BN Series Data | 15 |
| New Project Information Sheet | 16 |



Introduction

Tolerance Rings are highly engineered frictional fasteners used to economically join mating cylindrical parts. Manufactured from high quality spring steel or stainless steel strip, Tolerance Rings are widely accepted as a fastening device capable of handling torque transfer, axial retention and radial loading between mating machine parts.

Technical and economical advantages ensured by use of Tolerance Rings include:

- Rapid, low cost assembly
- Wider dimensional tolerance of mating diameters for interference fits
- Compensation for Δ thermal expansion between mating materials
- Elimination of keys, pins, adhesives, D-shafts, threads and splines
- Compensation for small amounts of misalignment of up to $1/2^\circ$ draft angle
- Infinite rotational indexing of parts prior to assembly
- Modification to spring rates/critical frequencies of assemblies

Custom Design Flexibility

Many non-catalog parts are available from inventory and thousands of additional configurations can be made with **Standard Tooling and Standard Materials!** Why consider a special? When radial or torque capacity of a standard ring does not meet application requirements, specials are **ECONOMICAL** alternatives. Yes, even if catalog ratings are 10 times too high or 10 times too low we often can vary the stiffness by an order of magnitude simply by substituting different thicknesses of material or by adjusting the pitch which provides more or less corrugations in a ring. Therefore, if catalog stated values are only a fraction of what you need, call us for special design considerations. Simply have information per your Design Specifications form handy to speed along our response.



A Glimpse of Our Manufacturing Process

1. Begin with a strip of material of proper thickness, cut to the proper width.
2. Run the material through our tooling disks which look like special gears. This tooling determines the spacing between the corrugations (pitch), the width of the corrugations, and the corrugation height (by adjusting the centerline distance between the disks.)
3. Measure a length of corrugated strip appropriate for circumference, then cut and roll it.

It is simple to corrugate different material thicknesses on a given set of tooling, or to cut different lengths of corrugated strip to accommodate various diameters. Our limitations are that with a given pitch we have finite tooling widths available. Reference the chart on page **13** to determine the ring widths available. The width values are dependent on the pitch, not the diameter of the ring.



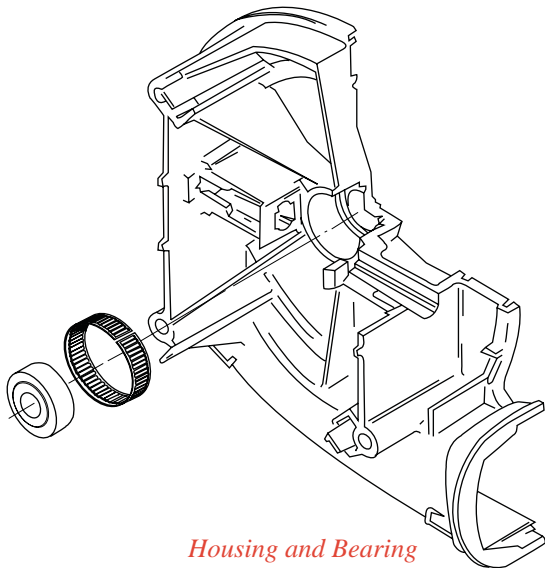
Check out our website! www.usatolerancerings.com

Common Uses of Tolerance Rings



Mounting Bearings

Tolerance Rings are ideally suited for mounting bearings since traditional installations require housing and shaft diameters to be held within a tolerance range of about 0.0005". Shaft or housing tolerances may be increased to .002", even up to .006" on larger diameters.



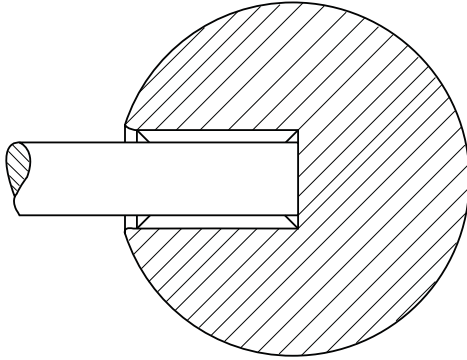
Torque Transfer

Tolerance Rings are used successfully to transmit torque from one cylindrical component to another.

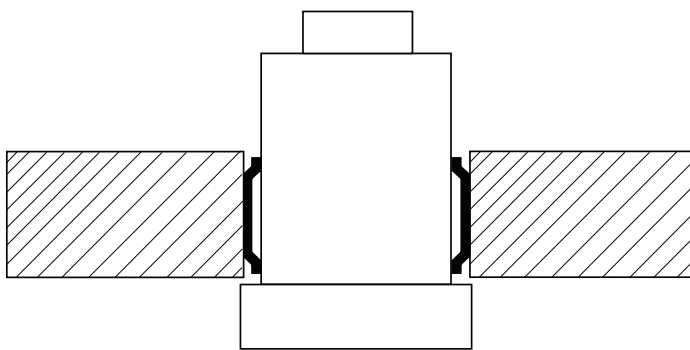
Examples include mounting impellers, gears, sprockets and pulleys to shafts. The same advantages as described earlier apply for torque transfer applications—broader machining tolerances, elimination of set screws, adhesives, knurls, D-shafts and nuts. In some cases even splines may be replaced with a Tolerance Ring.

Component Fastening

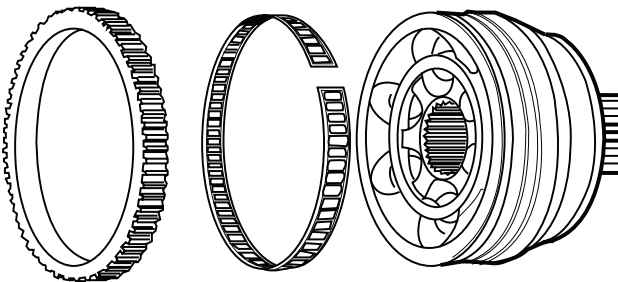
Tolerance Rings are employed as fasteners for applications such as the installation of knobs onto shafts and brush holders into electric motor housings. Tolerance Rings provide positive retention and allow for infinite rotational indexing prior to assembly.



Knob



Brush Holder



Mounting ABS Toner Rings

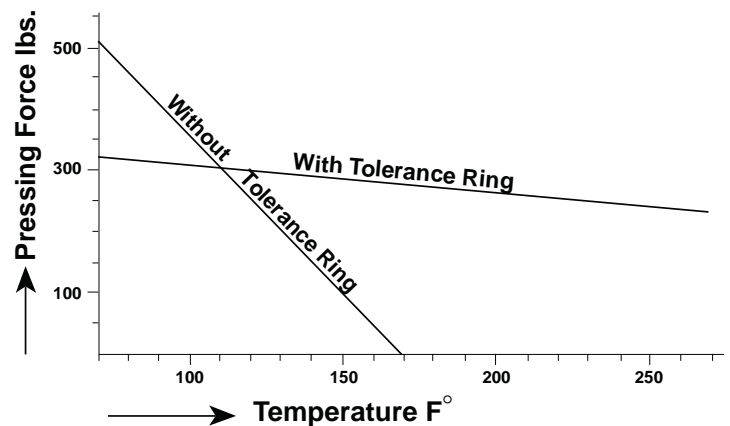
Reclamation of Bad Parts

Tolerance Rings are used to salvage worn housing bores or bores that have been accidentally machined oversized. Note that housing bores must be re-machined to appropriate diameters to accommodate the Tolerance Ring.



