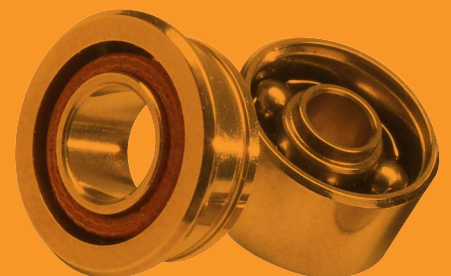


TIMKEN



TIMKEN MINIATURE AND THIN-SECTION BEARINGS CATALOG



MINIATURE AND THIN-SECTION BEARINGS CATALOG INDEX

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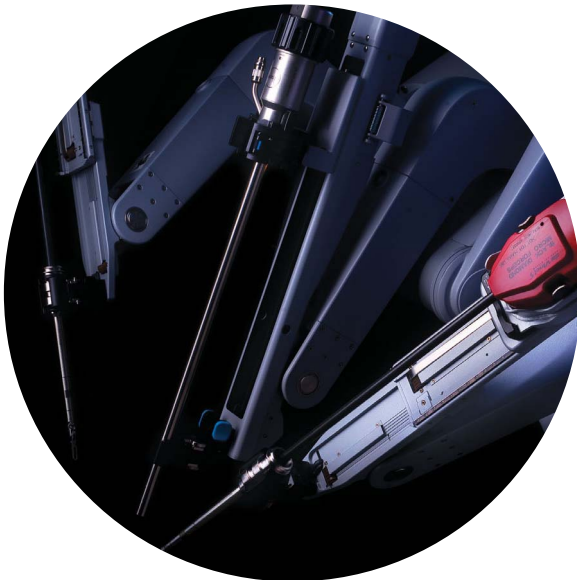
GROW STRONGER WITH TIMKEN

Every day, people around the world count on the strength of Timken. Our expertise in metallurgy, friction management and mechanical power transmission helps them accelerate improvements in productivity and uptime.

We supply products and services that can help keep your operations moving forward, whether you need drivetrain kits for commercial vehicles, durable housings for bearings in dirty environments, precision bearings for industrial motion control systems, medical and health equipment and precision robotics, or other products and services for your applications.

When you choose Timken, you receive more than high-quality products and services: you gain a worldwide team of highly trained and experienced Timken people committed to working collaboratively with you to improve your business.

Globally, our 20,000 people provide reliable answers for a wide range of operations in manufacturing, mining, medical equipment, aerospace, transportation, oil and gas – and other diverse industries.



PRECISION BEARINGS FOR MISSION-CRITICAL APPLICATIONS

Timken is known for high-quality bearings, engineered steel and mechanical power transmission components. Timken also designs and produces specialized integral assemblies, using precision bearings mated with components manufactured to extremely tight tolerances. Integral assemblies provide the ultimate bearing solution by avoiding tolerance stack-ups. When precise fits are required for system accuracy, we can match fit bearings and components for higher yields and lower costs. Our integrated assembly designs are offered in a variety of standard configurations to ABEC9 standards, or customized to meet specific application requirements.

Our 10 technology centers in the United States, Europe and Asia help pioneer tomorrow's innovations with extensive basic and applied scientific research programs. Through internal development and strategic acquisition of innovative companies, we continue to expand our portfolio of highly engineered bearings, steel and components.





DISCLAIMER

This catalog is provided solely to give you analysis tools and data to assist you in your product selection. Product performance is affected by many factors beyond the control of Timken. Therefore, you must validate the suitability and feasibility of all product selections for your applications.

Timken products are sold subject to Timken terms and conditions of sale, which include our limited warranty and remedy. You can find these at <http://www.timken.com/en-us/purchase/Pages/TermsandConditionsofSale.aspx>.

Please consult with your Timken engineer for more information and assistance.

Every reasonable effort has been made to ensure the accuracy of the information in this writing, but no liability is accepted for errors, omissions or for any other reason.

HOW TO USE THIS CATALOG

We designed this catalog to help you find the Timken® bearings best suited to your specifications.

Timken offers an extensive range of bearings and accessories in both imperial and metric sizes. For your convenience, size ranges are indicated in inches and millimeters. Contact your Timken engineer to learn more about our complete product line for the special needs of your application.

This publication contains dimensions, tolerances and load ratings, as well as engineering sections describing fitting practices for shafts and housings, internal clearances, materials and other bearing features. It provides valuable assistance in the initial consideration of the type and characteristics of the bearings that may best suit your particular needs.

ISO and ANSI/ABMA, as used in this publication, refer to the International Organization for Standardization and the American National Standards Institute/American Bearing Manufacturers Association.

Updates are made periodically to this catalog. Visit www.timken.com for the most recent version of the TIMKEN Miniature and Thin-Section BearingS Catalog.

WARNING

Failure to observe the following warnings could create a risk of death or serious injury.

Proper maintenance and handling practices are critical. Always follow installation instructions and maintain proper lubrication.

SHELF LIFE AND STORAGE OF GREASE-LUBRICATED BEARINGS AND COMPONENTS

Timken guidelines for the shelf life of grease-lubricated rolling bearings, components and assemblies are set forth below. Shelf life information is based on test data and experience. Shelf life should be distinguished from lubricated bearing/ component design life as follows:

SHELF LIFE POLICY

Shelf life of the grease-lubricated bearing/component represents the period of time prior to use or installation.

The shelf life is a portion of the anticipated aggregate design life. It is impossible to accurately predict design life due to variations in lubricant bleed rates, oil migration, operating conditions, installation conditions, temperature, humidity and extended storage.

Shelf life values, available from Timken, represent a maximum limit – and assume adherence to the Timken suggested storage and handling guidelines. Deviations from Timken storage and handling guidelines may reduce shelf life. Any specification or operating practice that defines a shorter shelf life should be used. Timken cannot anticipate the performance of the grease lubricant after the bearing or component is installed or placed in service.

TIMKEN IS NOT RESPONSIBLE FOR THE SHELF LIFE OF ANY BEARING/COMPONENT LUBRICATED BY ANOTHER PARTY.

EUROPEAN REACH COMPLIANCE

Timken-branded lubricants, greases and similar products sold in stand-alone containers or delivery systems are subject to the European REACH (**R**egistration, **E**valuation, **A**uthorization and **R**estriction of **C**hemicals) directive. For import into the European Union, Timken can sell and provide only those lubricants and greases that are registered with ECHA (**E**uropean **C**hemical **A**gency). For further information, please contact your Timken engineer.

STORAGE

Timken suggests the following storage guidelines for its finished products (bearings, components and assemblies, hereinafter referred to as “Products”):

- Unless directed otherwise by Timken, Products should be kept in their original packaging until they are ready to be placed into service.
- Do not remove or alter any labels or stencil markings on the packaging.
- Products should be stored in such a way that the packaging is not pierced, crushed or otherwise damaged.
- After a Product is removed from its packaging, it should be placed into service as soon as possible.
- When removing a Product that is not individually packaged from a bulk pack container, the container should be resealed immediately after the Product is removed.
- Do not use Product that has exceeded its shelf life as defined in Timken’s shelf life guidelines statement.
- The storage area temperature should be maintained between 0° C (32° F) and 40° C (104° F); temperature fluctuations should be minimized.
- The relative humidity should be maintained below 60 percent and the surfaces should be dry.

- The storage area should be kept free from airborne contaminants such as, but not limited to, dust, dirt, harmful vapors, etc.
- The storage area should be isolated from undue vibration.
- Extreme conditions of any kind should be avoided.

Due to the fact that Timken is not familiar with your particular storage conditions, we strongly suggest following these guidelines. However, you may be required by circumstances or applicable government requirements to adhere to stricter storage requirements.

Upon receipt of a bearing shipment, ensure that the bearings are not removed from their packaging until they are ready for mounting so that they do not become corroded or contaminated. Bearings should be stored in an appropriate atmosphere in order that they remain protected for the intended period.

Any questions concerning shelf life or storage should be directed to your local sales office.

ENGINEERING

The following topics are covered within this engineering section:

- Bearing designs, special products and materials.
- Shaft and housing fits.
- Lubrication recommendations.
- Testing and inspection.

This engineering section is not intended to be comprehensive, but does serve as a useful guide in miniature and thin-section bearing selection.

To view the complete engineering catalog, please visit www.timken.com. To order the catalog, please contact your Timken engineer and request a copy of the Timken Engineering Manual, order number 10424.



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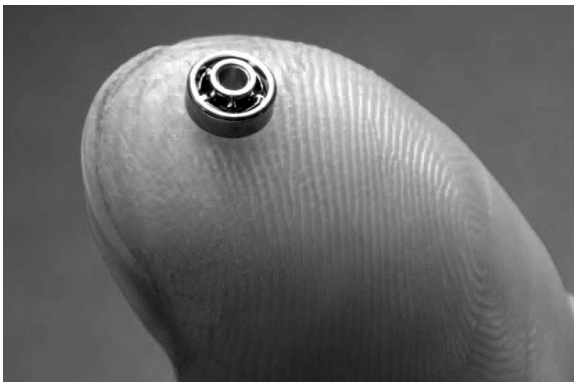
BEARING SELECTION PROCESS

TIMKEN® BEARINGS

Timken provides an extensive variety of rolling bearing types and sizes. Knowing that the bearing is often the most critical component within a moving assembly, Timken engineers take great care to ensure the customer is receiving maximum value when a Timken® bearing is selected. Timken provides the proper bearing for virtually any motion-control application. With more than a century of proven experience in bearing technology, Timken is a world leader in the rolling bearing industry.

The Timken Company has an experienced, highly skilled staff of trained engineers located around the world to assist the customer in bringing new, mechanized products to market. Timken engineers are a powerful resource for customers to turn to for assistance in the appropriate selection of bearings to meet any of the following considerations:

- Higher technical demands or higher levels of application requirements.
- Higher levels of application complexity.
- Critical applications where system damage must be avoided for all modes of operation.
- Potential exposure to personal injury.
- Costly damage or downtime resulting from the use of an inappropriate bearing for a given task.



Because Timken offers so many bearing configurations to serve a wide variety of situations, a suggested starting point in the selection process focuses on the assessment of two basic categories: the first being boundary (or fixed) conditions and the second being performance expectations (or desired results). Depending on your application, the boundary conditions and performance expectations will vary. Trade-offs or compromises must be addressed so that the final bearing type and size selected are a reasonable balance of all factors. It is a wise practice to examine factors critical to the success of the device and prioritize them.

Boundary (or fixed) conditions that should be taken into consideration include:

- External loads, including radial, thrust, moment, shock and combination loads.
- Acceleration and deceleration levels.
- Operating temperature range (including extreme limits and thermal cycling).
- Other environmental factors, such as humidity, fluids, vibration, debris, magnetic fields and vacuum.
- Spatial constraints.

Performance expectations (or desired results) to consider include:

- Rotational accuracy and repeatability (e.g., service precision level).
- System rigidity (axial or radial stiffness).
- Application service life.
- Speed.

Looking at the key operating parameters of the system will help focus on the most viable bearing solution.

Typical considerations in application design include optimization of controllable variables affecting application performance:

- Bearing design.
- Bearing shaft and housing arrangement; shaft and housing material.
- Installation and handling requirements of the bearing, as well as shaft and housing preparation.
- Presence of adequate sealing for the exclusion of contaminants; types of foreign materials possible.
- Lubricating method (lubrication type and delivery system).
- Maintenance procedures and intervals.

Once these conditions and expectations are identified and prioritized, the most appropriate bearing type(s), size(s), and part number(s) that meet the basic application requirements can be selected.

DISCLAIMER

This catalog is provided solely to give you analysis tools and data to assist you in your product selection. See page 4 for full disclaimer.

CATALOG PRODUCT SELECTION

Timken produces precision bearings and assemblies in miniature and thin-section series. The bearings are manufactured with quality steel, tolerances and features that meet demanding application challenges. These precision bearings and assemblies are found in surgical and diagnostic imaging devices, precision pumps, measurement and material handling equipment, as well as guidance, weapons and space applications. Standard sizes range from 0.025 in. to 11 in. bore (1 mm to 280 mm bore).

RADIAL BALL BEARINGS

Size Range:
0.0250 in. - 11.0000 in.

These deep-groove (Conrad) bearings allow for handling of radial, thrust in two directions, or combination of loads. The deep-groove bearings are produced to ABEC 5 - ABEC 7 precision levels as standard catalog offering. These are offered primarily with 440C stainless-steel rings and balls with a variety of separator types. In addition, other material options are available, as well as shields and seals, and ceramic or titanium carbide-coated balls. Radial ball bearings are the only bearings offered as a standard with two seals or shields. Flanges are offered on miniature product. Typical applications include guidance systems, medical (surgical instruments and devices) and robotic joints. Available as a single bearing or preloaded duplex pair.



Fig. 1. Radial ball bearing.

ANGULAR-CONTACT BALL BEARINGS

Size Range:
0.0250 in. - 11.0000 in.

Angular-contact ball bearings offer maximum ball complement for additional load capacity and axial stiffness. These angular-contact bearings allow for handling of radial, thrust in one direction, or a combination of loading. The one-piece precision machined retainer provides higher speed capability. Angular-contact bearings are manufactured to the same tolerances and standards as the radial ball bearings. Rings and balls are normally 440C stainless steel, but other material options are offered. Steel and ceramic balls are available as standard.



Fig. 2. Angular-contact ball bearing.

Typical applications use preloaded pairs for maximum stiffness, high speeds and precise positioning. These include surgical handpieces, control-moment gyros and other high-speed or high-stiffness applications. Available as a single bearing or preloaded duplex pair.

FRACTURED-RACE BALL BEARINGS

Size Range:
0.3750 in. - 3.0625 in.

These bearings have outer rings that are radially fractured in one location. This permits the race to be opened for complete flexibility in the choice of ball complement and separator in a deep-groove radial bearing. High-strength stainless-steel holding bands are pressed on the ground shoulders to maintain tight abutment and alignment of the fractured surface during handling. Full complement and several retainer options are available.



Fig. 3. Fractured-race ball bearing.

Typical applications have a limited radial cross section and a limited axial width. These applications require a bearing with maximum radial capacity, as well as some axial capacity in both directions. Contact Timken engineering for more information.

PIVOT BALL BEARINGS

Size Range:
0.0600 in. - 0.3750 in.

Designed for space-constrained environments where low torque is required, pivot bearings use the mating shaft for the inner raceway. These bearings achieve maximum power density with a full complement of larger balls, no separator or inner ring. Shields are available for the standard line. Typical applications are in guidance systems, such as commercial gyroscopes.

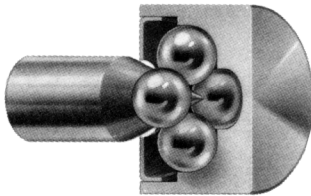


Fig. 4. Pivot ball bearing.

THRUST BALL BEARINGS

Size Range:
0.0937 in. - 0.1250 in.

These bearings are designed for applications where there is high-axial loading, low speeds and relatively high-allowable torque. The standard offering has all stainless-steel components for use where inert materials are required. Typical applications include fuel control systems.

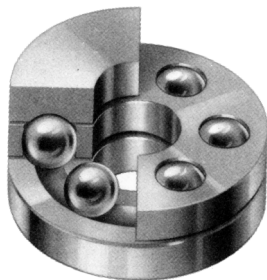


Fig. 5. Thrust ball bearing.

SPECIAL PRODUCTS

INTEGRAL ASSEMBLIES

Timken designs and produces specialized integral assemblies. These assemblies utilize precision bearings that are mated with components manufactured to extremely tight tolerances or contain bearing raceways integrated into the shaft and/or housing. By avoiding tolerance stack-ups, integral assemblies provide the ultimate bearing solution for critical applications requiring precise positional control and low radial/axial runout. Integral designs have the added benefits of mounting ease and more value to the user.



Fig. 6. X-ray and integrated bearing assemblies.

X-RAY

This bearing assembly supports the rotating anode in an X-ray-generating vacuum tube. To meet the severe operating conditions of 10-8 TORR vacuum, 752° F - 932° F (400° C - 500° C) and 10,000 RPM, super high-speed steel alloys, such as M62, are required for bearing rings and balls. The integral shaft raceway design offers cost and performance advantages.