Differential Thermal Expansion

Tolerance Rings are used with great success in compensating for differential thermal expansion of mating parts. Examples include aluminum housings with steel bearings, silicon carbide bushings and sleeves mated to steel housing and shafts, and glass-filled plastic impellers to shafts. Tolerance Rings maintain retention and minimum torque values, and may accommodate wide variations in diameter without overstressing brittle components.

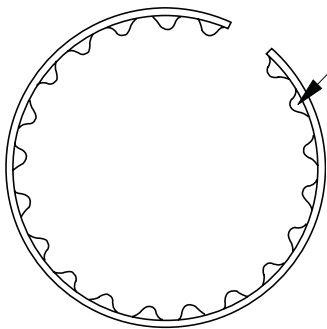


The graph above illustrates the superior performance of the Tolerance Ring in retaining a 2" diameter ball bearing in an aluminum housing. With .0012" traditional interference fit, an installation force of 500 lbs. is required. The bearing becomes loose at a temperature of 170°F. With the Tolerance Ring, an initial installation force of only 320 lbs is required, and retention remains high at 230 lbs. even at 270°F!



Types of Tolerance Rings

Tolerance Rings are made in three varieties: AN, ANL, and BN. The appropriate ring for your application will depend on such factors as assembly procedure, which part is a “nominal” diameter, and which part may be more readily modified to accept the Tolerance Ring in the design.



Corrugations face inward on AN and ANL rings. Corrugation heights range from .014" to .0394" for most rings.

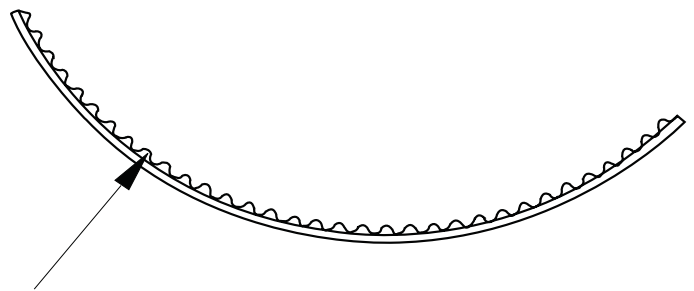
AN Style

The AN style ring is “open” in the free state so that when installed inside a bore the ring will conform to that bore and be self retaining. If used with the centered or half-centered arrangement no further handling of the ring is necessary during assembly of the mating machine parts. When used with the free arrangement, the ring must be supported axially during assembly of the mating machine parts.

The AN style is cut to length so as to fit *outside* a “nominal” circumference. Examples for use of the AN style include mounting a bearing outer race, or mounting a fan or pulley to a shaft of common inch or metric diameter.

ANL Style

The ANL style may be described as a very light duty AN style ring. It is often characteristic of this ring to not have a circular shape in the free state.



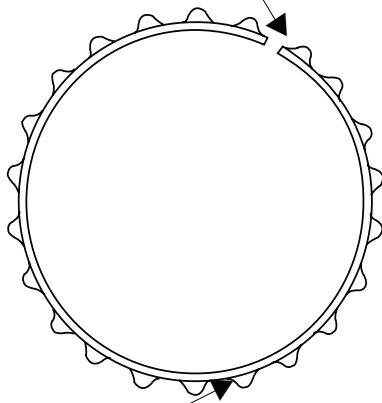
Designed for light duty, ANL rings have .014" corrugation height standard and use .004" thick material.

BN Style

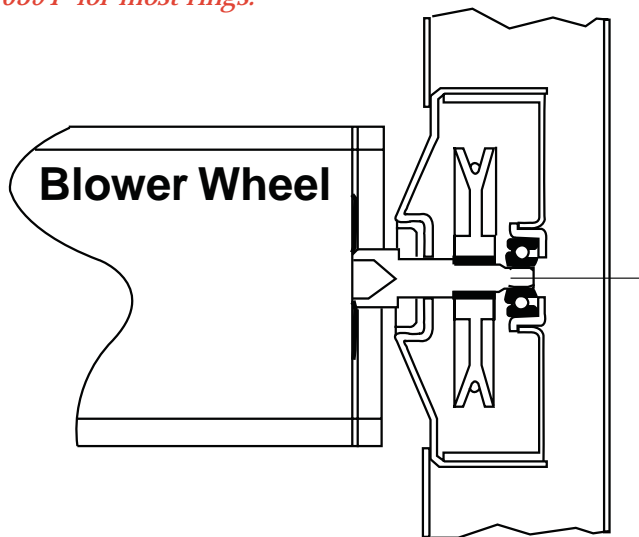
BN style rings have a free-state diameter smaller than the shaft diameter over which they are to be installed, so that when mounted to the shaft the rings conform to and become self-retaining on the shaft. If used with the centered or half-centered arrangement, the ring will snap into the groove and no further handling of the ring is necessary. If used with the free arrangement, the ring must be axially supported during assembly of the mating parts.

The BN ring is cut to fit *inside* a nominal circumference. Examples for use of the BN ring include mounting a bearing inner race to a shaft, or assemblies in which modification of the shaft is more practical than modifying the bore of the outer member.

The free-state shape of the BN ring may be overlapped or may have a slight gap, but the ring should always be self-retaining to the specified shaft diameter.



Corrugations point outward in the BN style. Corrugation heights are .0196" to .0394" for most rings.



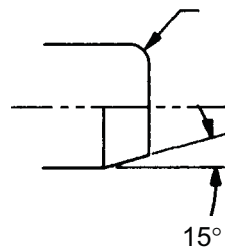
Design of Mating Parts

Assembly Procedure Considerations

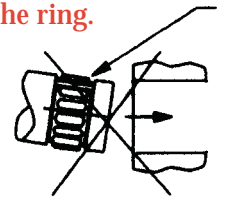
The "tops" of the corrugations (The I.D. on AN style rings, or the O.D. on BN rings) are formed with a rounded contour, which assists as a lead-in edge during assembly. It is very important that the lead-in edge of the mating part is contoured with a generous radius or a shallow (15°) chamfer. Sharp corners on the lead-in edge could dig in and mar the Tolerance Ring, sacrificing performance.

Best results of assembling mating parts are achieved by using an arbor press and fixturing the parts to hold them squarely in place during assembly. Except for very light duty rings, aligning the parts by hand and/or hammering the assembly together jeopardizes alignment and performance. If misalignment occurs during assembly, there is a tendency for the lead-in edge of the mating part to flatten corrugations in one area of the Tolerance Ring, resulting in reduction of ring integrity.

Radius or chamfer are options for part which slides on corrugations during assembly.



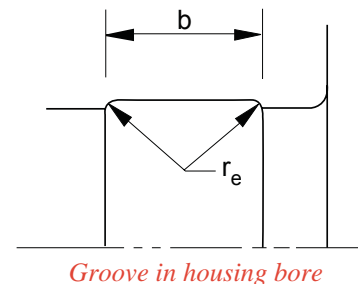
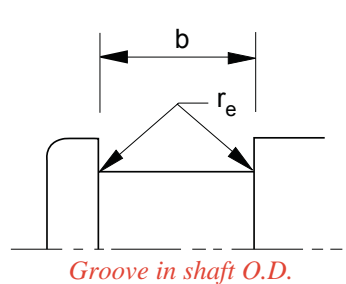
Misalignment as shown will cause flattening of corrugations in this circumferential portion of the ring.