DOUBLE-ROW AND SUPER DUPLEX BEARINGS

When two radial ball-bearing raceways are ground wider than standard width inner and outer rings, a double-row ball bearing is created. A double-row bearing has a single piece inner ring and a single piece outer ring for ease of handling. Double-row bearings are normally supplied to an axial play specification or a radial play specification, and also can incorporate special features such as slots, flanges and holes if required.

Super duplex bearings are a special version of a double-row bearing, where only one ring has two raceways ground into it. Super duplex bearings are typically manufactured as angular-contact ball bearings, and can be supplied as a DB (back-to-back) or a DF (face-to-face) super duplex assembly. A DB super duplex bearing utilizes a single outer ring with two angular-contact raceways, and two precisely matched inner rings to provide for the desired preload.

A DF super duplex bearing utilizes a single inner ring with two angular-contact raceways, and two precisely matched outer rings to provide for the desired preload. Super duplex bearings can be supplied with customized radial play or contact angle to meet specific application conditions, and also can incorporate special features such as slots, flanges and holes if required.

Double-row or super duplex bearings can be supplied as a cartridge bearing design. Timken uses the term cartridge bearing to denote the addition of inner- and outer-ring spacers, which results in an overall bearing assembly that is wider than two single-row bearings. Additional material can be added to the design at the bearing inner diameter (I.D.) or the bearing outer diameter (O.D.), resulting in thicker bearing ring cross sections for those applications that require a different ring thickness to meet special design requirements.

Integrating spacers or additional I.D. or O.D. material can offer distinct advantages over an assembly composed of discrete components (such as bearings plus spacers plus sleeves). Some design advantages include lower, more consistent torque, more consistent preload, improved running accuracy, and simplified installation. As with super duplex assemblies, cartridge bearings can be supplied with any desired preload, with customized radial play or contact angle to meet specific application conditions, and they also can incorporate special features such as slots, flanges and holes.

GIMBAL ASSEMBLIES

Precision grinding, machining and assembly capabilities along with the latest in bearing technology are combined to produce gimbals assemblies. Participation in design, prototype and production efforts enables Timken to supply hardware at all levels including bearings, component parts, subassemblies and assemblies. These mechanical assemblies are routinely built with gimbals axis and spin axis intersection tolerances of less than 0.0002 in. and in some instances include optical components.

HYBRID BEARINGS

In applications where marginal lubrication, high speed and heat are factors, Timken hybrid bearings may perform significantly better than all steel bearings. Ceramic or coated rolling elements can reduce wear of the raceway in marginally lubricated contacts. In high-speed applications, the lower density of silicon nitride reduces centrifugal forces of the balls on the outer race. Timken bearings may be ordered with either Silicon Nitride balls or Titanium-Carbide-coated steel balls in combination with 440C or 52100 steel rings. Hybrid bearings are currently used in many applications including gyro spin and gimbal applications, aircraft accessory and dental handpieces.



Fig. 7. Hybrid and full ceramic ball bearings.

FOUR-POINT CONTACT (GOTHIC ARCH) BEARINGS

The four-point contact bearing (raceway) consists of two true radius arcs with equally offset centers from the race centerline. With this construction, a single four-point contact ball bearing performs in many ways as if it were two bearings combined into one. By creating an X pattern of ball contact, a single bearing can define both radial and axial shaft location. Four-point contact bearings are attractive options on a variety of applications where space is limited and it is desirable to control axial play, resist overturning moments, or contain thrust in two directions. Among the mechanisms that commonly use this bearing are rotary tables, radar systems and material handling robots.

NON-BEARING SOLUTIONS

SENSORS

THS25 high-resolution magnetic encoder

The THS25 high-resolution, magnetic hollow-shaft incremental encoder offers reliable performance at an economical price. Its patented magnetic technology, available in a range of resolutions up to 2560 PPR, provides increased performance over standard optical encoders in high shock and vibration environments. The design handles shaft size ranges normally found in 2-in. to 3.5-in. hollow-shaft designs. Both inch and metric shafts from 0.250 in. - 1.125 in. are accommodated by using insulating inserts for smaller diameter shafts. The 2-in. deep, low-profile design is well-suited for a wide range of applications, including feedback and vector control, robotics, web processing and printing. The mechanical design comes standard in an IP50 package in a rugged polymer housing, with IP66 as an available option.



Fig. 8. THS25 Encoder.

M15 Modular magnetic encoder

The Timken M15 modular magnetic encoder is a high-resolution modular incremental encoder offering reliable performance at an economical price. Its patented magnetic technology provides operational advantages over conventional optical encoders in high-temperature, shock and vibration environments. The M15 encoder handles a wider range of shaft axial play and run out than modular optical encoders and offers more reliability in particulate-laden environments. The modular encoder is available in a range of resolutions up to 2048 PPR with multiple pole commutations and reference pulse options. The modular unit works in a range of applications, including stepper motor positioning and anti-stall feedback, DC brush-type motor positioning, brushless DC (BLDC) and servo motor control using the commutation options.



Fig. 9. M15 Encoder.

MPS 160 multiplying encoder ASIC

The MPS 160, or advanced multiplying encoder ASIC, offers design engineers an alternative to delicate optical sensors and expensive resolvers. The fully integrated Timken design features on-chip Hall sensors and processing that provide optical encoder resolutions in a small, durable, low-cost, off-axis magnetic encoder package. The MPS 160 combines a direction-sensing Hall Effect encoder with integrated index pulses and a high-accuracy resolution multiplying circuit. The result is a high-resolution speed and position sensor system on a chip that is mounted off-axis to the shaft. The ASIC produces and processes Hall Effect signals to create high-resolution quadrature output signals, providing zero speed and direction sensing. When used with special magnetized targets, digital index signals are output by the chip and synchronized with the high-resolution circuit signal.

Standard and special encoder kit designs are available with the MPS160.

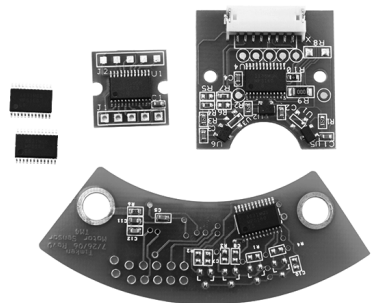


Fig. 10.
MPS160 encoder.



Fig. 11. Timken high-resolution magnetic sensor technology is used in a wide range of demanding industrial and automotive applications.

AUTOCHUCK ASSEMBLIES

Timken autochuck assemblies for high-speed dental handpieces are precision replacement components designed to meet or exceed original manufacturer specifications. Each autochuck is a precision-machined shaft that contains a push button actuated gripping mechanism to retain the dental bur in a dental handpiece. Customers can build a new or replacement high-speed dental turbine assembly with the use of a Timken autochuck, an air turbine impeller, and two high-speed miniature ball bearings. Timken autochucks are built with a number of different standard O.D. sizes and lengths, and are built of stainless steel to withstand the extreme environments of dental office use and cleaning. For help with a custom dimension or feature, please contact your local Timken engineer.



Fig. 12. Dental autochuck assemblies.

MATERIALS

Material selection is a critical consideration in ball bearing design. The interaction of the balls, races, retainer and lubricant with each other and the environment is usually the limiting factor in the overall performance of the bearing. Timken's extensive experience in the development and manufacture of ball bearings and bearing assemblies is a valuable resource for proper material selection.

Every component and raw material purchased by Timken is controlled by a material specification which meets or exceeds industry, government and customer specifications. Each lot of material is certified and checked against the material specification prior to being released to production. Bearing material requirements include hardness, grain size, chemical analysis and carbide and inclusion ratings. Bearing rings and rolling elements are checked in-process for hardness, dimensional stability and, if applicable, corrosion resistance.

Timken maintains an advanced heat-treat department utilizing vacuum furnaces and other special equipment. Vacuum hardening allows Timken to meet the strictest military and commercial requirements for product uniformity. Timken is NADCAP approved for heat-treat processes, as well as non-destructive testing and chemical processing.

RING AND BALL MATERIALS

Available ring and ball materials are summarized in table 1 on page 16.

440C STAINLESS STEEL

440C stainless steel is a martensitic high-carbon steel with up to 18 percent chromium, providing both the high hardness needed for bearing applications and atmospheric corrosion resistance. With standard heat treatment, bearings of 440C have a minimum hardness of HRC 58 and can be operated at temperatures of 250° F (121° C). Rings and balls are capable of meeting the dimensional stability requirements of MIL-B-81793, which specifies maximum dimensional size change over the temperature range of -80° F to +302° F (-62° C to +150° C). With special heat treatment, operating temperatures of 500° F (260° C) may be tolerated.

Timken uses the 440C steel made either by air melting, by the Electroslag Remelting (ESR) process, or by consumable electrode vacuum-arc remelting (CEVM). All 440C is made to the strictest limits of cleanliness and uniformity. These requirements, especially of micro-cleanliness and carbide structure, have resulted in improved raceway finishes.

52100 CHROMIUM STEEL

52100 high-carbon steel is a 1 ½ percent chromium steel and is used for a variety of bearing applications such as gyroscope spin-axis bearings where higher hardness and better surface finish are required. 52100 steel has a slightly higher minimum hardness than 440C at HRC 60 and greater wear resistance. It is sometimes chosen for instrument bearing applications because of its extraordinarily uniform microstructure. The standard heat treatment will be suitable for service at temperatures as high as 250° F (121° C). Rings and balls are capable of meeting the dimensional stability requirements of MIL-B-81793, which specifies maximum dimensional size change over the temperature range of -80° F to +302° F (-62° C to +150° C). Special heat treatments can be provided for higher operating temperatures.

The SAE-52100 Timken uses is made by either air melting followed by vacuum degassing or by double vacuum melting (VIM-VAR). Both of these processes provide material of high micro-cleanliness.

RING MARKING FOR MATERIAL IDENTIFICATION

For bearings with outside dimensions less than 1.18 in., certain radial lines on one bearing face indicate that the bearing was made by Timken and identify the material. These identifying marks are shown below.

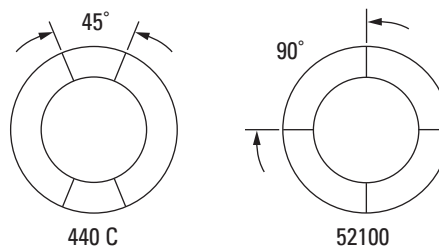


Fig. 13. Markings of ABEC 5P and 7P bearings per MIL-STD-1647.

NON-STANDARD MATERIALS

AMS 5749

AMS 5749⁽¹⁾ high-performance bearing steel is a martensitic high-speed stainless steel that combines the hot hardness characteristic of M50 with the corrosion and oxidation resistance of 440C. This material is suited to hot air valve bearings, but solves many other application problems as well.

AMS 5749 has excellent wear resistance, can operate at temperatures as high as 600° F (316° C) and has corrosion resistance superior to M50. The AMS 5749 material used at Timken is made by vacuum-induction melting followed by vacuum-arc remelting (VIM/VAR). This process achieves the highest degree of cleanliness and uniformity of structure for this material.

M50

M50 high-speed steel is a high-performance tool steel containing molybdenum, chromium and vanadium. This material is suited to main shaft bearings in gas turbine engines, however, it solves many other application problems as well. M50 has greater wear resistance than both 440C and 52100 and can operate at temperatures as high as 600° F (316° C). All M50 used at Timken is made by vacuum-induction melting followed by vacuum-arc remelting (VIM/VAR). This process achieves the highest degree of cleanliness and uniformity of structure for this material.

M62

M62 super-high-performance tool steel is a high-alloyed steel with very high hardness, excellent wear resistance and superior hot hardness. M62 is used in severe service applications with temperatures up to 1000° F (538° C). In addition, M62 has demonstrated 10 times the fatigue life compared to standard bearing steels.

Beryllium copper

Beryllium copper is a precipitation hardening alloy of 2 percent beryllium in copper used in applications where non-magnetic and electrical conductivity properties are required. It has far less hardness (HRC 38 minimum), wear resistance and strength than conventional bearing materials, resulting in lower load ratings.

Hybrid bearings

Hybrid bearings may perform significantly better than an all-steel bearing in applications where marginal lubrication, high speed and high heat are factors. Silicon nitride and titanium carbide hybrid bearings are currently used in many applications including gimbal, gyro spin, aircraft accessory and dental handpieces.

When the internal ball and raceway surfaces of a ball bearing are not separated by a sufficient oil film thickness, the surface finish high points (known as asperities) can contact each other. When the balls and races are made of the same material, the asperities can weld together under the very high localized contact stresses that occur, resulting in surface damage, particle generation, and ultimately shortened bearing service life. For unlubricated or marginally lubricated applications, ceramic balls eliminate ball-to-race asperity welding, and the resulting negative effects on bearing service life. Titanium carbide coated stainless-steel balls offer the same benefits, but are suggested for use in marginally lubricated applications only. Contact your Timken engineer to determine the suggested solution for your application.

In high-speed applications the lower density of silicon nitride significantly reduces the centrifugal forces of the balls on the outer race. Bearings with silicon nitride balls also operate cooler and exhibit less vibration.

Most Timken bearings may be ordered with silicon nitride or titanium carbide coated balls in combination with 440C and 52100 steel rings.

Nickel-cobalt alloys

Nickel-cobalt alloys are used in bearings developed by Timken for applications requiring non-magnetic and noncorrosive materials with greater load capacity than beryllium copper bearings. While not commonly used, these materials can be used in applications such as medical components, seawater, chemical and food processing environments. Because these materials cannot be hardened past HRC 40, they yield bearings with relatively low static capacities, and so their application needs to be considered very carefully.

Full ceramic bearings

Full ceramic bearings can be developed for applications requiring high hardness, light weight, high temperature and corrosion resistance. Limited sizes are available. Consult your engineer for availability.

⁽¹⁾Known as BG-42®.

TABLE 1. RING AND BALL MATERIALS

Material	Approximate Chemical Analysis %	Temp. °F	Hardness HRC	-100° F -73° C	-65° F -54° C	0° F -18° C	100° F 38° C	200° F 93° C	250° F 121° C	300° F 149° C	400° F 204° C	500° F 260° C	600° F 316° C	700° F 371° C	800° F 427° C	1000° F 538° C	1500° F 816° C
Corrosion-resistant 440C stainless steel	1.0 C, 1.0 Si, 1.0 Mn, 17.0 Cr, 0.75 Mo	70 (21)	58	Predominate alloy for standard instrument bearing rings and balls. Excellent hardness and corrosion resistance. Up to 500° F (260° C) operating temperature with special heat-treatments.													
AMS 5749 high-performance steel	1.15 C, 0.30 Si, 0.50 Mn, 14.50 Cr, 4.00 Mo, 1.20 V	70 (21)	61	Corrosion resistance with good hot hardness and hardness retention.													
High-carbon 52100 chromium steel	1.0 C, 0.25 Si, 0.30 Mn, 1.50 Cr, 0.10 Mo, 0.25 Ni	70 (21)	60	Extraordinarily uniform microstructure. Slightly higher minimum hardness and greater wear resistance than 440C.													
M-50 high-speed steel	0.80 C, 0.2 Si, 0.25 Mn, 4.0 Cr, 4.0 Mo, 1.00 V, 0.25 Co, 0.25 W, 0.15 Ni	70 (21)	62	Excellent wear resistance and hot hardness.													
M-62 super-high-speed steel	1.35 C, 0.25 Si, 0.35 Mn, 3.75 Cr, 10.5 Mo, 2.00 V, 6.25 W	70 (21)	66	Extraordinarily fine microstructure, high hot hardness to 1000° F (538° C).													
Beryllium copper	97.0 Cu, 2.0 Be, 0.6 Co+Ni+Fe, 0.4 Pb	70 (21)	38	Non-magnetic. Electrical conductivity.													
Nickel-cobalt alloy	51.0 Co, 10.0 Ni, 20.0 Cr, 15.0 W, 3.0 Fe, 1.5 Mn, 0.4 Si, 10.0 C	70 (21)	50	Excellent corrosion resistance and high-temperature capability.													
Silicon nitride		70 (21)	>70	Excellent corrosion resistance and high-temperature capability. Non-magnetic, non-conductive.													

SEPARATOR, SHIELD AND SEAL MATERIALS

The physical characteristics of the separator, shield and seal materials are critical to the overall performance of the bearing. There are several different materials used for bearing retainers, each carefully selected for a particular design.

TABLE 2. CAGE MATERIAL MAXIMUM OPERATING TEMPERATURE

	Maximum Operating Temperature ⁽¹⁾	Minimum Operating Temperature ⁽¹⁾
Separator Material		
Stainless steel	600° F (316° C)	-100° F (-73° C)
Phenolic laminate	275° F (135° C)	-65° F (-54° C)
6/6 fiberglass reinforced nylon (Minapar II™)	275° F (135° C)	-65° F (-54° C)
PTFE	500° F (260° C)	-320° F (-196° C)
Aluminum bronze	500° F (260° C)	-65° F (-54° C)
Porous polyimide	600° F (316° C)	-65° F (-54° C)
Polyamide-imide	400° F (204° C)	-65° F (-54° C)
PTFE-molybdenum disulfide-glass fiber reinforced composite	550° F (288° C)	-320° F (-196° C)
PTFE-bronze composite	550° F (288° C)	-320° F (-196° C)
Shields		
Stainless steel	600° F (316° C)	-100° F (-73° C)
Seals		
Buna N/Nitrile	275° F (135° C)	-65° F (-54° C)
Fluoroelastomer	400° F (204° C)	-15° F (-26° C)
Stabilized TFE Fluorocarbon ⁽²⁾	500° F (260° C)	-320° F (-196° C)
TFE Fluorocarbon (with glass fabric) ⁽²⁾	500° F (260° C)	-320° F (-196° C)

⁽¹⁾Minimum and maximum operating temperatures are solely based on material properties. Standard retainer designs are suitable for ambient conditions. Consult your Timken engineer for extreme environments.

⁽²⁾Limited life above these temperatures.













SEPARATORS

The correct choice of retainer for a precision ball bearing is often critical to ensuring bearing performance sufficient for application requirements.

Aside from its obvious function as a ball separator, the retainer makes a vital contribution to overall bearing performance and helps determine a bearing's:

- Maximum rotational speed (dN).
- Torque characteristics.
- Temperature limits.
- Lubricant system.

TABLE 3. LOW-SPEED AND HIGH-SPEED BALL SEPARATORS

Separator Code	Bearing Types	Bearing Series ⁽¹⁾	Design	Description	Notes ⁽²⁾
LOW-SPEED BALL SEPARATORS					
C	Radial	M		Stamped one-piece stainless-steel crown retainer.	General purpose cage. Speeds up to 10000 RPM, not suggested for applications with high acceleration.
R	Radial	M		Stamped-stainless two-piece ribbon retainer.	Speeds up to 10000 RPM. General purpose cage for low-torque applications.
ST	Radial and fractured outer race	T		Individual PTFE cylindrical ball separators between every ball.	Low breakaway friction. Speeds up to 10000 dN.
SO	Angular contact and fractured outer race	T		Individual PTFE toroids that encircle every other ball. Machined.	Low breakaway friction. Good for oscillatory applications. Speeds up to 10000 dN.
MCX	Radial	M		PTFE-bronze snap-in crown retainer. Machined.	Retainer is self-lubricating and is good from cryogenic temperatures up to 550° F (288° C) applications. Long life is dependent on low speeds and light loads.
MCJ	Radial	M		PTFE-MoS ₂ snap-in crown retainer. PGM-HT Machined.	Retainer is self-lubricating and is good from cryogenic temperatures up to 550° F (288° C) applications. Long life is dependent on low speeds and light loads.
MR (ang. cont.) (fract.) ⁽³⁾	Angular contact and fractured outer race	M, T		Full complement Minapar II™.	Relatively high radial-load capacity. Relatively higher torque due to ball on ball contact.
HIGH-SPEED BALL SEPARATORS					
MCK	Radial	M, T		Molded nylon 6/6 fiberglass snap-in crown retainer. Minapar II.	Cost effective and can be used up to 200000 RPM (M), 500000 dN (T). Temperatures up to 275° F (135° C).
MC	Radial	M, T		Machined-phenolic snap-in crown retainer.	Can be vacuum impregnated with oil. Can be used up to 200000 RPM (M), 500000 dN (T) ⁽³⁾ . Standard designs are suitable for ambient conditions (temperature and humidity). Consult your Timken engineer for extreme environments.
M	Angular contact and fractured outer race	M, T		Machined-phenolic one-piece retainer.	Can be vacuum impregnated with oil, and can be used up to 400000 RPM (M), 750000 dN (T) ⁽³⁾ . Standard designs are suitable for ambient conditions (temperature and humidity). Consult your Timken engineer for extreme environments.
MCP (radial) MP (ang. cont.)	Radial and angular contact	M		MCP is machined Minapore™ porous polyimide snap-in crown retainer. MP is machined Minapore thru-hole retainer (not shown).	Can be vacuum impregnated with oil, and can be used up to 200000 RPM (M).
MT	Angular contact and fractured outer race	T		Machined aluminum-bronze one-piece retainer.	High strength, can be used up to 500° F (260° C) and 1000000 dN.

⁽¹⁾M is miniature series. T is thin-section series.

⁽²⁾dN = bore [mm x speed (RPM)] . dN value typically used for thin-section series.

⁽³⁾Speeds in excess of 1000000 dN are achievable depending on the application conditions. Consult your Timken engineer.

SHIELDS AND SEALS

Some applications may not allow the use of open bearings. Shields or seals may be used to protect against contamination and help retain lubricant.

SHIELDS

Timken miniature and instrument series bearings use precision 300 series stainless-steel shields held in the outer ring by snap wires. These shields are accurately positioned in the outer ring to maintain a close clearance with the outer diameter of the inner ring.

Timken thin-section series bearings use a shield that incorporates a stainless-steel insert which has Nitrile rubber bonded to it. The shield is held securely in place by compression of the rubber around the outside diameter of the insert. The shield bore is held concentric to the outside diameter of the inner ring with tight tolerances to maintain close running clearance. Shields made from Nitrile rubber can be used to 275° F (135° C). For higher temperature applications special fluorocarbon or stainless-steel shields can be used.

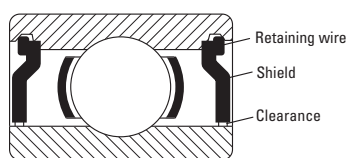
Fractured race thin-section bearings cannot use standard shields due to the thin cross sectional area between the shield recess and holding wire shoulder grooves. This bearing type is available with integral shields machined as part of the inner ring.

SHIELD ADVANTAGES

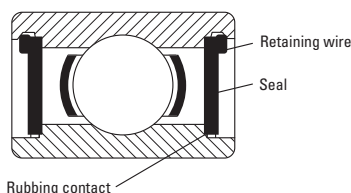
- Non-contacting with inner ring will not affect torque.
- Prevents large particles (over 0.005 in.) from entering bearing.
- Improves lubrication retention in bearing.

SHIELD DISADVANTAGES

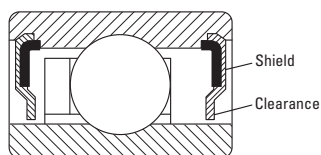
- Does not provide positive sealing against fine contamination (under 0.005 in.).



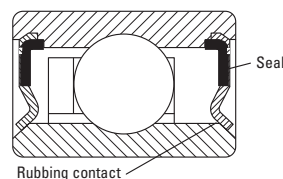
Miniature and instrument shield
Typically SST⁽¹⁾



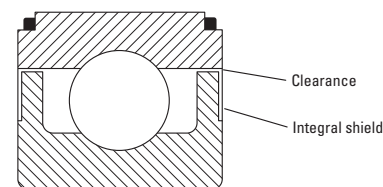
Miniature and instrument seal
Typically fiberglass reinforced PTFE⁽¹⁾



Thin-section shield
Typically nitrile or fluoroelastomer⁽¹⁾



Thin-section seal
Typically nitrile or fluoroelastomer⁽¹⁾



Integral shield

Fig. 14. Standard shield and seal configurations.

SEALS

In debris-heavy applications, seals provide extra contamination protection at the sacrifice of the lowest possible frictional torque levels.

Timken miniature and instrument series bearings use a thin fluoro-polymer impregnated glass cloth washer held in the outer ring by snap wires. The seal contacts a smooth shoulder on the inner ring.

The standard seal design for Timken thin-section series bearings is similar to the shield except that the bore of the rubber molding is controlled to maintain positive contact with the inner ring.

In addition to the standard shields and seals, special designs have been developed by Timken for demanding applications where a standard configuration would not suffice. Consult your Timken engineer for more information on special closure designs.

SEAL ADVANTAGES

- Contact with inner ring prevents small and large particulate from entering bearing.
- Greatly improves lubricant retention in bearing.
- Acts as a pressure or flow barrier.

SEAL DISADVANTAGES

- Increases bearing torque.
- Limits bearing speed due to inner ring contact.

⁽¹⁾Additional materials may be specified to best meet specific application requirements.

TOLERANCES

Timken miniature, instrument and thin-section bearings are manufactured in accordance with tolerance classes specified by American National Standards Institute (ANSI) and the American Bearing Manufacturer’s Association (ABMA). ANSI/ABMA Standard 12 covers miniature and instrument bearings and Standard 26 covers thin-section bearings.

Timken miniature, instrument and thin-section bearings are manufactured in precision classes from ABEC 3 (lowest) to ABEC 9 (highest) with the most common being ABEC 5 or 7. Please note the ANSI/ABMA does not define an ABEC 9 class for thin-section bearings. For applications that require a special tolerance not covered by any of these precision classes, please contact your Timken engineer.

The tables that follow compare the tolerance features of the various ABEC classes for miniature, instrument and thin-section bearings. These tolerances relate to external dimensions as well as the geometric relationship of the ball groove with bearing mounting surfaces. These individual tolerance values provide a guide to the bearing user in designing his shaft and housings, since surfaces to which bearings are mounted should have tolerance levels equivalent to those on the corresponding bearing surface.

Please note that the 610 and 812 bearings have tolerances controlled by the miniature and instrument bearing specification (Standard 12), even though they are dimensionally classified as thin-section parts.

TABLE 4. MINIATURE STANDARD ABEC/ISO TOLERANCES – INNER RING

Inner Ring													
Bearing Bore		Bore Diameter +0.0000 in. , +0.000 mm. $\Delta_{amp}, \Delta_{dm}^{(1)}$				Width Variation V_{Bs}				Raceway Radial Runout K_i			
Miniature and Instrument P Tolerances													
Over	Including	3P	5P	7P	9P	3P	5P	7P	9P	3P	5P	7P	9P
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
0.0000 0.000	0.3937 10.000	-0.0002 -0.0051	-0.0002 -0.0051	-0.0002 -0.0051	-0.0002 -0.0051	N/A	0.0002 0.0051	0.0001 0.0025	0.00005 0.0013	0.0002 0.0051	0.00015 0.0038	0.0001 0.0025	0.00005 0.0013
0.3937 10.000	0.5000 12.700	-0.0002 -0.0051	-0.0002 -0.0051	-0.0002 -0.0051	-0.0002 -0.0051	N/A	0.0002 0.0051	0.0001 0.0025	0.00005 0.0013	0.0003 0.0076	0.00015 0.0038	0.0001 0.0025	0.00005 0.0013

NOTE: Applies to all miniature and instrument bearings as well as 610 and 812 thin-section bearings.

NOTE: P tolerances per ABMA std. 12.2.

⁽¹⁾ Δ_{dm} bore tolerance applicable to ABEC 3P only, all other bore size tolerances to Δ_{amp} definition per ABMA std 12.2.

TABLE 5. MINIATURE STANDARD ABEC/ISO TOLERANCES – OUTER RING

Outer Ring													
Bearing O.D.		O.D. Size +0.0000 in. , +0.000 mm. $\Delta_{Dmp}, \Delta_{Dm}^{(1)}$				Width Variation V_{Cs}				Raceway Radial Runout K_e			
Miniature and Instrument P Tolerances													
Over	Including	3P	5P	7P	9P	3P	5P	7P	9P	3P	5P	7P	9P
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
0.0000 0.000	0.70866 18.000	-0.0003 -0.0076	-0.0002 -0.0051	-0.0002 -0.0051	-0.0001 -0.0025	N/A	0.0051 0.0002	0.0025 0.0001	0.0013 0.00005	0.0102 0.0004	0.0051 0.0002	0.0038 0.00015	0.0013 0.00005
0.70867 18.000	1.1250 28.575	-0.0003 -0.0076	-0.0002 -0.0051	-0.0002 -0.0051	-0.00015 -0.0038	N/A	0.0051 0.0002	0.0025 0.0001	0.0013 0.00005	0.0102 0.0004	0.0051 0.0002	0.0038 0.00015	0.0025 0.0001

NOTE: Applies to all miniature and instrument bearings as well as 610 and 812 thin-section bearings.

NOTE: P tolerances per ABMA std. 12.2.

⁽¹⁾ Δ_{Dm} O.D. tolerance applicable to ABEC 3P only, all other O.D. size tolerances to Δ_{Dmp} definition per ABMA std 12.2.

Inner Ring									
Raceway Axial Runout S_i				Face Runout with Bore S_d				Width Inner Ring $+0.0000$ in., $+0.000$ mm. Δ_{Bs}	
Miniature and Instrument P Tolerances									
3P	5P	7P	9P	3P	5P	7P	9P	3P	5P, 7P, 9P
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
N/A	0.0003 0.0076	0.0001 0.0025	0.00005 0.0013	N/A	0.0003 0.0076	0.0001 0.0025	0.00005 0.0013	-0.0050 -0.1270	-0.0010 -0.0254
N/A	0.0003 0.0076	0.0001 0.0025	0.00005 0.0013	N/A	0.0003 0.0076	0.0001 0.0025	0.00005 0.0013	-0.0050 -0.1270	-0.0010 -0.0254

ABMA Symbols – Inner Ring

- Δ_{dmp} Single plane mean bore diameter deviation from basic bore diameter, e.g., bore tolerance for a basically tapered bore, Δ_{dmp} refers only to the theoretical small bore end of the bore
- Δ_{dm} Mean bore diameter deviation, e.g., difference between mean bore and basic bore diameter
- V_{Bs} Inner ring width variation, e.g., parallelism
- K_i Radial runout of assembled bearing inner ring, e.g., radial runout of raceway
- S_i Axial runout of assembled bearing inner ring, e.g., lateral (axial) runout of raceway
- S_d Inner ring reference face runout with bore, e.g., squareness - bore to face
- Δ_{Bs} Inner ring width deviation from basic, e.g., width tolerance

Outer Ring									
Raceway Axial Runout S_e				Face Runout with O.D. S_D				Width Outer Ring $+0.0000$ in., $+0.000$ mm. Δ_{Cs}	
Miniature and Instrument P Tolerances									
3P	5P	7P	9P	3P	5P	7P	9P	3P	5P, 7P, 9P
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
N/A	0.0003 0.0076	0.0002 0.0051	0.00005 0.0013	N/A	0.0003 0.0076	0.00015 0.0038	0.00005 0.0013	-0.005 -0.1270	-0.0010 -0.0254
N/A	0.0003 0.0076	0.0002 0.0051	0.0001 0.0025	N/A	0.0003 0.0076	0.00015 0.0038	0.00005 0.0013	-0.005 -0.1270	-0.001 -0.0254

ABMA Symbols – Outer Ring

- Δ_{Dmp} Single plane mean outside diameter deviation from basic O.D. diameter, e.g., O.D. tolerance
- Δ_{Dm} Mean outside diameter deviation, e.g., difference between mean O.D. and basic O.D.
- V_{Cs} Outer ring width variation, e.g., parallelism
- K_e Radial runout of assembled bearing outer ring, e.g., radial runout of raceway
- S_e Axial runout of assembled bearing outer ring, e.g., lateral (axial) runout of raceway
- S_D Outer ring reference face runout with O.D., e.g., squareness - O.D. to face
- Δ_{Cs} Outer ring width deviation from basic, e.g., width tolerance