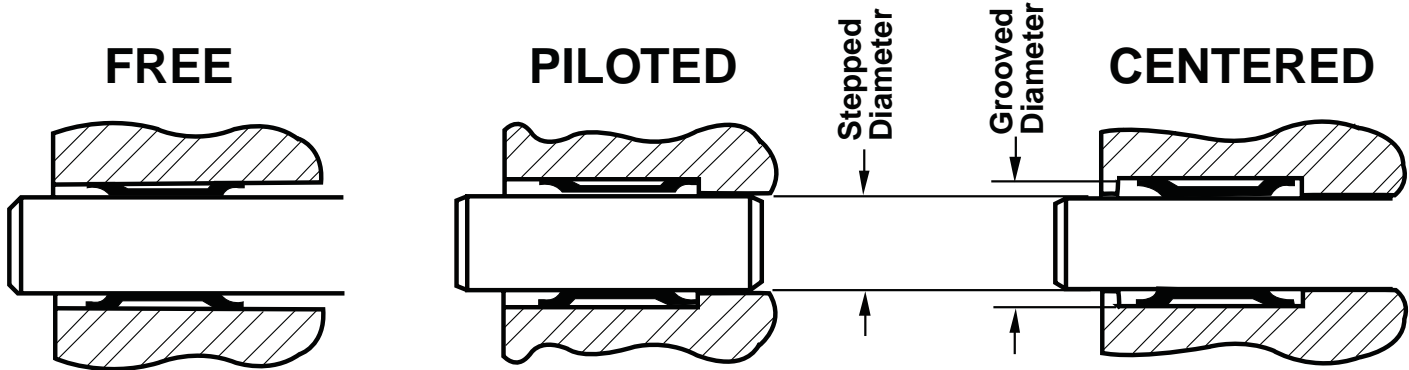
Keep Alignment True

When using the centered arrangement, a small radius and adequate groove width should be used to ensure that the Tolerance Ring may be properly seated on the cylindrical surface.

$$r_e = .010 \text{ max for dia } < 2" \\ = .020 \text{ max for dia } > 2" \\ b_{\text{min}} = (3 \times r_e) + \text{ring width}$$



Types of Mounting

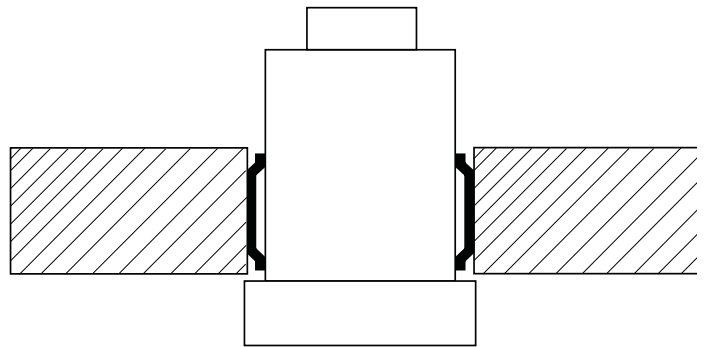
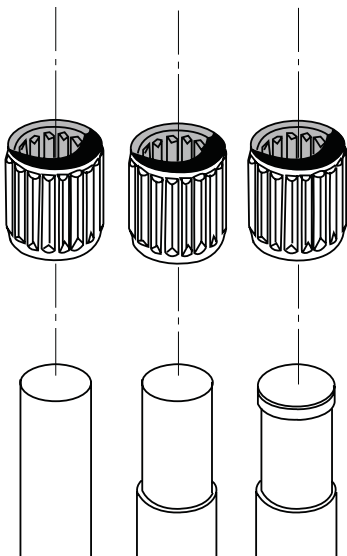


AN Ring Mounting Arrangements

Centered Arrangement

This arrangement provides a groove in the housing for AN rings or a groove in the shaft for BN rings. These grooves capture the ring axially on both sides and simplify assembly. When the shoulder (stepped) diameter is held close to the nominal diameter, the following advantages occur:

- Improved alignment of parts during installation
- Improved concentricity due to low radial clearance at the shoulder
- Excessive radial loads and shock loads can be accommodated since the Tolerance Ring is protected in its own cavity. The corrugations will deflect until the shoulder or stepped diameter contacts the mating member. Additional loading will be transmitted through the step, and will not act to further deflect or crush the corrugations.



Brush Holder

Piloted (Half-Centered) Arrangement

This arrangement is similar to the centered configuration, at a lower cost. With the exception of piloting for alignment, this method may provide the advantages of the centered arrangement when the stepped diameter is held close to the nominal diameter of the mating component.

Free Arrangement

This arrangement will not provide axial support to the ring in either direction, so the assembly machine must be fixtured to “back up” or axially locate the ring temporarily while the mating components are assembled. The Tolerance Ring will be subjected to all radial loading and should be selected with appropriate capacity.



Operating Principle

Tolerance Rings work on the two physics principles of springs and friction.

Spring Formula: $F = kx$
 where F = force required to compress the spring (lbs or N)
 k = spring rate (lbs/in or N/m)
 x = distance the spring is compressed (inches or m)

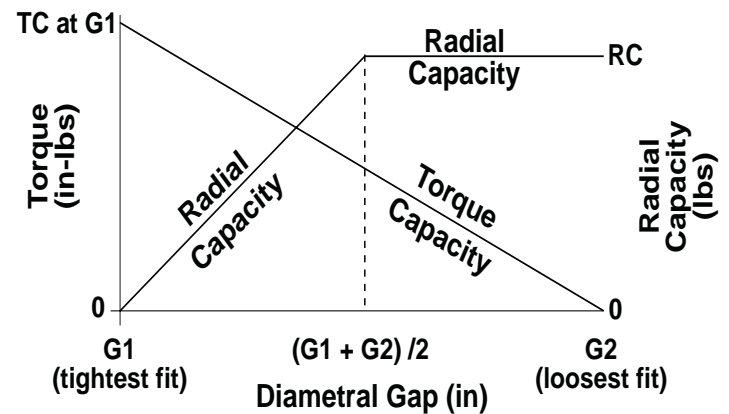
Friction Formula: $F_f = cN$
 where F_f = friction force opposing movement (lbs or N)
 c = coefficient of friction
 N = force which is perpendicular to the surface.

Each corrugation (“wave” or “bump”) on a Tolerance Ring acts like a stiff radial spring. We can calculate the spring rate, k , specify the deflection, x , and estimate the coefficient of friction. All this, coupled with limits related to yield strength of the material, permits us to estimate the assembly forces, torque, and radial load capacities of a Tolerance Ring.

The load capacities, both torque and radial, vary with the amount of interference. Radial capacity is related to the yield limits of the material, the cumulative compression of the corrugations caused by interference fit plus externally applied radial loads, and the preload caused by the interference fit. Torque capacities are related to the amount of interference and coefficient of friction.

The graph below summarizes the capacities in practical terms. G1 represents the minimum diametral gap (smallest space, tightest fit) and G2 represents the maximum diametral space (biggest gap, loosest fit). Torque capacity is maximum in the tightest fit at G1 and drops to minimum at the loosest fit at G2. Radial capacity is at maximum value throughout the top half of the interference range (due to a preload effect), but drops linearly (right to left on the curve) from the midpoint to the tightest fit at G1.

The Curve Demonstrates that Maximum Torque Values and Maximum Radial Capacities Cannot Exist Simultaneously.



Load capacities as related to the amount of interference fit.