TABLE 6. THIN-SECTION STANDARD ABEC/ISO TOLERANCES – INNER RING

Inner Ring										
Bearing Bore		Bore Diameter $+0.0000$ in., $+0.000$ mm. $\Delta_{dm}, \Delta_{dm}^{(1)}$			Width Variation V_{Bs}			Raceway Radial Runout $K_r^{(3)}$		
Thin-Section T Tolerances										
Over	Including	Class 3 ⁽³⁾	5T	7T	Class 3 ⁽³⁾	5T	7T	Class 3 ⁽³⁾	5T	7T
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
0.5000 12.700	0.7087 18.000	± 0.0002 ± 0.0051	-0.0002 -0.0051	-0.0002 -0.0051	0.0003 0.0076	0.0002 0.0051	0.0001 0.0025	0.0004 0.0102	0.0002 0.0051	0.0001 0.0025
0.7087 18.000	1.1811 30.000	± 0.0002 ± 0.0051	-0.0002 -0.0051	-0.0002 -0.0051	0.0003 0.0076	0.0002 0.0051	0.0001 0.0025	0.0004 0.0102	0.0002 0.0051	0.00015 0.0038
1.1811 30.000	1.7717 45.000	± 0.0003 ± 0.0076	-0.0003 -0.0076	-0.0002 -0.0051	0.0003 0.0076	0.0002 0.0051	0.0001 0.0025	0.0005 0.0127	0.0003 0.0076	0.00015 0.0038
1.7717 45.000	2.5591 65.000	$+0.0003/-0.0004$ $+0.0076/-0.0102$	-0.0004 -0.0102	-0.0003 -0.0076	0.0004 0.0102	0.0003 0.0076	0.00015 0.0038	0.0006 0.0152	0.0004 0.0102	0.0002 0.0051
2.5591 65.000	3.1496 80.000	$+0.0003/-0.0004$ $+0.0076/-0.0102$	-0.0004 -0.0102	-0.0003 -0.0076	0.0005 0.0127	0.0003 0.0076	0.00015 0.0038	0.0006 0.0152	0.0004 0.0102	0.0002 0.0051
3.1496 ⁽²⁾ 80 ⁽²⁾	4.0000 ⁽²⁾ 101.600 ⁽²⁾	$+0.0003/-0.0005$ $+0.0076/-0.0127$	-0.0004 ⁽²⁾ -0.0102 ⁽²⁾	-0.0003 ⁽²⁾ -0.0076 ⁽²⁾	0.0005 0.0127	0.0003 ⁽²⁾ 0.0076 ⁽²⁾	0.0002 ⁽²⁾ 0.0051 ⁽²⁾	0.0006 0.0152	0.0004 ⁽²⁾ 0.0102 ⁽²⁾	0.0002 ⁽²⁾ 0.0051 ⁽²⁾

NOTE: Applies to thin-section bearing sizes between 1014 and 6476.

NOTE: T tolerances per ABMA std. 12.2.

⁽¹⁾ Δ_{dm} bore tolerance applicable to ABEC 3P only, all other bore size tolerances to Δ_{dm} definition per ABMA std 12.2.

⁽²⁾Value is an extension of ABMA standard 12.2.

⁽³⁾Class 3 is an internal Timken tolerance range for thin-section bearings similar to ABEC 3 tolerance levels.

⁽⁴⁾Width tolerance for all sizes of class 3 single bearings is $+0.000$ in./ -0.005 in. ($+0.000$ mm/ -0.127 mm).

TABLE 7. THIN-SECTION STANDARD ABEC/ISO TOLERANCES – OUTER RING

Outer Ring										
Bearing O.D.		O.D. Size $+0.0000$ in., $+0.000$ mm. $\Delta_{Dm}, \Delta_{Dm}^{(1)}$			Width Variation V_{Cs}			Raceway Radial Runout K_e		
Thin-Section T Tolerances										
Over	Including	Class 3 ⁽³⁾	5T	7T	Class 3 ⁽³⁾	5T	7T	Class 3 ⁽³⁾	5T	7T
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
0.8750 22.225	1.1024 28.000	-0.0004 -0.0102	-0.0002 -0.0051	-0.0002 -0.0051	0.0003 0.0076	0.0002 0.0051	0.0001 0.0025	0.0004 0.0102	0.0002 0.0051	0.00015 0.0038
1.1024 28.000	1.9685 50.000	-0.0005 -0.0127	-0.0004 -0.0102	-0.0002 -0.0051	0.0004 0.0102	0.0002 0.0051	0.0001 0.0025	0.0005 0.0127	0.0003 0.0076	0.0002 0.0051
1.9685 50.000	3.1496 80.000	-0.0006 -0.0152	-0.0004 -0.0102	-0.0003 -0.0076	0.0004 0.0102	0.0002 0.0051	0.00015 0.0038	0.0006 0.0152	0.0003 0.0076	0.0002 0.0051
3.1496 80.000	4.7244 120.000	-0.0008 -0.0203	-0.0005 -0.0127	-0.0004 -0.0102	0.0005 0.0127	0.0003 0.0076	0.0002 0.0051	0.0008 0.0203	0.0004 0.0102	0.0003 0.0076
4.7244 120.000	4.7500 120.650	-0.0008 -0.0203	-0.0005 ⁽²⁾ -0.0127 ⁽²⁾	-0.0004 ⁽²⁾ -0.0102 ⁽²⁾	0.0005 0.0127	0.0003 ⁽²⁾ 0.0076 ⁽²⁾	0.0002 ⁽²⁾ 0.0051 ⁽²⁾	0.0008 0.0203	0.0004 ⁽²⁾ 0.0102 ⁽²⁾	0.0003 ⁽²⁾ 0.0076 ⁽²⁾

NOTE: Applies to thin-section bearing sizes between 1014 and 6476.

NOTE: T tolerances per ABMA std. 12.2.

⁽¹⁾ Δ_{Dm} O.D. tolerance applicable to ABEC 3P only all other O.D. size tolerances to Δ_{Dm} definition per ABMA std 12.2.

⁽²⁾Value is an extension of ABMA standard 12 T tolerances.

⁽³⁾Class 3 is an internal Timken tolerance range for thin-section bearings similar to ABEC 3 tolerance levels.

⁽⁴⁾Width tolerance for all sizes of class 3 single bearings is $+0.000$ in./ -0.005 in. ($+0.000$ mm/ -0.127 mm).

Inner Ring							
Raceway Axial Runout S_i			Face Runout with Bore S_d			Width Inner Ring ⁽⁴⁾ +0.0000 in., +0.000 mm Δ_{Bs}	
Thin-Section T Tolerances							
Class 3 ⁽³⁾	5T	7T	Class 3 ⁽³⁾	5T	7T	5T	7T
in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm
0.0005 0.0127	0.0003 0.0076	0.0001 0.0025	0.0004 0.0102	0.0003 0.0076	0.0001 0.0025	-0.0010 -0.0254	-0.0010 -0.0254
0.0005 0.0127	0.0003 0.0076	0.00015 0.0038	0.0004 0.0102	0.0003 0.0076	0.00015 0.0038	-0.0010 -0.0254	-0.0010 -0.0254
0.0005 0.0127	0.0003 0.0076	0.00015 0.0038	0.0004 0.0102	0.0003 0.0076	0.00015 0.0038	-0.0050 -0.1270	-0.0010 -0.0254
0.0006 0.0152	0.0004 0.0102	0.0002 0.0051	0.0004 0.0102	0.0003 0.0076	0.0002 0.0051	-0.0050 -0.1270	-0.0010 -0.0254
0.0006 0.0152	0.0004 0.0102	0.0002 0.0051	0.0005 0.0127	0.0003 0.0076	0.0002 0.0051	-0.0050 -0.1270	-0.0010 -0.0254
0.0006 0.0152	0.0004 ⁽²⁾ 0.0102 ⁽²⁾	0.0002 ⁽²⁾ 0.0051 ⁽²⁾	0.0005 0.0127	0.0003 ⁽²⁾ 0.0076 ⁽²⁾	0.0002 ⁽²⁾ 0.0051 ⁽²⁾	-0.0050 ⁽²⁾ -0.1270 ⁽²⁾	-0.0010 ⁽²⁾ -0.0254 ⁽²⁾

ABMA Symbols – Inner Ring

- Δ_{dmp} Single plane mean bore diameter deviation from basic bore diameter, e.g., bore tolerance for a basically tapered bore, Δ_{dmp} refers only to the theoretical small bore end of the bore
- Δ_{dm} Mean bore diameter deviation, e.g., difference between mean bore and basic bore diameter
- V_{Bs} Inner ring width variation, e.g., parallelism
- K_i Radial runout of assembled bearing inner ring, e.g., radial runout of raceway
- S_i Axial runout of assembled bearing inner ring, e.g., lateral (axial) runout of raceway
- S_d Inner ring reference face runout with bore, e.g., squareness - bore to face
- Δ_{Bs} Inner ring width deviation from basic, e.g., width tolerance

Outer Ring							
Raceway Axial Runout S_e			Face Runout with Bore S_D			Width Outer Ring ⁽⁴⁾ +0.0000 in., +0.000 mm Δ_{Cs}	
Thin-Section T Tolerances							
Class 3 ⁽²⁾	5T	7T	Class 3 ⁽²⁾	5T	7T	5T	7T
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
0.0005 0.0127	0.0003 0.0076	0.0002 0.0051	0.0004 0.0102	0.0003 0.0076	0.00015 0.0038	-0.0010 -0.0254	-0.0010 -0.0254
0.0006 0.0152	0.0003 0.0076	0.0002 0.0051	0.0004 0.0102	0.0003 0.0076	0.00015 0.0038	-0.0010 -0.0254	-0.0010 -0.0254
0.0006 0.0152	0.0004 0.0102	0.0002 0.0051	0.0004 0.0102	0.0003 0.0076	0.00015 0.0038	-0.0050 -0.1270	-0.0010 -0.0254
0.0008 0.0203	0.0005 0.0127	0.0003 0.0076	0.0005 0.0127	0.0003 0.0076	0.0002 0.0051	-0.0050 -0.1270	-0.0010 -0.0254
0.0008 0.0203	0.0005 ⁽³⁾ 0.0127 ⁽³⁾	0.0003 ⁽³⁾ 0.0076 ⁽³⁾	0.0005 0.0127	0.0003 ⁽³⁾ 0.0076 ⁽³⁾	0.0002 ⁽³⁾ 0.0051 ⁽³⁾	-0.0050 ⁽³⁾ -0.1270 ⁽³⁾	-0.0010 ⁽³⁾ -0.1270 ⁽³⁾

ABMA Symbols – Outer Ring

- Δ_{Dmp} Single plane mean outside diameter deviation from basic O.D. diameter, e.g., O.D. tolerance
- Δ_{Dm} Mean outside diameter deviation, e.g., difference between mean O.D. and basic O.D.
- V_{Cs} Outer ring width variation, e.g., parallelism
- K_e Radial runout of assembled bearing outer ring, e.g., radial runout of raceway
- S_e Axial runout of assembled bearing outer ring, e.g., lateral (axial) runout of raceway
- S_D Outer ring reference face runout with O.D., e.g., squareness - O.D. to face
- Δ_{Cs} Outer ring width deviation from basic, e.g., width tolerance

TABLE 8. LARGE THIN-SECTION STANDARD ABEC/ISO TOLERANCES – INNER RING, ABEC 7F

Bearing Bore		Inner Ring									
		Bore Diameter +0.0000 in., +0.000 mm $\Delta_{dmp}, \Delta_{dm}^{(1)}$			Raceway Radial Runout K_e			Raceway Axial Runout S_i			Width Inner Ring +0.0000 in., +0.000 mm Δ_{Bs}
		Thin-Section F Tolerances						Thin-Section F Tolerances			
Over	Including	3F	5F	7F	3F	5F	7F	3F	5F	7F	3F, 5F, 7F
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm
4.0000 101.600	4.5000 114.300	-0.0005 -0.0127	-0.0003 -0.0076	-0.00025 -0.0064	0.0005 0.0127	0.0003 0.0076	0.0002 0.0051	0.0005 0.0127	0.0004 0.0102	0.0002 0.0051	-0.0050 -0.1270
4.5000 114.300	5.0000 127.000	-0.0006 -0.0152	-0.0004 -0.0102	-0.0003 -0.0076	0.0006 0.0152	0.0003 0.0076	0.0003 0.0076	0.0006 0.0152	0.0004 0.0102	0.0003 0.0076	-0.0050 -0.1270
5.0000 127.000	6.5000 165.100	-0.0006 -0.0152	-0.0004 -0.0102	-0.0003 -0.0076	0.0006 0.0152	0.0003 0.0076	0.0003 0.0076	0.0006 0.0152	0.0004 0.0102	0.0003 0.0076	-0.0050 -0.1270
6.5000 165.100	7.0000 177.800	-0.0006 -0.0152	-0.0004 -0.0102	-0.0003 -0.0076	0.0006 0.0152	0.0003 0.0076	0.0003 0.0076	0.0006 0.0152	0.0004 0.0102	0.0003 0.0076	-0.0050 -0.1270
7.0000 177.800	9.0000 228.600	-0.0007 -0.0178	-0.0005 -0.0127	-0.0004 -0.0102	0.0008 0.0203	0.0004 0.0102	0.0003 0.0076	0.0008 0.0203	0.0005 0.0127	0.0003 0.0076	-0.0050 -0.1270
9.0000 228.600	11.0000 279.400	-0.0008 -0.0203	-0.0005 -0.0127	-0.0005 -0.0127	0.0010 0.0254	0.0005 0.0127	0.0004 0.0102	0.0010 0.0254	0.0006 0.0152	0.0004 0.0102	-0.0050 -0.1270
11.0000 279.400	12.0000 304.800	-0.0008 -0.0203	-0.0005 -0.0127	-0.0005 -0.0127	0.0010 0.0254	0.0005 0.0127	0.0004 0.0102	0.0010 0.0254	0.0006 0.0152	0.0004 0.0102	-0.0050 -0.1270

NOTE: Applies to thin-section bearings sizes 6480 and larger.

NOTE: F tolerances per ABMA std. 26.2.

⁽¹⁾ Δ_{dm} bore tolerance applicable to ABEC 3P only, all other bore size tolerances to Δ_{dmp} definition per ABMA std 12.2.

ABMA Symbols – Inner Ring

- Δ_{dmp} Single plane mean bore diameter deviation from basic bore diameter, e.g., bore tolerance for a basically tapered bore, Δ_{dmp} refers only to the theoretical small bore end of the bore
- Δ_{dm} Mean bore diameter deviation, e.g., difference between mean bore and basic bore diameter
- V_{Bs} Inner ring width variation, e.g., parallelism
- K_i Radial runout of assembled bearing inner ring, e.g., radial runout of raceway
- S_i Axial runout of assembled bearing inner ring, e.g., lateral (axial) runout of raceway
- S_d Inner ring reference face runout with bore, e.g., squareness - bore to face
- Δ_{Bs} Inner ring width deviation from basic, e.g., width tolerance

TABLE 9. LARGE THIN-SECTION STANDARD ABEC/ISO TOLERANCES – OUTER RING, ABEC 7F

Outer Ring												
Bearing O.D.		O.D. Size +0.0000 in., +0.000 mm $\Delta_{Dmp}, \Delta_{Dm}^{(1)}$			Raceway Radial Runout K_e			Raceway Axial Runout S_e			Width Outer Ring +0.0000 in., +0.000 mm Δ_{Cs}	
		Thin-Section F Tolerances						Thin-Section F Tolerances				
Over	Including	3F	5F	7F	3F	5F	7F	3F	5F	7F	3F, 5F, 7F	
in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	
4.7500 120.650	5.0000 127.000	-0.0005 -0.0127	-0.0004 -0.0102	-0.0004 -0.0102	0.0008 0.0203	0.0004 0.0102	0.0003 0.0076	0.0008 0.0203	0.0005 0.0127	0.0003 0.0076	-0.0050 -0.1270	
5.0000 127.000	6.5000 165.100	-0.0006 -0.0152	-0.0005 -0.0127	-0.0004 -0.0102	0.0009 0.0229	0.0005 0.0127	0.0003 0.0076	0.0009 0.0229	0.0006 0.0152	0.0003 0.0076	-0.0050 -0.1270	
6.5000 165.100	7.0000 177.800	-0.0007 -0.0178	-0.0005 -0.0127	-0.0004 -0.0102	0.0010 0.0254	0.0005 0.0127	0.0004 0.0102	0.0010 0.0254	0.0006 0.0152	0.0004 0.0102	-0.0050 -0.1270	
7.0000 177.800	9.0000 228.600	-0.0007 -0.0178	-0.0005 -0.0127	-0.0004 -0.0102	0.0010 0.0254	0.0005 0.0127	0.0004 0.0102	0.0010 0.0254	0.0006 0.0152	0.0004 0.0102	-0.0050 -0.1270	
9.0000 228.600	11.0000 279.400	-0.0008 -0.0203	-0.0005 -0.0130	-0.0005 -0.0130	0.0012 0.0305	0.0006 0.0152	0.0004 0.0102	0.0012 0.0305	0.0007 0.0178	0.0004 0.0102	-0.0050 -0.1270	
11.0000 279.400	12.0000 304.800	-0.0009 -0.0229	-0.0006 -0.0152	-0.0005 -0.0127	0.0014 0.0356	0.0007 0.0178	0.0005 0.0127	0.0014 0.0356	0.0008 0.0203	0.0005 0.0127	-0.0050 -0.1270	

NOTE: Applies to thin-section bearings sizes 6480 and larger.

NOTE: F tolerances per ABMA std. 26.2.

⁽¹⁾ Δ_{Dm} O.D. tolerance applicable to ABEC 3P only all other O.D. size tolerances to Δ_{Dmp} definition per ABMA std 12.2.

ABMA Symbols – Outer Ring

- Δ_{Dmp} Single plane mean outside diameter deviation from basic O.D. diameter, e.g., O.D. tolerance
- Δ_{Dm} Mean outside diameter deviation, e.g., difference between mean O.D. and basic O.D.
- V_{Cs} Outer ring width variation, e.g., parallelism
- K_e Radial runout of assembled bearing outer ring, e.g., radial runout of raceway
- S_e Axial runout of assembled bearing outer ring, e.g., lateral (axial) runout of raceway
- S_D Outer ring reference face runout with O.D., e.g., squareness - O.D. to face
- Δ_{Cs} Outer ring width deviation from basic, e.g., width tolerance

TABLE 10. MINIATURE, THIN-SECTION AND LARGE THIN-SECTION WIDTH TOLERANCES

Bearing Bore		Preloaded Pair Width Tolerance +0.0000 in., +0.000 mm	
in. mm	in. mm	in. mm	
Miniature			
Over	Including	ABEC 3P	ABEC 5P, 7P, 9P
0.0000 38.100	0.5000 50.800	-0.0200 -0.500	-0.0150 -0.04
Thin Section			
Over	Including	Class 2, ABEC 5T, 7T	
0.35433 9.000	1.1811 30.000	-0.0150 -0.400	
1.1811 30.000	3.14961 80.000	-0.0200 -0.500	
Large Thin Section			
Over	Including	Class 3, ABEC 5T, 7T	
1.5000 38.100	2.0000 50.800	-0.0200 -0.500	
2.0000 50.800	5.0000 127.000	-0.0300 -0.762	
5.0000 127.000	12.0000 304.800	-0.0400 -1.016	

BEARING INTERNAL GEOMETRY

Both the internal clearance and raceway geometry of a bearing have a significant impact on performance.

CONTACT ANGLE

The contact angle of a bearing is the angle between a line through the ball center perpendicular to the bearing axis and a line through the two points where the ball contacts the races when the bearing axial play is removed.

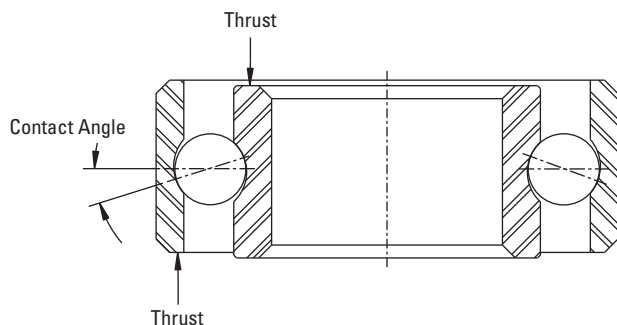


Fig. 15. Contact angle.

The contact angle of a bearing establishes the bearing's relative axial and radial capability.

Generally, increasing the contact angle increases axial load capacity, axial stiffness and moment stiffness, but at the expense of radial load capacity and radial stiffness. Decreasing the contact angle has the opposite effect. There is a geometric limit to increasing contact angle. Too great a contact angle increase results in the ball/raceway contact path reaching the edge of the raceway, which is called truncation.

The contact angle is commonly referred to in two conditions – free contact angle and loaded contact angle.

Free contact angle is the contact angle of a bearing with its axial play removed but without any axial loads applied.

Free contact angle is geometrically related to the bearing raceway curvature and radial play.

With all other parameters fixed, increasing radial play increases free contact angle.

Loaded contact angle is the contact angle of a bearing under an applied axial load. The loaded contact angle is the free contact angle plus the increase due to the applied axial load.

RACEWAY CURVATURE

Raceway curvature is defined as the ratio of raceway radius to ball diameter. Raceway curvature impacts many aspects of bearing performance including:

- Load capacity.
- Internal friction.
- Radial play to axial play relationship.
- Radial play to contact angle relationship.

Timken has selected the raceway curvatures for its standard product to provide the appropriate performance balance for the typical miniature and instrument bearing applications.

RADIAL PLAY

Radial play, also known as radial internal clearance or diametral clearance, is the total range of movement in the radial direction that one ring can have relative to the other.

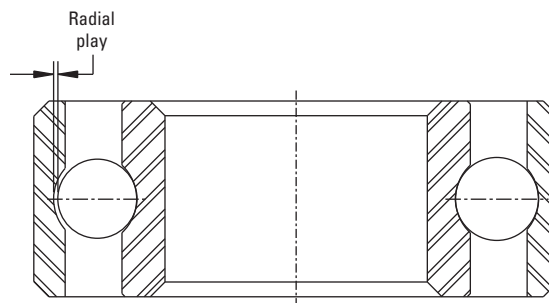


Fig. 16. Radial play.

Proper selection of radial play is essential for performance of a bearing. Radial play impacts the following aspects of a bearing:

- Contact angle.
- Axial play.
- Axial and radial capacity.

It is important to realize that the radial play of the bearing can be reduced by a number of application conditions including:

- Interference fits at installation.
- Interference fit changes due to temperature changes.
- Temperature gradients across the bearing.
- Centrifugal forces during operation.

Proper consideration of the radial play change due to these operating conditions is critical. Care must be taken to ensure that there is sufficient internal clearance in the bearing to prevent complete loss of radial play from the application conditions. Complete loss of radial play results in significant increases in friction and heat. It can result in premature bearing damage.

Timken is able to build product to either contact angle or radial play but our standard product is built to the parameter defined in the table below unless otherwise requested.

TABLE 11. RADIAL PLAY

Bearing Description	Ball Size	Standard Radial Play/ Contact Angle
	in.	in.
Miniature and instrument	All	0.0002 - 0.0008
Thin section		
Conrad	1/16, 3/32	0.0003 - 0.0008
Conrad - ABEC 5T - 7T (up to 4962 size)	1/8	0.0005 - 0.0011
	5/32	0.0006 - 0.0012
	3/16	0.0007 - 0.0015
Conrad - ABEC 1 & 3	1/8 and larger	0.0005 - 0.0015
Conrad (5664 and over)	All	Contact angle 30° nominal
Angular contact	1/16, 3/32	0.0003 - 0.0008
Angular contact (up to 4962 size)	1/8 and larger	0.0007 - 0.0012
Angular contact (5664 and over)	All	Contact angle 30° nominal
Fractured race	1/16, 3/32	0.0003 - 0.0008
	1/8 and larger	0.0005 - 0.0015

AXIAL PLAY

Axial play, also known as endplay, is the total range of pure axial movement that that one ring can have relative to the other.

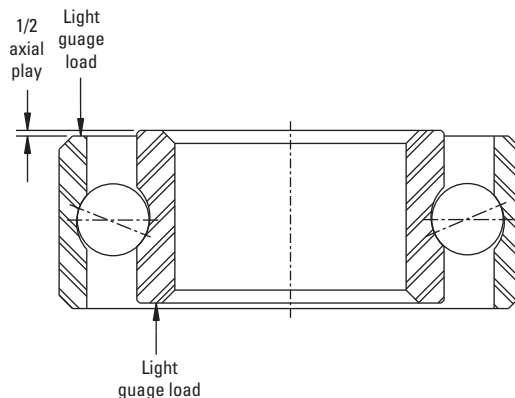


Fig. 17. Axial play.

Axial play is a function of the radial play of the bearing and its ball and raceway geometry. It is not typically used to specify a bearing’s internal clearance since radial play or contact angle are the primary parameters used to specify bearing internal clearance.

Control of axial play in an application can be achieved through changes in internal geometry of a single bearing or more commonly by incorporating an additional bearing. The bearing pair can either be configured to have reduced shared axial play or it can be preloaded with no axial play. This is commonly achieved by accurately controlling the axial separation between the outer and inner ring pairs through spacers or shimming.

LUBRICATION FOR MINIATURE AND THIN-SECTION BEARINGS

Lubrication selection and application has a significant impact on the performance and operational life of a ball bearing. The lubrication of a bearing does the following:

- Reduce friction and wear of contacting surfaces.
- Protect surfaces from oxidation/corrosion.

Other aspects of bearing performance impacted by lubrication are:

- Operating temperature management.
- Contamination management.

REDUCE FRICTION AND WEAR

A lubricant may be seen as a separating layer between two sliding surfaces. Its purpose is to inhibit surface wear while maintaining the lowest possible friction torque level. The ball and raceway surfaces, although precision honed and lapped, appear microscopically as a pattern of peaks and valleys. When rubbed together under the high unit loading inherent in point contact, these asperities are thought to weld together, then break off, initiating an adhesive wear process which ultimately damages the bearing. Adhesive wear is inhibited by:

- Elastohydrodynamic (EHD) film.
- Boundary lubrication.
- Mixed-film lubrication.

EHD FILMS

EHD films are generated dynamically in a rotating bearing and are a function of the bearing's speed, operating load and the lubricant's viscosity in the contact area. Lubricant viscosity typically increases when subject to pressure but decreases at elevated temperatures so the lubricant viscosity in the contact area is a function of the lubricant properties, bearing speed, operating load and operating temperatures. Rolling element-to-race contacts can be effectively separated by the high lubricant viscosities generated under the typical surface contact pressures which are in the hundreds of thousands of pounds per square inch. Once separated by a distance greater than the combined asperity height, the surfaces will not contact and adhesive wear will be eliminated.

BOUNDARY LUBRICATING FILMS

Boundary lubricating films are formed on machined-steel surfaces as chemically absorbed compounds resulting from the surface's interaction with its environment. Preferred films may be formed by chemical treatment of the surface as it is processed and by additives in the lubricating fluid.

MIXED-FILM LUBRICATION

This combination of EHD film and boundary conditions describes the regime in which many miniature, instrument and thin-section ball bearing contacting surfaces operate.

OPERATING TEMPERATURE MANAGEMENT

Lubrication can have a significant impact on the operating temperature of a bearing. This impact can either be positive or negative. Lubrication can positively impact bearing operating temperature when the lubrication method and quantity is properly configured to both reduce heat generation and support heat removal from the bearing. Conversely, excessive lubricant quantity or too high a lubricant viscosity can result in excessive heat generation due to shearing of the lubricant.

CONTAMINATION MANAGEMENT

Lubrication also can be used to manage bearing contamination. Greases provide some protection of internal geometry from external contamination. Circulated and filtered lubrication is able to flush wear particles from the rolling contact area.

GENERAL LUBRICANT TYPES

There are three general types of lubricants used in bearings:

- Oil.
- Grease.
- Solid film.

Available lubrication types are summarized in table 12 on page 30.

OIL LUBRICATION

Oil lubrication is primarily used where low bearing friction torque is essential for the application. It is also used when the application requires the thermal and/or contamination control possible with the use of a proper oil system with oil cooling and/or filtration capability.

GREASE LUBRICATION

Greases are comprised of a base oil blended with a thickener in order to provide a reservoir, to maintain position within the bearing, and to provide some protection against external contamination. This typically results in it providing extended service life over oil lubrication.

The actual contact surface lubrication performance of a grease-lubricated bearing is provided primarily by the base oil used in the grease.

The capability of the grease to maintain its position in the bearing and the amount of impact it has on bearing torque are primarily a function of the thickener used in the grease.

SOLID-FILM LUBRICATION

Solid-film lubricants are an alternative to conventional oil or grease lubrication. They are primarily used when the operating environmental conditions are beyond the allowable limits of oil and grease lubrication. Solid-film lubricants have been developed for specific operating conditions. Understanding the capabilities and limitations of a solid-film lubricant is important when selecting one for your application. Please consult your Timken engineer for assistance with solid-film lubricant selection.

LUBRICANT SELECTION

Proper selection of a lubricant involves careful consideration of the following:

- Operating temperature range.
- Viscosity throughout operating temperature range.
- Operating speeds including type (continuous or oscillatory).
- Friction torque requirements.
- Lubricant migration control.
- Operating loads.
- Material compatibility.
- Corrosion protection.
- Volatility/out gassing tolerance.
- Storage life.

Military specifications describe various classes of lubricants, both oils and greases, and usually relate to bulk properties rather than to specific formulation. As a result, there are a variety of lubricants that meet the various lubricant MIL specifications. When selecting a lubricant, the actual lubricant formulation and properties should be considered in addition to the MIL standard compliance.

TIMKEN LUBRICATION METHODS

Proper performance of a bearing will depend on both the lubricant type and the method of lubricant application. The amount and location of lubricant in the bearing, as well as the cleanliness of the lubricant depend on the correct method of application. Timken can apply a variety of application methods to meet a wide range of application requirements. Timken factory-lubricated bearings are provided with specially filtered lubricants, allowing them to be installed directly upon removal from the package. We strongly suggest that no further processing be performed on the bearings that could affect the cleanliness of the lubricant. Timken offers a number of different lubrication techniques to assure the optimal lubricant amount and placement.

OILING METHODS

Dip and Drain: Slight excess of oil on all bearing surfaces, providing corrosion protection as well as final lubrication. Specify as LO or LY.

Dip and Centrifuge: Oil on all surfaces with quantity controlled by specified centrifuge level. Specify as LOC or LYC. Special G levels along with the time duration of the applied G load can be accommodated.

Vacuum Impregnate: Bearings with porous ball retainers are immersed in oil under vacuum followed by soak at room pressure, thereby forcing oil into pores. Specify as LOV or LYV .

Metered Application: Specific quantities of oil can be applied to our bearings by applying a specific amount to specific locations from a defined needle size. Specify LOD or LYD and number of drops and needle size (#26 needle is default size).

Film Oiling: Dip bearing into oil-solvent mixture, leaving a thin film on all surfaces. Specify as LOF or LYF. Special oil-to-solvent ratios or special solvents can be accommodated.

GREASING METHODS

Standard Greasing: A controlled quantity of grease evenly distributed into bearing cavity. The standard fill quantity is one third full. Special quantities are available upon request.

Film Greasing: Apply grease-solvent mixture exclusively to bearing cavity to achieve controlled quantity. Specify as LGF or LYF, plus quantity in percent fill or in milligrams.

Grease Plating: Apply grease-solvent mixture to entire bearing, coating all internal and external surfaces. Specify as LGP or LYP.

SOLID LUBRICATION METHODS

Typically, solid lubricants are either applied as a coating directly on the raceways and/or rolling elements, or incorporated into the ball retainer for subsequent transfer to the rolling elements and raceways during operation.