Part Identification Chart

| | | | | | |
|----|-----|---|-----|---|---|
| BN | 5 | X | 6 | C | |
| AN | 125 | | 075 | S | 2 |

SERIES:
AN, ANL, BN

DIAMETER:
mm or x.xx"

INCH SERIES = blank
METRIC SERIES = X

WIDTH:
mm or x.xx"

DESIGNATES
SPECIAL DESIGN

MATERIAL:
S = 301 Stainless Steel
C = Carbon Steel
H = Hastelloy
M = Monel

SAMPLE PART NUMBER IDENTIFICATION:

BN 5 X 6 C

BN series, 5 mm DIA, 6 mm width, carbon steel

AN 125075 S2

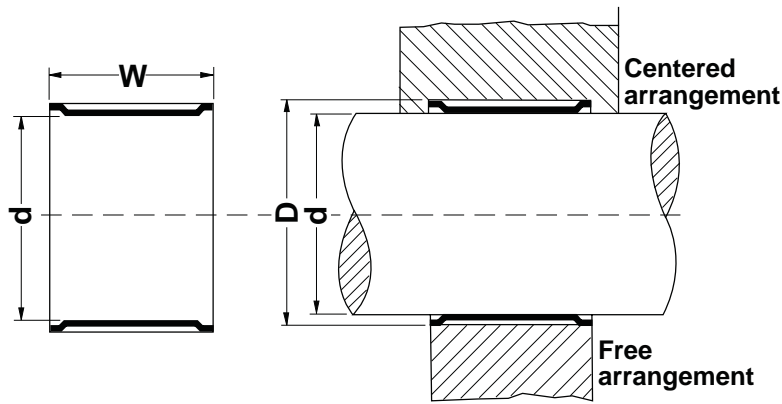
AN series, 1-1/4" DIA, 3/4" width, stainless, special

SIZE RANGE OF STANDARD RINGS

| Diameter Range | Ring Widths Available | Pitch | Material Thickness |
|--------------------------------|--|------------------|--------------------|
| Inch .18 / .29 mm 4.5 / 7.5 | In: 1/4, 5/16, 3/8, 7/16, 1/2, 5/8 mm: 5, 6 | .059" 1.5 mm | .006" .15 mm |
| Inch .31 / .73 mm 8 / 18 | In: 1/4, 5/16, 3/8, 1/2, 5/8, 3/4 mm: 4, 5, 6, 8 | .0984" 2.5 mm | .008" .2 mm |
| Inch .5+ mm | mm: 4, 5, 6, 7, 8, 10, 14, 15 <i>This Pitch is ANL Version Only</i> | .1236" | .004" .1 mm |
| Inch .70 / 1.23 mm 19 / 30 | In: 1/4, 3/8, 1/2, 5/8, 3/4, 1, 1-1/8 mm: 6, 7, 8, 9, 10, 13, 16, 22 | .1378" 3.5 mm | .012" .3 mm |
| Inch 1.25+ mm 32+ | In: 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1-1/4, 1-1/2 mm: 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 30 | .1968" 5 mm | .016" .4 mm |
| Inch 2+ mm 52+ | mm: 10, 15, 16 | .248" 6.3 mm | .020" .5 mm |
| Inch 3+ mm 82+ | mm: 19, 21 | .2953" 7.5 mm | .024" .6 mm |
| Inch 5+ mm 125 | In: 1/2, 5/8 mm: 12 | .370" 9.4 mm | .028" .7 mm |