TABLE 12. LUBRICATION TYPES

Lubrication Name	Lubrication Code	Oil Type	Thickener Type	Temp. Range	Viscosity - Base Oil	MIL-Spec	Application Information
Oils							
Winsor Lube L-245X	LO1	Diester	—	-65° F to 300° F (-54° C to 149° C)	3.4 cSt @ 210° F (99° C) 12.7 cSt @ 100° F (38° C)	MIL-PRF-6085	General purpose instrument oil. Standard oil for all bearings.
Timken M018	LY313	Synthetic hydrocarbon	—	-80° F to 300° F (-62° C to 149° C)	3.7 cSt @ 210° F (99° C) 18 cSt @ 100° F (38° C)	MIL-DTL-53131 Grade 4	Ultra-clean, low-viscosity oil. Oxidation and wear inhibitors.
Timken M075	LY314	Synthetic hydrocarbon	—	-65° F to 300° F (-54° C to 149° C)	10.9 cSt @ 210° F (99° C) 75 cSt @ 100° F (38° C)	MIL-L-53131 Grade 9	Ultra-clean, medium-viscosity oil. Oxidation and wear inhibitors.
Timken M0119	LY315	Synthetic hydrocarbon	—	-60° F to 300° F (-51° C to 149° C)	15.4 cSt @ 210° F (99° C) 119 cSt @ 100° F (38° C)	MIL-DTL-53131 Grade 14	Ultra-clean, high-viscosity oil. Oxidation and wear inhibitors.
Bray 815Z	LY303	Perfluorinated polyether	—	-112° F to 392° F (-80° C to 200° C)	45 cSt @ 210° F (99° C) 150 cSt @ 100° F (38° C)		PFPE vacuum lube, space/vacuum applications. Low out gassing, optically transparent, chemically inert.
NYE Synthetic Oil 2001	LY652	Synthetic hydrocarbon	—	-49° F to 257° F (-45° C to 125° C)	15 cSt @ 212° F (100° C) 110 cSt @ 100° F (38° C)		Synthetic hydrocarbon vacuum lube.
Greases							
Timken Minapure™ Grease	LG31	Diester	Lithium soap	-65° F to 250° F (-54° C to 121° C)	3.3 cSt @ 212° F (100° C) 12.5 cSt @ 104° F (40° C)	MIL-G-81937	Ultra-clean, general purpose miniature bearing grease.
Beacon 325	LG20	Diester	Lithium soap	-65° F to 250° F (-54° C to 121° C)	3.3 cSt @ 212° F (100° C) 11.8 cSt @ 104° F (40° C)		Standard grease for thin-section double-sealed bearings.
Chevron SRI-2	LY121	Mineral	Polyurea	-20° F to 350° F (-29° C to 177° C)	110 cSt @ 104° F (40° C)		General purpose grease. Good water resistance.
Aeroshell 7	LY196	Diester	Microgel	-100° F to 300° F (-73° C to 149° C)	3.1 cSt @ 210° F (99° C) 4500 cSt @ -40° F (-40° C)	MIL-PRF-23827	Aviation grease. Microgel thickener.
Mobil Grease 28	LY231	Synthetic hydrocarbon	Clay (organic)	-85° F to 350° F (-65° C to 177° C)	5.7 cSt @ 210° F (99° C) 31.7 cSt @ 100° F (38° C)	MIL-PRF-81322	Aviation grease. Used for oscillatory and vibratory applications. Good anti-fretting capabilities.
Royco 27	LY238	Synthetic ester	Lithium soap	-100° F to 275° F (-73° C to 135° C)	3.2 cSt @ 212° F (100° C) 11 cSt @ 100° F (38° C)	MIL-PRF-23827	Aviation grease. Lithium soap thickener.
Braycote 601EF	LY304	Perfluorinated polyether	PTFE	-112° F to 400° F (-80° C to 204° C)	45 cSt @ 210° F (99° C) 150 cSt @ 100° F (38° C)		PFPE. Base oil vacuum grease, common for space/vacuum environments; also chemically inert.
NYE Rheotemp 500	LY360	Ester	Sodium-complex soap	-65° F to 300° F (-54° C to 149° C)	9 cSt @ 210° F (99° C) 55 cSt @ 100° F (38° C)		Good high-temperature, high-speed grease.
NYE Rheolube 2000	LY653	Synthetic hydrocarbon	Gel (organic)	-50° F to 250° F (-46° C to 121° C)	15 cSt @ 212° F (100° C) 104 cSt @ 110° F (43° C)		Space flight applications, fairly low vapor pressure. Oxidation and wear inhibitors.

PRELOAD AND DEFLECTION

The preloading of bearings is typical of applications where speed, stiffness or position control is critical. Preloading subjects bearing components to compressive forces that bring the balls into contact with their respective raceways and take up the initial clearances of the bearings. There are several basic reasons for preloading a ball-bearing set:

- To remove radial and axial play for more precise positioning.
- To control the axial and radial stiffness (compliance) of the system.
- To maintain ball-race contact to prevent skidding and reduce noise.
- To improve load sharing between bearings.

Timken supplies preloaded bearings that are flush-ground or have matched stick-out/stick-in as a pair to achieve a specified preload range when mounted together. Bearings also can be preloaded by:

- Using springs.
- Using differential spacers.
- Gluing bearings (under load) onto a shaft or into a housing.

DB (BACK-TO-BACK)

Preferred for:

- High moment stiffness.
- High speeds.
- High shaft to housing temperature differential.

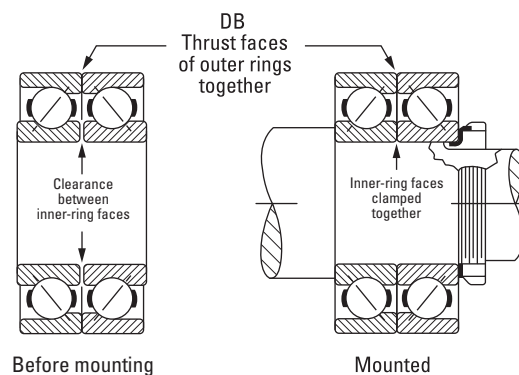


Fig. 18. Back-to-back bearing assemblies before and after mounting.

DF (FACE-TO-FACE)

DF, or face-to-face mounting, provides higher compliance to allow for slight misalignment in the application. This arrangement is typically used where the shaft and housing do not have a large temperature differential.

- Low moment stiffness requirements – allows for slight misalignment.
- Use where housing and shaft do not have a large temperature differential.

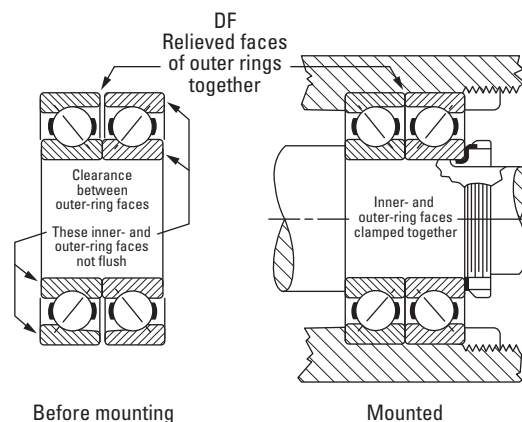


Fig. 19. Face-to-face bearing assemblies before and after mounting.

DT (TANDEM)

The DT, or tandem arrangement, provides for unidirectional axial load sharing between rows. This arrangement is often used with a spring preload and results in greater axial stiffness in one direction.

- Unidirectional axial load sharing.
- Spring preloads.
- Greater axial stiffness in one direction.

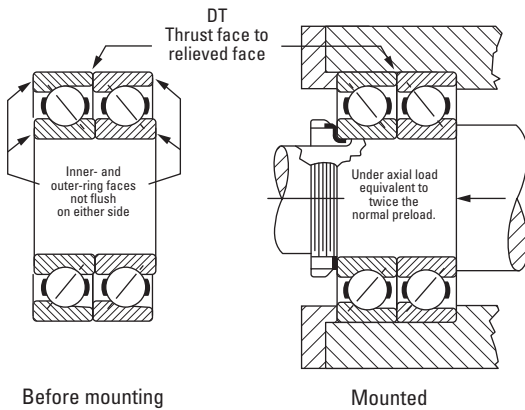


Fig. 20. Tandem bearing assemblies before and after mounting.

SPECIAL SETS

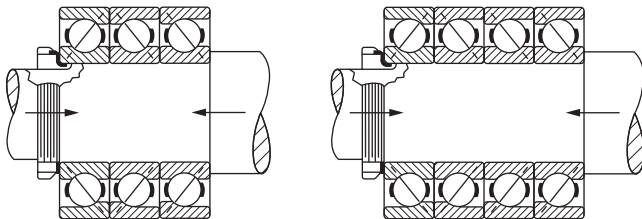


Fig. 21. Special triplex and quadruplex bearing mountings.

SELECTING PRELOAD

Selecting preload is highly dependent on the requirements of each application. For example, high-speed operation will require a different preload from an application where torque is to be minimized, or an application where bearing stiffness is to be maximized. Preload values are specific to the end use of each bearing pair. For this reason, standard preload ranges are not applied to the miniature, instrument and thin-section series bearings.

Preload should be optimized based on the application requirements. Miniature and instrument bearings can be preloaded to very low levels with preload tolerances as low as one pound. Thin-section bearings are inherently very stiff and require a wider preload tolerance range than miniature and instrument bearings. Timken engineers can assist with selecting proper preload specifications for each application.

PRELOAD MARKING

Our bearing pairs are marked with two axial lines forming a V etched across their outer diameter as shown in the following figure. This ensures proper orientation during installation.

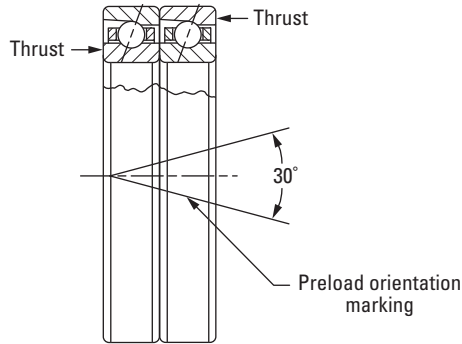


Fig. 22. Preload orientation.

DEFLECTION (COMPLIANCE)

Under applied loads, the balls and raceways will deflect elastically up to the yield point of the material. This limit is approximated by the static radial (Rs) and static thrust (Ts) load-capacity rating for each bearing.

Due to differences in internal geometry, miniature, instrument and thin-section bearings have different deflection rates. Timken engineers are available to provide technical assistance in evaluating bearing deflection under specific application conditions.

PRELOAD MEASUREMENT

Timken has advanced capabilities to measure preload in bearing sets. This allows us to provide miniature and thin-section bearings with accurate and repeatable preload levels.



Fig. 23. Preload gauge.

LOAD RATINGS

Load ratings are provided as a guide for bearing selection when considering the application requirements. Differences in the methods of load rating calculation exist within the industry and care should be taken when comparing different manufacturers' catalog load rating values. Load ratings in this catalog are calculated for bearing steels using the mean of the standard radial play range or in the case of angular-contact bearings, the nominal contact angle tabulated.

DYNAMIC LOAD RATING

Bearing life may be defined as the length of time a bearing will operate satisfactorily in the application at its operating speed under an applied load. Life predictions depend on careful definition of failure criteria and consideration of the full range of operating conditions, including load cycles, operating speeds, mounting practice, environmental conditions and contamination.

The expected fatigue life under operating loads is often not the most important design consideration in the selection of instrument ball bearings. The dynamic load-rating figures are presented primarily to permit a comparison of the load-carrying potential for bearings of similar material but differing in size, internal design and ball complement.

Life predictions are necessarily non-precise because of the interaction of these many parameters. There is an established method of calculating fatigue life, outlined in ISO/ABMA Standards. The ISO/ABMA rating Life (L_{10}) is the number of revolutions, or hours at constant speed, that 90 percent of a group of nominally identical bearings will attain, or exceed, before the first evidence of fatigue develops. The dynamic load rating (C) is the constant radial load, stationary with respect to the outer ring, that a bearing can endure for a rating life of one million revolutions of the inner ring, or 500 hours at 33 1/3 RPM. The dynamic load rating is determined by bearing geometry, number and size of balls, bearing pitch diameter, and ring and ball material. The dynamic load rating (C) for each bearing is shown in the tabulations in the body of the catalog.

This load rating is used in conjunction with the actual applied radial load (R) to calculate bearing fatigue life as follows:

$$L_{10} = \frac{16667}{N} \left[\frac{C}{R} \right]^3$$

Where: L_{10} = Rating life in hours
 N = Speed of inner ring rotation, in RPM
 C = Dynamic load rating
 R = Applied pure radial load, in lbs.

The rating life as defined above relates solely to metal fatigue and assumes nominal bearing configuration, alignment, lubrication and cleanliness. In addition, these load ratings and life calculations are based on the application of a pure radial load. Note that the dynamic load rating value is used only in life calculations and, for instrument bearing applications, should not be approached in actual applied load. Your Timken engineer can assist in establishing fatigue life calculations for combination thrust and radial loads, pure thrust loads, outer-ring rotation, preloaded bearing pairs or probabilities other than 90 percent.

STATIC LOAD RATINGS

As increasing load is applied to a non-rotating bearing, a value will be reached at which permanent deformation of raceways and balls occurs. The resulting indentations or brinells become defects interfering with smooth operation and shortening bearing life. Static load ratings relate to limiting loads applied to non-rotating bearings, as in bearing mounting, or to shock loads applied to rotating bearings. Operating loads should not approach the rated value.

ISO/ABMA standards state that static load ratings depend on the maximum contact stress between the balls and either of the two raceways. It is affected by material, number and size of balls, raceway curvatures, raceway depths and contact angle.

A maximum contact stress level of 580,000 PSI (4.0 GPa) has been established as a satisfactory limit for most instrument-bearing applications and is the basis for static load ratings tabulated herein.

Where low vibration and frictional torque levels are of primary concern, applied loads should result in no more than 508,000 PSI (3.5 GPa) maximum contact stress, representing an approximate 40 percent reduction from the tabulated static load ratings.

STATIC RADIAL LOAD RATINGS

The static radial load rating (R_s) is that pure radial load which, when applied to a non-rotating ball bearing, will result in a maximum stress level of 580,000 PSI (4.0 GPa) at the most heavily loaded ball contact.

STATIC THRUST LOAD RATINGS

The static thrust load rating (T_s) is that pure axial load which, when applied to a ball bearing, will result in:

- a maximum stress level of 580,000 PSI (4.0 GPa) and or
- the limit at which the ball-raceway contact area is contained completely within the raceway (i.e., the contact area is not truncated by the raceway shoulder or either ring).

SHAFT AND HOUSING FITS

Since Timken miniature, instrument and thin-section ball bearings are precision mechanical components, it is important that the size and tolerances of the shaft O.D., housing bore, and adjacent shoulders be carefully chosen and be consistent with the tolerances of the bearings.

The inner and outer rings of these bearings are relatively thin in cross section. These bearing rings will be distorted when fitted with interference on shafts or in housings which are not of true geometric form. Shaft and housing geometric dimensioning and tolerancing should meet or exceed that of the bearings. See pages 38 and 39 for values based on journal size.

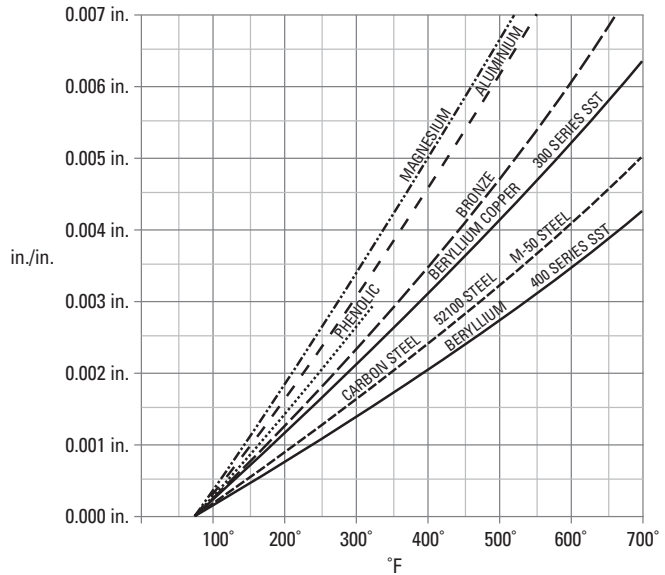
When designing mating components to be used with miniature and thin-section ball bearings, users must be aware of the effects of mating component design upon the bearing geometry. Clearance holes or tapped holes in close proximity to the shaft seat or housing bore can cause distortions in the final fitted bearing. Many customers need to install bearings easily, which will necessitate loose fits on both the shaft and in the housing. Some customers also utilize adhesives during fitting of the bearing, in which case the shaft and housing sizes will be dictated by the clearance required by the adhesive. During final assembly of a bearing with adhesive, much care must be taken to keep adhesive, primer, sealer, curing agents, etc., out of the bearing, or early bearing damage will result.