Check out our website! www.usatolerancerings.com

AN Series



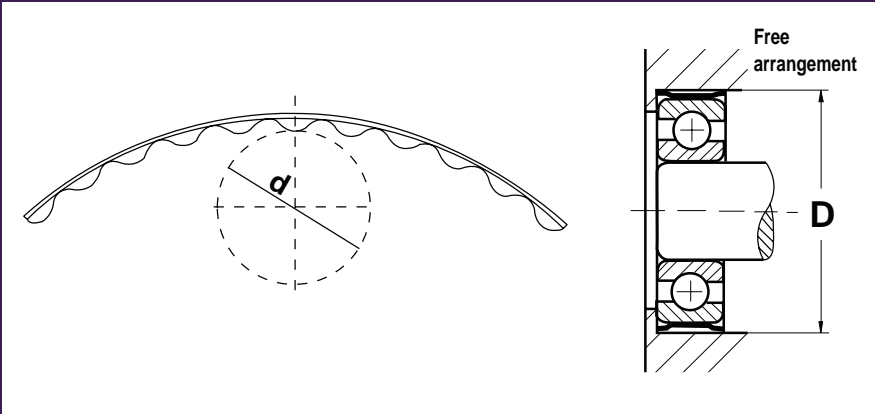
| d nominal | d (in) | w2 (in) | PART NUMBER | d min (in) | D max (in) | DIAMETRAL ² CLEARANCE | | RADIAL CAPACITY (lbs) | TORQUE CAPACITY @ G1 ³ (in-lbs) | TYPICAL BORE FOR TORQUE | | | TYPICAL BORE FOR BEARING MOUNT | |
|-----------|--------|---------|-------------|------------|------------|----------------------------------|---------|-----------------------|--|-------------------------|------------|------------|--------------------------------|------------|
| | | | | | | G1 (in) | G2 (in) | | | TC (in-lbs) | D min (in) | D max (in) | D min (in) | D max (in) |
| 4 mm | 0.157 | 0.236 | AN4X8C | 0.156 | 0.195 | 0.032 | 0.039 | 20 | 3 | 2 | 0.190 | 0.192 | 0.193 | 0.195 |
| 3/16 | 0.188 | 0.250 | AN018025C | 0.187 | 0.226 | 0.032 | 0.039 | 23 | 4 | 3 | 0.219 | 0.221 | 0.224 | 0.226 |
| 6 mm | 0.236 | 0.236 | AN6X6C | 0.235 | 0.274 | 0.032 | 0.039 | 30 | 6 | 4 | 0.269 | 0.270 | 0.273 | 0.274 |
| 1/4 | 0.250 | 0.250 | AN025025C | 0.249 | 0.289 | 0.032 | 0.039 | 45 | 9 | 4 | 0.283 | 0.285 | 0.287 | 0.289 |
| 5/16 | 0.313 | 0.250 | AN031025C | 0.312 | 0.370 | 0.048 | 0.058 | 65 | 11 | 7 | 0.362 | 0.364 | 0.368 | 0.370 |
| 3/8 | 0.375 | 0.250 | AN037025S | 0.374 | 0.433 | 0.048 | 0.058 | 190 | 21 | 15 | 0.424 | 0.426 | 0.430 | 0.433 |
| 7/16 | 0.438 | 0.250 | AN043025S | 0.437 | 0.495 | 0.048 | 0.058 | 230 | 25 | 18 | 0.487 | 0.489 | 0.492 | 0.495 |
| 1/2 | 0.500 | 0.250 | AN050025S | 0.498 | 0.558 | 0.048 | 0.058 | 270 | 50 | 25 | 0.549 | 0.552 | 0.555 | 0.558 |
| 1/2 | 0.500 | 0.750 | AN050075S | 0.498 | 0.558 | 0.048 | 0.058 | 810 | 150 | 75 | 0.549 | 0.552 | 0.555 | 0.558 |
| 5/8 | 0.625 | 0.250 | AN062025S | 0.623 | 0.683 | 0.048 | 0.058 | 320 | 75 | 37 | 0.674 | 0.677 | 0.680 | 0.683 |
| 16 mm | 0.630 | 0.197 | AN16X5S | 0.628 | 0.688 | 0.048 | 0.058 | 250 | 58 | 30 | 0.678 | 0.682 | 0.685 | 0.688 |
| 11/16 | 0.688 | 0.250 | AN068025S | 0.686 | 0.746 | 0.048 | 0.058 | 370 | 100 | 50 | 0.737 | 0.740 | 0.743 | 0.746 |
| 19 mm | 0.748 | 0.236 | AN19X6S | 0.746 | 0.826 | 0.066 | 0.078 | 420 | 98 | 60 | 0.814 | 0.817 | 0.823 | 0.826 |
| 3/4 | 0.750 | 0.250 | AN075025S | 0.748 | 0.828 | 0.066 | 0.078 | 440 | 115 | 70 | 0.816 | 0.819 | 0.825 | 0.828 |
| 22 mm | 0.866 | 0.276 | AN22X7S | 0.864 | 0.944 | 0.066 | 0.078 | 550 | 220 | 135 | 0.932 | 0.935 | 0.941 | 0.944 |
| 7/8 | 0.875 | 0.500 | AN087050S | 0.873 | 0.953 | 0.066 | 0.078 | 1200 | 325 | 200 | 0.941 | 0.944 | 0.950 | 0.953 |
| 1 | 1.000 | 0.500 | AN100050S | 0.998 | 1.078 | 0.066 | 0.078 | 1300 | 425 | 260 | 1.066 | 1.069 | 1.075 | 1.078 |
| 28 mm | 1.102 | 0.472 | AN28X12S | 1.100 | 1.181 | 0.066 | 0.078 | 1330 | 525 | 325 | 1.168 | 1.171 | 1.177 | 1.181 |
| 1 1/8 | 1.125 | 0.500 | AN112050S | 1.123 | 1.203 | 0.066 | 0.078 | 1440 | 530 | 330 | 1.188 | 1.192 | 1.199 | 1.203 |
| 30 mm | 1.181 | 0.512 | AN30X13S | 1.179 | 1.259 | 0.066 | 0.078 | 1400 | 640 | 390 | 1.247 | 1.250 | 1.256 | 1.259 |
| 1 1/4 | 1.250 | 0.500 | AN125050S | 1.248 | 1.328 | 0.066 | 0.078 | 890 | 530 | 410 | 1.316 | 1.320 | 1.324 | 1.328 |
| 1 3/8 | 1.375 | 0.500 | AN137050S | 1.373 | 1.453 | 0.066 | 0.078 | 1040 | 650 | 500 | 1.441 | 1.445 | 1.449 | 1.453 |
| 35 mm | 1.378 | 0.433 | AN35X11S | 1.376 | 1.456 | 0.066 | 0.078 | 820 | 550 | 290 | 1.444 | 1.448 | 1.452 | 1.456 |
| 1 1/2 | 1.500 | 0.500 | AN150050S | 1.498 | 1.578 | 0.066 | 0.078 | 1100 | 795 | 420 | 1.566 | 1.570 | 1.574 | 1.578 |
| 1 9/16 | 1.563 | 0.500 | AN156050S | 1.561 | 1.641 | 0.066 | 0.078 | 1100 | 860 | 460 | 1.629 | 1.633 | 1.637 | 1.641 |
| 40 mm | 1.575 | 0.472 | AN40X12S | 1.573 | 1.653 | 0.066 | 0.078 | 1000 | 835 | 445 | 1.641 | 1.645 | 1.649 | 1.653 |
| 1 5/8 | 1.625 | 0.500 | AN162050S | 1.623 | 1.703 | 0.066 | 0.078 | 1200 | 940 | 500 | 1.691 | 1.695 | 1.699 | 1.703 |
| 42 mm | 1.654 | 0.512 | AN42X13S | 1.652 | 1.731 | 0.066 | 0.078 | 1200 | 890 | 475 | 1.720 | 1.724 | 1.727 | 1.731 |
| 1 3/4 | 1.750 | 0.500 | AN175050S | 1.748 | 1.828 | 0.066 | 0.078 | 1200 | 1110 | 590 | 1.816 | 1.820 | 1.824 | 1.828 |
| 47 mm | 1.850 | 0.551 | AN47X14S | 1.848 | 1.928 | 0.066 | 0.078 | 1400 | 1360 | 720 | 1.916 | 1.920 | 1.924 | 1.928 |
| 1 7/8 | 1.875 | 0.500 | AN187050S | 1.873 | 1.953 | 0.066 | 0.078 | 1300 | 1240 | 660 | 1.941 | 1.945 | 1.949 | 1.953 |
| 2 | 2.000 | 0.500 | AN200050S | 1.998 | 2.097 | 0.080 | 0.098 | 1100 | 1175 | 675 | 2.082 | 2.087 | 2.092 | 2.097 |

1. See SIZE RANGE OF STANDARD RINGS chart on page 13 for other widths which are available. Radial load and torque capacities are generally proportional to width. Performance is influenced by design of mating components and assembly procedures - actual capacities may vary from the stated values. For sizes or load requirements other than shown, contact our Engineering Department for recommendations.

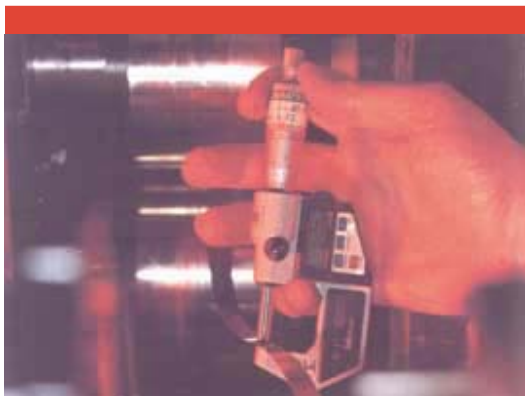
2. Diametral clearance or Diametral Gap is the void where the Tolerance Ring fits (mathematically represented by D-d). The size of this gap determines the amount of interference fit. G1 and G2 are design limits.

3. Torque capacity is dependent on fit. **Torque Capacity @ G1** is the expected torque capacity at the tightest fit allowable. **TC** is the expected minimum torque transfer capacity at the Typical Bore For Torque diameter range (which occurs with Dmax).

Bearing & ANL Series

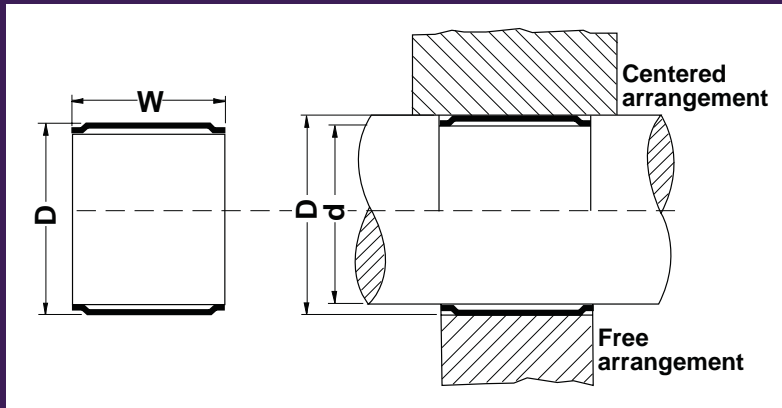


| BEARING NUMBER | d Nominal | BRG O.D. d (in) | BRG W W (in) | PART NUMBER | RADIAL CAPACITY (lbs) | TYPICAL BORE FOR BEARING MOUNT | | BEARING NUMBER | d nominal | BRG O.D. d (in) | BRG W W (in) | PART NUMBER | RADIAL CAPACITY (lbs) | TYPICAL BORE FOR BEARING MOUNT | |
|------------------|--------------|-----------------------|--------------------|-------------|--------------------------|--------------------------------|---------------|----------------|--------------|-----------------------|--------------------|-------------|--------------------------|--------------------------------|---------------|
| | | | | | | D min (in) | D max (in) | | | | | | | D min (in) | D max (in) |
| R3 | 1/2 | 0.5000 | 0.1960 | AN12.7X5S | 180 | 0.555 | 0.558 | 6310 | 110 mm | 4.3307 | 1.0630 | AN110X25S9 | 7190 | 4.406 | 4.409 |
| R4 | 5/8 | 0.6250 | 0.1960 | AN16X5S | 250 | 0.680 | 0.683 | 6213 | 120 mm | 4.7244 | 0.9055 | AN120X22S9 | 7190 | 4.799 | 4.802 |
| 34 | 16 mm | 0.6299 | 0.1969 | AN16X5S | 250 | 0.685 | 0.688 | 6311 | 120 mm | 4.7244 | 1.1417 | AN120X25S9 | 7950 | 4.799 | 4.802 |
| 35 | 19 mm | 0.7480 | 0.2362 | AN19X6S | 420 | 0.823 | 0.826 | 6214 | 125 mm | 4.9213 | 0.9449 | AN125X22S9 | 7480 | 4.996 | 4.999 |
| 38/608 | 22 mm | 0.8661 | 0.2756 | AN22X7S | 550 | 0.941 | 0.944 | 6215 | 130 mm | 5.1181 | 0.9843 | AN130X25S9 | 8550 | 5.193 | 5.196 |
| R6 | 7/8 | 0.8750 | 0.2500 | AN087025S | 580 | 0.950 | 0.953 | 6312 | 130 mm | 5.1181 | 1.2205 | AN130X31S9 | 10500 | 5.193 | 5.196 |
| 6000 | 26 mm | 1.0236 | 0.3150 | AN26X8S | 770 | 1.098 | 1.101 | 6216 | 140 mm | 5.5118 | 1.0236 | AN140X25S9 | 9200 | 5.587 | 5.590 |
| 6001 | 28 mm | 1.1024 | 0.3150 | AN28X8S | 840 | 1.177 | 1.181 | 6313 | 140 mm | 5.5118 | 1.2992 | AN140X33S9 | 12200 | 5.587 | 5.590 |
| R8 | 1-1/8 | 1.1250 | 0.2500 | AN112025S | 720 | 1.199 | 1.203 | 6217 | 150 mm | 5.9055 | 1.1024 | AN150X25S9 | 9950 | 5.980 | 5.983 |
| 6200 | 30 mm | 1.1811 | 0.3543 | AN30X9S | 980 | 1.256 | 1.259 | 6314 | 150 mm | 5.9055 | 1.3780 | AN150X33S9 | 13000 | 5.980 | 5.983 |
| 6201 | 32 mm | 1.2598 | 0.3937 | AN32X10S | 670 | 1.334 | 1.338 | 6218 | 160 mm | 6.2992 | 1.1811 | AN160X25S9 | 10550 | 6.374 | 6.377 |
| 6202/6300 | 35 mm | 1.3780 | 0.4331 | AN35X11S | 820 | 1.452 | 1.456 | 6315 | 160 mm | 6.2992 | 1.4567 | AN160X33S9 | 13950 | 6.374 | 6.377 |
| 6301 | 37 mm | 1.4567 | 0.4724 | AN37X12S | 900 | 1.531 | 1.535 | 6316 | 170 mm | 6.6929 | 1.5354 | AN170X39S9 | 17250 | 6.767 | 6.770 |
| 6203 | 40 mm | 1.5748 | 0.4724 | AN40X12S | 1000 | 1.649 | 1.653 | 6317 | 180 mm | 7.0866 | 1.6142 | AN180X39S9 | 19000 | 5.161 | 7.164 |
| 6302 | 42 mm | 1.6535 | 0.5118 | AN42X13S | 1200 | 1.727 | 1.731 | 6318 | 190 mm | 7.4803 | 1.6929 | AN190X39S9 | 20500 | 7.555 | 7.558 |
| ANL RINGS | | | | | | | | | | | | | | | |
| BEARING NUMBER | d nominal | BRG O.D. d (in) | BRG W W (in) | PART NUMBER | RADIAL CAPACITY (lbs) | TYPICAL BORE FOR BEARING MOUNT | | BEARING NUMBER | d nominal | BRG O.D. d (in) | BRG W W (in) | PART NUMBER | RADIAL CAPACITY (lbs) | TYPICAL BORE FOR BEARING MOUNT | |
| | | | | | | D min (in) | D max (in) | | | | | | | D min (in) | D max (in) |
| R3 | 1/2 | 0.5000 | 0.1960 | ANL12.7X5S | 6 | 0.525 | 0.527 | R3 | 1/2 | 0.5000 | 0.1960 | ANL12.7X5S | 6 | 0.525 | 0.527 |
| R4 | 5/8 | 0.6250 | 0.1960 | ANL16X5S | 8 | 0.650 | 0.652 | R4 | 5/8 | 0.6250 | 0.1960 | ANL16X5S | 8 | 0.650 | 0.652 |
| 34 | 16 mm | 0.6299 | 0.1969 | ANL16X5S | 8 | 0.655 | 0.657 | 34 | 16 mm | 0.6299 | 0.1969 | ANL16X5S | 8 | 0.655 | 0.657 |
| 6210 | 11/16 | 0.6875 | 0.3125 | ANL17.5X8S | 11 | 0.714 | 0.716 | 21104 | 11/16 | 0.6875 | 0.3125 | ANL17.5X8S | 11 | 0.714 | 0.716 |
| 35 | 19 mm | 0.7480 | 0.2362 | ANL19X6S | 10 | 0.773 | 0.775 | 35 | 19 mm | 0.7480 | 0.2362 | ANL19X6S | 10 | 0.773 | 0.775 |
| 608/38 | 22 mm | 0.8661 | 0.2756 | ANL22X7S | 13 | 0.890 | 0.892 | 608/38 | 22 mm | 0.8661 | 0.2756 | ANL22X7S | 13 | 0.890 | 0.892 |
| 608/38 | 22 mm | 0.8661 | 0.2756 | ANL22X10S | 21 | 0.890 | 0.892 | 608/38 | 22 mm | 0.8661 | 0.2756 | ANL22X10S | 21 | 0.890 | 0.892 |
| 6203 | 40 mm | 1.5748 | 0.4724 | ANL40X12S | 45 | 1.600 | 1.602 | 6203 | 40 mm | 1.5748 | 0.4724 | ANL40X12S | 45 | 1.600 | 1.602 |



1. Recommended bore sizes assume no differential thermal expansion (going looser). Radial Capacity is a static load rating.
2. USA Tolerance Rings may also be used to mount inner bearing races to shafts (BN series). Please contact our engineers to review these applications since they usually involve cyclical loading rather than static loads.
3. These part numbers are for "Free Arrangement" mounting configurations (REF p. 10). Assemblies using narrow, light-duty rings and a centered arrangement benefit from lighter assembly forces while still preventing bearing race rotation. Consult our Sales or Engineering Department for recommendations.