Shaft and housing diameters should be held to tolerances equal to the bore and O.D. tolerances of the bearing to be used. Use of larger tolerances negates the advantages of precision positional control built into the bearing itself.

A significant percent of the interference fit reduces the internal clearance of the bearing. Interference fits are even more significant in their effect on increasing preload in factory duplex preloaded pairs.

If variation in tolerance results in unacceptable range of interference or clearance fits between the bearing and the shaft and/or housing, selective assembly of coded bearings matched with similarly graded shaft and housing diameters may be utilized. This approach can be more economical than machining shafts and housings to tighter tolerances. See page 37 for coding of bores and O.D. style.

This information assumes that the shaft and housing are manufactured from materials with a similar coefficient of thermal expansion as bearing steel (5.6 E-6 to 6.6 E-6 in./in./° F). See fig. 24 for coefficients of expansion.



Multiply bore or O.D. times the expanse for each material at maximum temperature required. Contraction at temperatures below 70° F (20° C) equal to the expansion for comparable temperature differentials.

Fig. 24. Coefficients of expansion.

SHOULDER HEIGHTS

Shaft and housing shoulders are critical to the performance of the bearing.

Housing and shaft fillet radii for the shoulders should not exceed the radius (r) dimension listed in the product data tables (starting on page 50). The product tables also provide shaft and housing shoulder diameters for Timken standard bearings.

Sleeves, spacers, snap rings and similar devices can be used to provide shoulders, if the appropriate tolerances are maintained.

CODING

When more precise fits than can be achieved with standard tolerances are desired, the bore and/or O.D. dimensions can be coded to the nearest 0.000100 in. or, if necessary, to the nearest 0.000050 in. Bearings so coded are packaged in groups and labeled with their specific code. Coded bearings can be selectively assembled with components that are similarly coded so the actual fits are closer to the average fit specified. Bearing codes for the various tolerances are listed in table 13.

For miniature, instrument and thin-section bearings, the codes are determined on the basis of the minimum bore and the maximum O.D. size.

TABLE 13. TOLERANCE DATA

Tolerance	0.0001 in. Increment Coding (standard)	0.000050 in. Increment Coding	Half Tolerance Coding
Nominal to -0.000050 in.	1	A	H
-0.000050 in. to -0.000100 in.		B	
-0.000100 in. to -0.000150 in.	2	C	L
-0.000150 in. to -0.000200 in.		D	
-0.000200 in. to -0.000250 in.	3	E	L
-0.000250 in. to -0.000300 in.		F	
Graded Symbols			
Graded bore and O.D.	ZD	XZD	HZD
Graded O.D. only	ZO	XZO	HZO
Graded bore only	ZB	XZB	HZB
Graded bore and O.D. matched for preloaded pairs	ZDM	XZDM	HZDM

The basic symbol ZDM is used to define or specify a condition where both bores and both O.D.s of a preloaded pair are selected to be the same size within the increment indicated. It is not necessary that the bore and O.D. be of the same code symbol. The code symbol of the pair will be that of the smaller bore and the larger O.D. of the pair (maximum material condition).

Also available on metric bearings is coding to 1 micrometer increments rounded off to 0.000040 in. Use prefix M, as in MZD, etc., to specify.

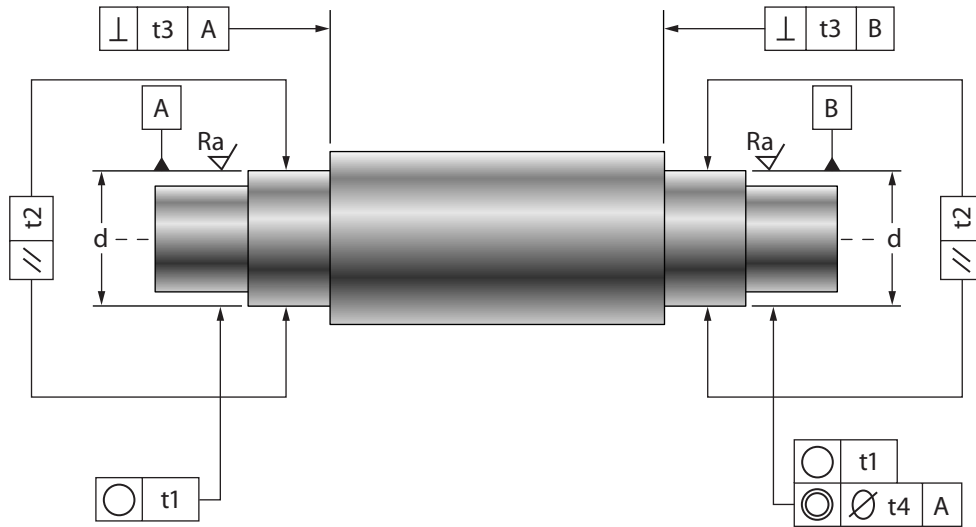
To avoid confusion between digits or letters and symbols, hyphens are used before bore and/or O.D. symbols. The bore code is the first digit.

TABLE 14. CODING EXAMPLES

ZD-1-2	Bore nominal to -0.000100 in. O.D. -0.000100 in. to -0.000200 in.
XZD-D-A	Bore -0.000150 in. to -0.000200 in. O.D. nominal to -0.000050 in.
ZO-1	O.D. nominal to -0.000100 in.
HZB-L	Bore size in lower half of bore tolerance
ZDM-2-1	Both bores of pair are equal size within 0.000100 in. The smaller bore is from -0.000100 in. to 0.000200 in. Both O.D.s of pair are equal size within 0.000100 in. The larger O.D. is from nominal to -0.000100 in.

SHAFT AND HOUSING TOLERANCES

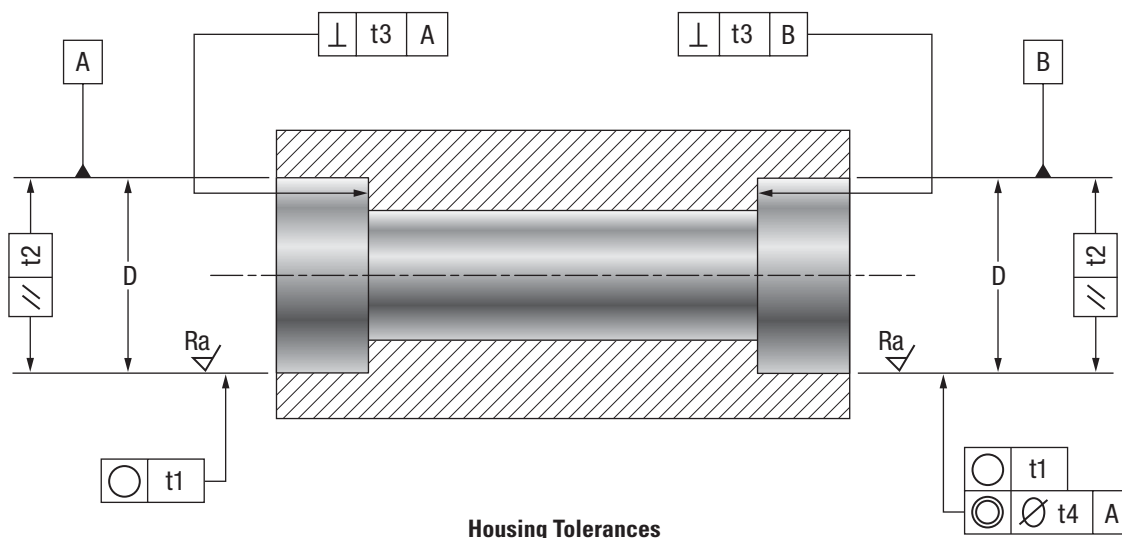
SHAFT GEOMETRY REQUIREMENTS



Shaft Tolerances

Shaft Journal	ABEC 5P, 5T & 5F							ABEC 7P, 7T & 7F				
			Roundness	Perpendicularity	Taper	Concentricity	Surface Finish	Roundness	Perpendicularity	Taper	Concentricity	Surface Finish
	d		○ t1	⊥ t3	// t2	◎ ∅ t4	√ Ra	○ t1	⊥ t3	// t2	◎ ∅ t4	√ Ra
Over	Including	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.
ABEC 5P, 5T & 7P, 7T	0	1.1811	50	300	100	200	8	50	100	100	100	8
	1.1811	1.7717	150	300	150	250		100	150	100	150	
	1.7717	1.8125	200	300	200	250		150	200	150	150	
	1.8125	3.0625	200	300	200	300	16	150	200	150	200	12
	3.0625	3.1496	200	300	200	300		150	200	150	200	
	3.1496	4.0000	200	300	200	400		150	200	150	250	
ABEC 5F & 7F	2.0000	2.5000	150	300	150	300		100	200	100	200	
	2.5000	3.0000	150	300	150	300		100	200	100	200	
	3.0000	4.0000	150	300	150	400		125	200	125	250	
	4.0000	4.5000	150	300	150	400	16	125	200	125	250	12
	4.5000	7.0000	200	400	200	500		150	200	150	300	
	7.0000	9.0000	250	400	250	550		200	200	200	400	
	9.0000	12.0000	250	500	250	650		225	300	250	500	
	12.0000	14.0000	300	500	300	700		250	300	250	500	

HOUSING GEOMETRY REQUIREMENTS



Housing Bore	ABEC 5P, 5T & 5F						ABEC 7P, 7T & 7F					
	d		Roundness	Perpendicularity	Taper	Concentricity	Surface Finish	Roundness	Perpendicularity	Taper	Concentricity	Surface Finish
	Over	Including	○ t1	⊥ t3	// t2	◎ ∅ t4	✓ Ra	○ t1	⊥ t3	// t2	◎ ∅ t4	✓ Ra
		μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.	μin.
ABEC 5P, 5T & 7P, 7T	0	1.1024	50	300	100	200	8	50	150	100	150	8
	1.1024	1.9685	200	300	200	250	16	100	150	100	150	12
	1.9685	3.1496	200	300	200	300		150	150	150	200	
	3.1496	4.7244	250	300	250	300		200	200	200	250	
ABEC 5F & 7F	2.0000	2.5000	150	300	150	300	16	100	150	100	200	12
	2.5000	3.0000	150	300	150	300		150	150	150	200	
	3.0000	4.0000	150	300	150	300		150	200	150	250	
	4.0000	5.0000	200	300	200	400		200	200	200	300	
	5.0000	7.0000	250	300	250	400		200	200	200	300	
	7.0000	9.0000	250	400	250	500		200	300	200	400	
	9.0000	11.0000	250	500	250	550		250	300	250	500	
	11.0000	15.0000	300	500	300	650		250	300	250	500	

BEARING TESTING

BEARING TORQUE TESTING

Ball bearing frictional torque measurements are dependent upon bearing speed, load, alignment, internal geometries and surface finishes. Since bearing applications involve infinite variations of these parameters, Timken has standardized production tests for measurement of both starting torque and running torque. These tests compare bearing performance levels under standardized test conditions but do not necessarily simulate actual application levels. These tests meet or exceed guidelines established in MIL-STD-206, the most comprehensive torque specification in the industry. Torque testing conditions other than the ones defined in MIL-STD-206 are available upon request.

STARTING TORQUE MEASUREMENT

Starting torque, defined as the torque necessary to start bearing rotation under an applied thrust load, is measured under a 75 gm thrust load on bearings with an O.D. of 3/8 in. or less, 400 gm on larger bearing sizes, and is expressed in milligram-millimeters. Torque testing is performed for customers requiring verification that a bearing is capable of meeting a certain torque limit. Often, customers will define a maximum starting torque which is limited by the available power to start rotation in an application.

TABLE 15. STANDARD STARTING TORQUE LEVELS FOR MINIATURE BEARINGS

Basic Bearing Size	Test Load	Maximum Starting Torque Radial Play Range		
		P13	P25	P58
	grams	milligram-millimeter		
2	75	1800	1500	1400
2 1/2	75	1800	1500	1400
3	75	1800	1500	1400
3332	75	1800	1500	1400
4	75	1800	1500	1400
418	75	1800	1500	1400
5	75	1800	1500	1400
518	75	1800	1500	1400
5532	75	1800	1500	1400
5632	75	1800	1500	1400
618	75	2000	1600	1500
6632	75	2000	1600	1500
6316	75	2000	1600	1500
614	75	1800	1500	1400
814	400	6000	5200	4800
8516	400	6000	5200	4800
R 2	400	5000	4500	4200
R 2A	400	5000	4500	4200
R 3	400	6500	5500	5000
R 4	400	7000	6000	5500
R 4A	400	8000	7000	6500
R6	400	11000	9500	9000

GENERAL CONDITIONS

The maximum starting values in the table 15 are subject to specific definitions and test conditions covered in ABMA Standard 12 for instrument ball bearings. These standard torque values are valid for bearings that are:

- ABEC 7P tolerances.
- Open or shielded bearings.
- Stainless 440C or SAE 52100 material.
- Crown or ribbon retainers.
- Lubrication with MIL-PRF-6085 oil.

Timken interprets the test conditions such that prior to testing, the bearings are to be cleaned with a filtered solvent, lubricated with one drop of filtered MIL-PRF-6085 oil (or an equivalent viscosity lube) and demagnetized. Testing is to be done in a clean room environment.

The bearings are to be tested a minimum of 10 starts (5 per side) with the test load applied axially in a vertical position.

RUNNING-TORQUE MEASUREMENT

Running torque is the resistance to rotation under specific operating parameters. Timken can perform running-torque measurements on most miniature, instrument and thin-section ball bearing types and sizes. When testing miniature bearings to MIL-STD-206, a low rotational speed of 2 RPM is used and loads of 75 gm or 400 gm are applied axially to the bearing. Thin-section bearings are tested under user specified loads and speeds. This type of testing is usually reserved for customers who require an estimate of the average torque it takes to operate the bearing. Typically, customers will define a maximum running torque so they are sure that the driving components in their system will have the ability to operate correctly on a continuous basis.

TORQUE TRACES

Bearing running-torque traces can help ensure maximum performance of bearings by visually identifying problems in existing bearing equipment or identifying problems prior to use.

Torque testing can be used to diagnose a variety of issues with bearings, including, for example, poor geometry, particulate contaminants, retainer hang-up, bruises or damage to the raceway.

Running-torque traces provide the following data:

- ART - average running torque.
- PRT - peak running torque.
- AHW - average hash width.
- MHW - max. hash width.

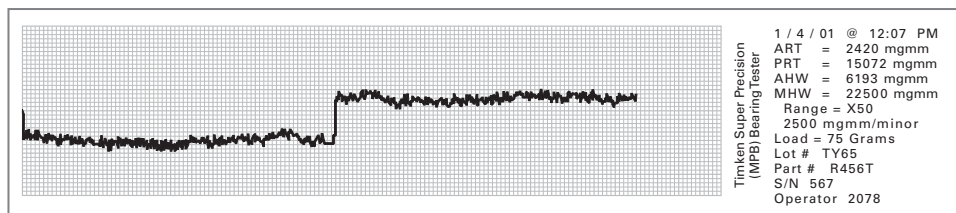


Fig. 25. Sample torque-tester printout.

INSPECTION

Quality is a core value of The Timken Company. The quality control system utilized by Timken complies with ISO 9001 and AS9100. Both in-process and final inspection are performed as standard practice on a sample from each lot. These controls ensure the highest level of product quality is supplied.

Higher levels of inspection may be applied to spaceflight or other critical use bearing applications. A 100 percent inspection of critical dimensional and visual features can be performed. In addition, actual measured values for designated features may be documented for each assembly by serial number. The following are examples of features that may be inspected and documented on each assembly:

- Bore.
- Outside diameter.
- Width.
- Contact angle/radial play.
- Preload.
- Lubrication weight.
- Torque.