BN Series



| D nominal | D (in) | W ¹ (in) | PART NUMBER | d min (in) | D max (in) | DIAMETRAL ² CLEARANCE | | RADIAL CAPACITY (lbs) | TORQUE CAPACITY @ G1 ³ (in-lbs) | TYPICAL O.D. FOR TORQUE | | | TYPICAL O.D. FOR BEARING MOUNT | |
|-----------|--------|---------------------|-------------|------------|------------|----------------------------------|---------|-----------------------|--|-------------------------|------------|------------|--------------------------------|------------|
| | | | | | | G1 (in) | G2 (in) | | | TC (in-lbs) | d min (in) | d max (in) | d min (in) | d max (in) |
| 3/16 | 0.188 | 0.250 | BN018025C | 0.149 | 0.189 | 0.032 | 0.039 | 50 | 3 | 1.8 | 0.153 | 0.155 | 0.149 | 0.150 |
| 5 mm | 0.197 | 0.236 | BN5X6C | 0.159 | 0.198 | 0.032 | 0.039 | 50 | 3 | 2 | 0.162 | 0.164 | 0.159 | 0.160 |
| 6 mm | 0.236 | 0.236 | BN6X6C | 0.198 | 0.237 | 0.032 | 0.039 | 85 | 4 | 2 | 0.201 | 0.203 | 0.198 | 0.200 |
| 1/4 | 0.250 | 0.250 | BN025025C | 0.211 | 0.251 | 0.032 | 0.039 | 105 | 7 | 4 | 0.215 | 0.217 | 0.211 | 0.213 |
| 5/16 | 0.313 | 0.250 | BN031025C | 0.254 | 0.314 | 0.048 | 0.058 | 55 | 11 | 8 | 0.262 | 0.264 | 0.254 | 0.256 |
| 8 mm | 0.315 | 0.197 | BN8X5S | 0.257 | 0.316 | 0.048 | 0.058 | 125 | 9 | 5 | 0.264 | 0.266 | 0.257 | 0.259 |
| 3/8 | 0.375 | 0.250 | BN037025S | 0.317 | 0.376 | 0.048 | 0.058 | 190 | 21 | 12 | 0.323 | 0.326 | 0.317 | 0.320 |
| 10 mm | 0.394 | 0.276 | BN10X7S | 0.336 | 0.395 | 0.048 | 0.058 | 200 | 24 | 17 | 0.342 | 0.345 | 0.336 | 0.339 |
| 12 mm | 0.472 | 0.197 | BN12X5S | 0.414 | 0.473 | 0.048 | 0.058 | 200 | 31 | 18 | 0.420 | 0.423 | 0.414 | 0.417 |
| 1/2 | 0.500 | 0.250 | BN050025S | 0.442 | 0.501 | 0.048 | 0.058 | 240 | 37 | 21 | 0.448 | 0.451 | 0.442 | 0.445 |
| 9/16 | 0.563 | 0.250 | BN056025S | 0.505 | 0.564 | 0.048 | 0.058 | 240 | 47 | 28 | 0.511 | 0.514 | 0.505 | 0.508 |
| 15 mm | 0.591 | 0.236 | BN15X6S | 0.532 | 0.592 | 0.048 | 0.058 | 270 | 49 | 30 | 0.539 | 0.542 | 0.532 | 0.535 |
| 5/8 | 0.625 | 0.250 | BN062025S | 0.567 | 0.627 | 0.048 | 0.058 | 300 | 75 | 38 | 0.573 | 0.576 | 0.567 | 0.570 |
| 17 mm | 0.669 | 0.472 | BN17X12S | 0.611 | 0.671 | 0.048 | 0.058 | 640 | 185 | 92 | 0.617 | 0.620 | 0.611 | 0.614 |
| 11/16 | 0.688 | 0.375 | BN068037S | 0.629 | 0.690 | 0.048 | 0.058 | 510 | 160 | 80 | 0.636 | 0.639 | 0.629 | 0.632 |
| 3/4 | 0.750 | 0.500 | BN075050S | 0.672 | 0.752 | 0.066 | 0.078 | 880 | 200 | 120 | 0.681 | 0.684 | 0.672 | 0.675 |
| 20 mm | 0.787 | 0.472 | BN20X12S | 0.710 | 0.789 | 0.066 | 0.078 | 840 | 175 | 110 | 0.718 | 0.721 | 0.710 | 0.713 |
| 7/8 | 0.875 | 0.500 | BN087050S | 0.797 | 0.877 | 0.066 | 0.078 | 1000 | 300 | 185 | 0.806 | 0.809 | 0.797 | 0.800 |
| 15/16 | 0.938 | 0.500 | BN093050S | 0.859 | 0.940 | 0.066 | 0.078 | 1125 | 405 | 245 | 0.869 | 0.872 | 0.859 | 0.862 |
| 25 mm | 0.984 | 0.472 | BN25X12S | 0.907 | 0.986 | 0.066 | 0.078 | 1100 | 275 | 170 | 0.915 | 0.918 | 0.907 | 0.910 |
| 1 | 1.000 | 0.500 | BN100050S | 0.922 | 1.002 | 0.066 | 0.078 | 1200 | 400 | 245 | 0.931 | 0.934 | 0.922 | 0.925 |
| 1 1/8 | 1.125 | 0.500 | BN112050S | 1.047 | 1.127 | 0.066 | 0.078 | 1300 | 515 | 315 | 1.056 | 1.059 | 1.047 | 1.050 |
| 30 mm | 1.181 | 0.512 | BN30X13S | 1.104 | 1.183 | 0.066 | 0.078 | 1400 | 550 | 340 | 1.112 | 1.115 | 1.104 | 1.107 |
| 1 3/16 | 1.188 | 0.875 | BN118087S | 1.109 | 1.190 | 0.066 | 0.078 | 2500 | 1150 | 700 | 1.119 | 1.122 | 1.109 | 1.112 |
| 1 1/4 | 1.250 | 0.750 | BN125075S | 1.172 | 1.252 | 0.066 | 0.078 | 1200 | 740 | 450 | 1.181 | 1.184 | 1.172 | 1.175 |
| 1 3/8 | 1.375 | 0.688 | BN137068S | 1.297 | 1.377 | 0.066 | 0.078 | 1170 | 770 | 410 | 1.305 | 1.309 | 1.297 | 1.301 |
| 35 mm | 1.378 | 0.669 | BN35X17S | 1.300 | 1.380 | 0.066 | 0.078 | 1220 | 785 | 415 | 1.308 | 1.312 | 1.300 | 1.304 |
| 1 1/2 | 1.500 | 0.750 | BN150075S | 1.422 | 1.502 | 0.066 | 0.078 | 1500 | 1120 | 595 | 1.430 | 1.434 | 1.422 | 1.426 |
| 40 mm | 1.575 | 0.551 | BN40X14S | 1.497 | 1.577 | 0.066 | 0.078 | 1200 | 850 | 450 | 1.505 | 1.509 | 1.497 | 1.501 |
| 1 5/8 | 1.625 | 1.000 | BN162100S | 1.547 | 1.627 | 0.066 | 0.078 | 2200 | 1800 | 955 | 1.555 | 1.559 | 1.547 | 1.551 |
| 1 3/4 | 1.750 | 1.000 | BN175100S | 1.672 | 1.752 | 0.066 | 0.078 | 2400 | 2100 | 1115 | 1.680 | 1.684 | 1.672 | 1.676 |
| 2 | 2.000 | 1.000 | BN200100S | 1.922 | 2.002 | 0.066 | 0.078 | 2700 | 2900 | 1775 | 1.931 | 1.934 | 1.922 | 1.926 |

1. See SIZE RANGE OF STANDARD RINGS chart on page 13 for other widths which are available. Radial load and torque capacities are generally proportional to width. Performance is influenced by design of mating components and assembly procedures - actual capacities may vary from the stated values. For sizes or load requirements other than shown, contact our Engineering Department for recommendations.

2. Diametral clearance or Diametral Gap is the void where the Tolerance Ring fits (mathematically represented by $D-d$). The size of this gap determines the amount of interference fit. $G1$ and $G2$ are design limits.

3. Torque capacity is dependent on fit. **Torque Capacity @ $G1$** is the expected torque capacity at the tightest fit allowable. **TC** is the expected minimum torque transfer capacity at the Typical Bore For Torque diameter range (which occurs with D_{max}).

NEW PROJECT INFORMATION SHEET

Date:

Contact:

Company:

Phone:

Address:

Fax:

Description and Sketch of Current Application and Proposed Location of Tolerance Ring

Describe reasons for considering Tolerance Rings.

USA Tolerance Ring to be mounted in Bore or on Shaft?

Describe Assembly Procedure.

Desired Performance

| | | | |
|-----------------------|------|----------------|----------------|
| Torque: | max. | min. | |
| Axial force | max. | min. | |
| Radial force | max. | Cyclical load: | ____Yes ____No |
| Radial runout | max. | | |
| Operating temperature | max. | min. | |

Dimensions

| | | |
|---|------------|-----------------|
| Shaft diameter (Inner) | Tolerance: | Wall thickness: |
| Bore diameter (Outer) | Tolerance: | Wall thickness: |
| Maximum width available for tolerance ring: | | |
| Which dimensions can be changed? | | |
| Which Mounting Configuration is preferred (Centered, Piloted, or Free?) | | |

Material Of Mating Components

| | Material | Hardness | Coefficient of thermal expansion |
|---------------------------|----------|----------|----------------------------------|
| Shaft (Inner Member) | | | |
| Housing (Outer Member) | | | |
| Can materials be changed? | | | |

What Quality Standards are Required?

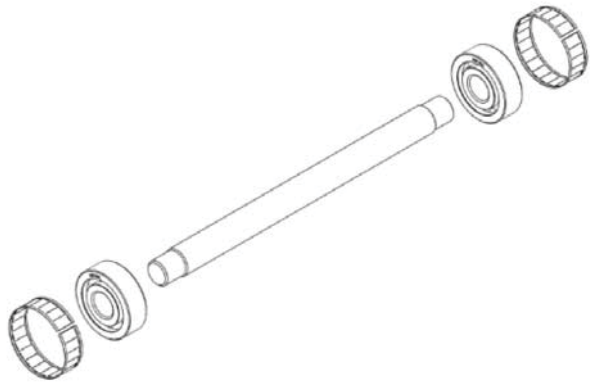
Estimated Annual Quantity?

Schedule:

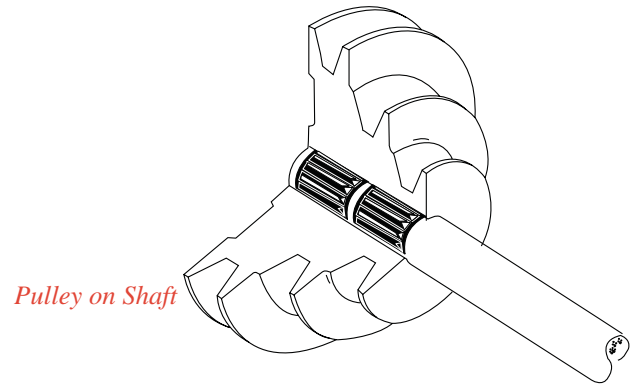
Design to be Finalized by:
Samples by:
Production by:

Competing Solutions

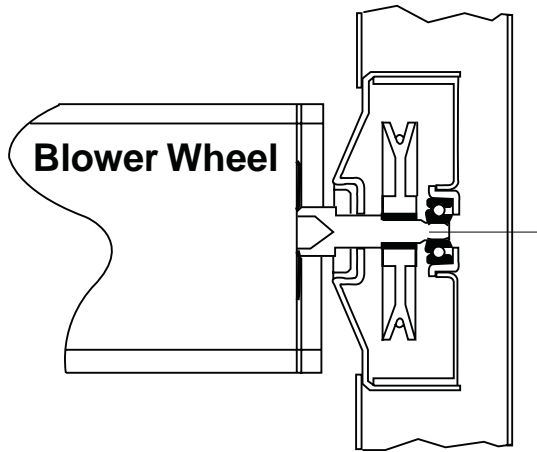
Comments:



USA Tolerance Rings Mount Bearings

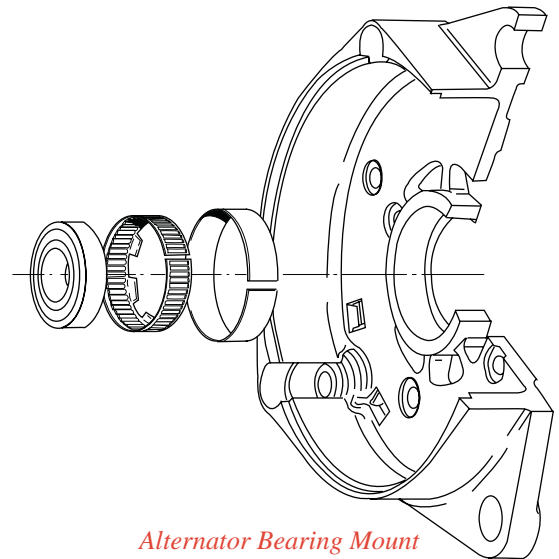


Pulley on Shaft

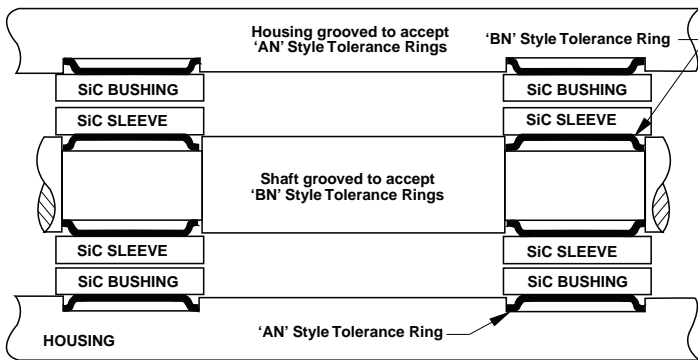


Blower Wheel

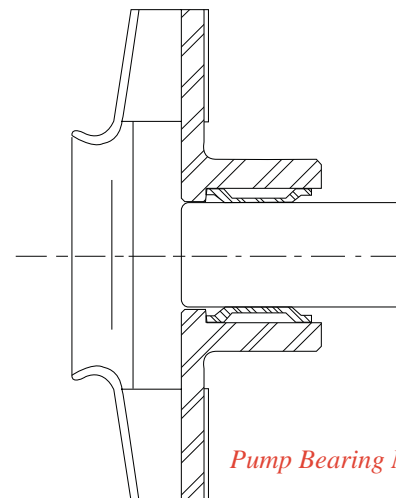
USA Tolerance Ring in Ptu Heating/AC Unit



Alternator Bearing Mount



Silicon Carbide Bushing and Sleeve in a Seal-less Chemical pump



Pump Bearing Mount



Check out our website! www.usatolerancerings.com



USA
TOLERANCE RINGS

85 Route 31 North
Pennington, New Jersey 08534
Toll Free: 1-877-865-7464
Telephone: 609-745-5000
Fax: 609-745-5012

www.usatolerancerings.com