Material traceability information can be supplied with each lot. Certification of ring material, ball material, separator material and lubrication may be supplied as part of the end item data package. If required, this information can be traceable to a specific bearing serial number.



Fig. 26.
Advanced bore gauging.



Fig. 27. Highly skilled assembly personnel.

IN-PROCESS HANDLING AND CLEANING

To ensure optimum performance, Timken miniature, instrument and thin-section bearings are processed under strict controls.

- Testing and final cleaning is performed in an ISO 14644-2 Class 7 clean room (formerly FED-STD-209, Class 10,000).
- Assembly, lubrication, and packaging of critical use bearings is performed in an ISO 14644-2 Class 5 clean bench (formerly FED-STD-209, Class 100).
- Clean room gloves or finger cots are worn while handling bearings.
- Aqueous chemistry cleaning is used on components and assembled bearings.
- Specialized cleaning processes can be developed for components including porous retainers and assembled bearings.

PACKAGING/LABELING

The packaging of Timken bearings is designed to ensure that clean and undamaged product is delivered to the customer. The containers provide easy identification, complete protection in transit and storage, and best meet the use and handling requirements of the customer. To prevent contamination, packaging operations are performed in a Timken clean room. The same rigid cleanliness standards are observed in the packaging section as are specified for the inspection, lubricating and testing sections of the clean room.

A wide range of packaging materials and methods are available to accommodate a variety of customer needs. Examples of standard packages available:

- Intimate packaging:
 - Pill pack.
 - Vial pack.
 - Nylon bag.
 - Polyethylene bag.
- Secondary packaging:
 - Box.
 - Aclar® pouch.
 - Aluminum foil pouch.

The necessary type or method of packaging should always be specified on drawings or purchase orders. If no specific packaging is requested, bearings will be packed in pill pack strips or individual clean bags. Timken engineers can assist in developing specific packaging instructions for each application.

To reduce the possibility of bearing contamination at the user's facility, all outer packaging, such as boxes, cartons, or secondary pouches, should be removed and the intimate wrap cleaned before being taken into clean areas.

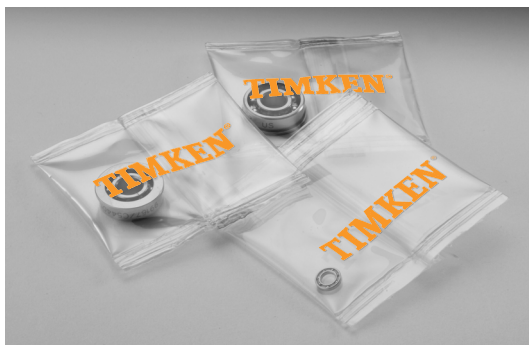


Fig. 28. Miniature pill pack.

INTIMATE PACKAGING

PILL PACK

Pill packs are formed from strips of transparent, heat-sealable, polymer film. This material is impervious to most lubricants, offers low vapor permeability and low gas penetration. The static-free and clean film is heat-sealed into a strip of five pouches with one bearing in each pouch. Each pouch is labeled. To prevent damage during shipment, multiple pill pack strips are placed in a unit box and then enclosed in a sturdy, corrugated shipping carton. Filler material is used to prevent shifting and to strengthen the package.

VIAL PACK

For high production requirements, packaging in transparent vials (that may be opened and resealed) is available. Each vial contains up to 50 bearings and is capped on each end. A label is applied to each vial. Several vials are normally packed in a polyethylene bag and each bag is labeled with the same information as on the individual vial label. The vials are then placed into a shipping container.

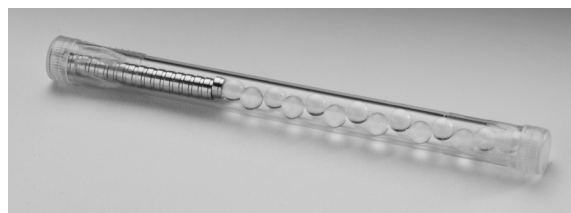


Fig. 29. Vial pack.

NYLON BAG

Intimate bags of Nylon 6 material are available. The nylon material provides an excellent air and moisture barrier along with good chemical resistance. These clean bags are certified to NASA JPG 5322.1 Level 25 cleanliness or better. Bearings are heat-sealed into individual bags. If requested, bags can be backfilled with dry nitrogen and/or vacuum heat-sealed for added protection.

POLYETHYLENE BAG

Intimate bags of polyethylene provide a good moisture barrier and chemical-resistance. Bags are produced from material meeting the requirements of A-A-3174, Type 1 and are in compliance with MIL-DTL-117, Type I, Class B, Style 2. Cleanliness is certified to NASA JPG 5322.1 Level 50 or better. Bearings are heat-sealed into individual bags.

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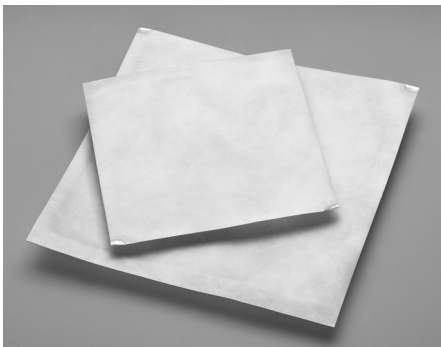
SECONDARY PACKAGING

To provide additional protection during shipment and storage, intimately packaged bearings can be placed into secondary packaging. The intimate nylon or polyethylene bag can be inserted into a unit box. Unit boxes comply with PPP-B-566 and/or PPP-B-676. Also available for secondary packaging are Aclar and aluminum foil pouches. The Aclar pouches used are produced from MIL-PRF-22191, Type I, Class 2 material and comply with MIL-DTL-117, Type I, Class E, Style 2 (heavy duty, waterproof, transparent). The aluminum foil pouches are produced from MIL-PRF-131, Class 1 material and comply with MIL-DTL-117, Type I, Class E, Style 1 (heavy duty, waterproof, opaque).



Fig. 30. External box.

Fig. 31.
Aluminum foil
pouch.



MILITARY SPECIFICATION PACKAGING

Packaging in accordance with MIL-DTL-197 Method 41B or MIL-STD-2073-1 Method 31 may be specified. MIL-STD-129 package marking along with bar code marking per MIL-STD-1189 also can be provided upon request.

BEARING HANDLING

Miniature, instrument and thin-section ball bearings are precision devices that provide long service life when properly specified and applied. However, unskilled or careless handling will inevitably result in poor performance and life. Many problems encountered by miniature, instrument and thin-section bearing users are created through improper handling.

Particulate contamination into miniature, instrument and thin-section ball bearings is probably the most universal problem and one of the more difficult to control.

Miniature, instrument and thin-section ball bearings are used in torque and noise-sensitive applications. Even very small particles of foreign matter, even a few micrometers in size can degrade the quiet-running qualities and low-torque values of the bearing.

Particulate contamination must be controlled throughout the entire life of the bearing. Timken miniature, instrument and thin-section bearings are manufactured, assembled, inspected, tested and packaged under rigidly controlled conditions. It is imperative that bearing users extend good handling practices so that the full performance potential of Timken bearings may be realized.

Some fundamentals to preserve bearing cleanliness are:

- Clean work areas.
- Properly dressed personnel.
- Cleaned and maintained bearing handling instruments and related equipment.
- Proper handling techniques.
- The customer should maintain demagnetized bearing condition.

Timken bearings should be kept in the original, unopened packages until ready for installation. Only the actual required number of bearings should be removed from the package at a time. Bearings should be removed from the protective package only in a clean, dry and dust-free atmosphere. If the bearings are removed from their packaging, any unused bearings should be stored and properly identified in clean, dry, covered containers.

It is preferable to handle bearings with specifically designed, handheld instruments, such as precision non-magnetic tweezers.

In some instances, it may be necessary to handle bearings by hand. In this case, clean, dry, talc-free, silicon-free finger cots or gloves should be worn. Microscopic skin particles shed easily from hands and can cause bearing contamination. Furthermore, most bearing steels, other than AISI 440C, will corrode rapidly from moisture and other residue left after skin contact.

A controlled work environment for handling bearings will help to reduce contamination and corrosion problems. Ideally, a clean room should be used for installation of precision assemblies. If not available, an individual hooded work-station or laminar flow bench may be used.

Timken bearings are thoroughly inspected, washed and lubricated to stringent specifications prior to final packaging. Timken bearings are usually ready for immediate installation without the need for further cleaning or lubrication.

If any bearings become accidentally contaminated, it is suggested they be returned to Timken for cleaning and relubrication.

Note: Timken bearings are thoroughly demagnetized prior to shipment to the customer. Since bearings can potentially become partially magnetized during shipment, it is suggested that the customer perform a demagnetization process, if applicable.

BEARING INSTALLATION

- The mounting components, shafts/housings/related hardware and tooling should be thoroughly cleaned prior to any contact with the bearing.
- The overall performance of a ball bearing is significantly affected by the geometry of the mating components. Shaft or housing diameters and geometry must be established before any attempt is made to install the bearings (see shaft and housing tolerances, page 38-39).
- Interference fits with the shaft or housing provides positive retention and location. Excessive interference between the bearing and mounting surfaces will reduce the designed internal clearances.
- Geometric errors such as out-of-roundness will be transferred to the mating bearing ring. Therefore, a round bearing can be distorted by an out-of-round shaft or housing.
- Clearance fits do not affect bearing geometry, but also do not provide for the same degree of positive positioning as interference fits. Clearance fits are prone to fretting corrosion at the mounting interfaces during normal operation.

Installation tooling must be properly designed and manufactured. Important points to consider are:

- Tooling should be designed to be easily cleaned and remain burr free.
- Tooling should mount the bearings squarely onto the shaft or into the housing. Misalignment during installation can severely distort a bearing.
- Tooling must be designed and used in a manner that will not damage a bearing.

- All installation forces must be transmitted through the mounting ring and not through the balls. Transferring the force through the balls will result in damage to the balls and races, resulting in high torque and noise. See fig. 32.
- Shock or impact techniques should never be used to mount the bearing.
- Differential thermal expansion methods may be used in the assembly to reduce the amount of force required to mount the bearing. Bearings may be temporarily heated up to 275° F (+135° C) to aid in assembly onto shafts.

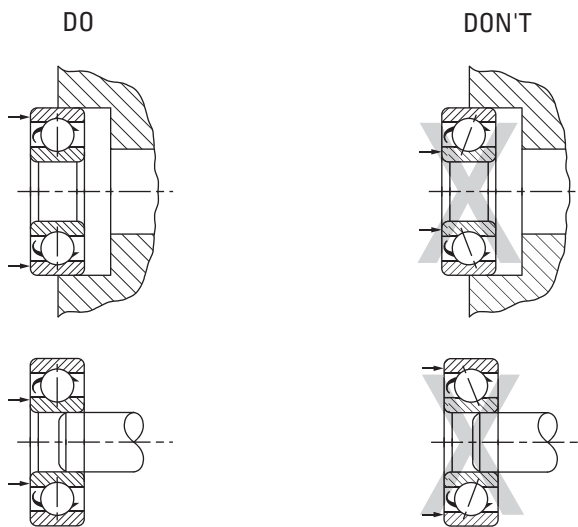


Fig 32. Correct and incorrect mounting practices.



MINIATURE AND INSTRUMENT BALL BEARINGS

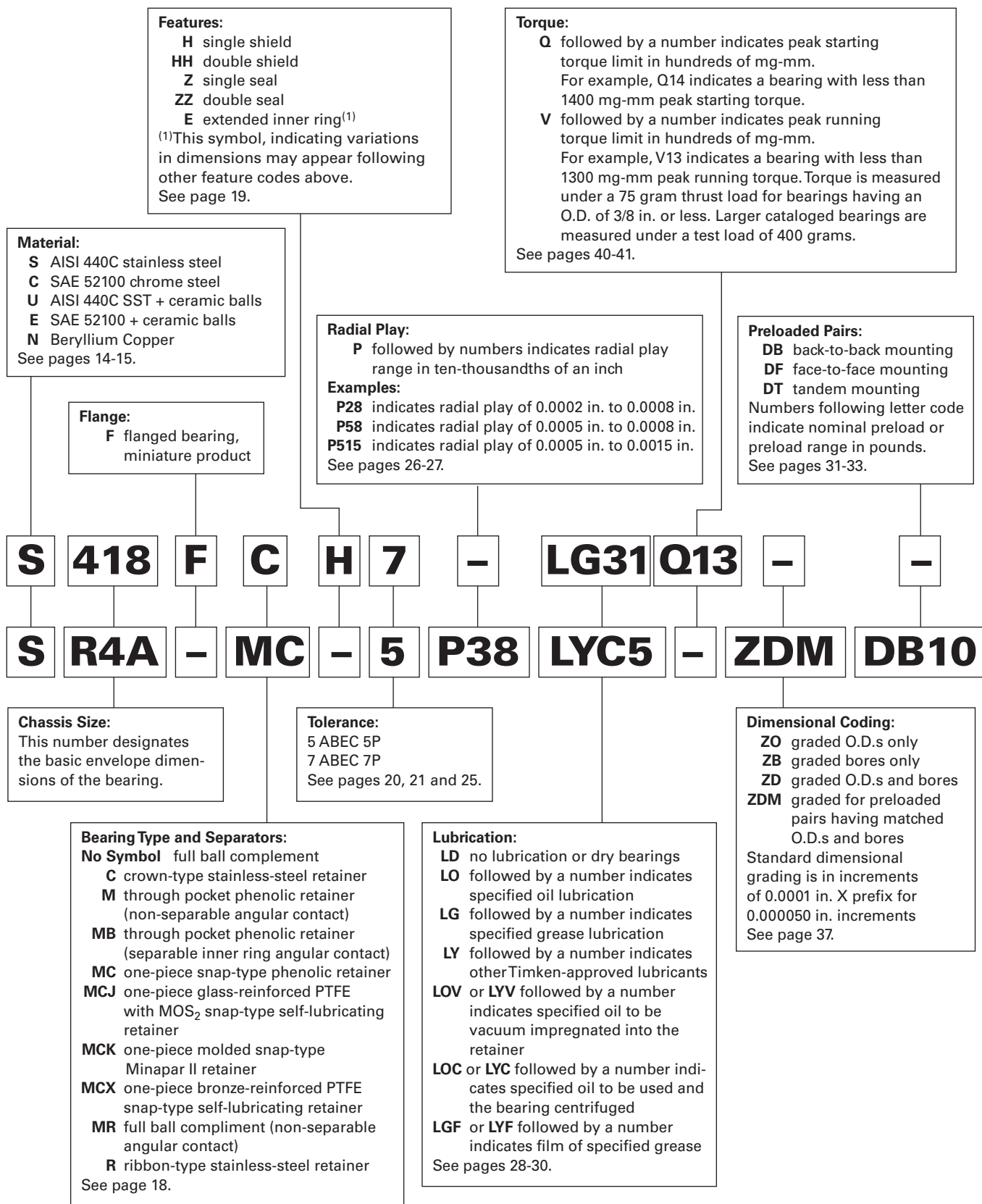
Miniature and instrument ball bearings are used in a large number of applications including synchros, servos, motors, medical and industrial handpieces, fuel controls, carriage assemblies, recorders, flow meters and many more.

This miniature and instrument ball bearing product section represents a portion of products offered by Timken. Timken also produces many specialized bearings, assemblies and bearing-related products for particular applications where a standard bearing will not do.

Contact your Timken engineer for assistance in choosing the most appropriate standard or custom Timken product for your specific application.

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MINIATURE AND INSTRUMENT BALL BEARING PART-NUMBERING NOMENCLATURE



RADIAL RETAINER OPEN BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

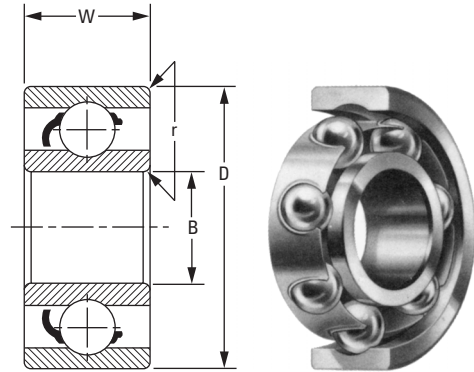
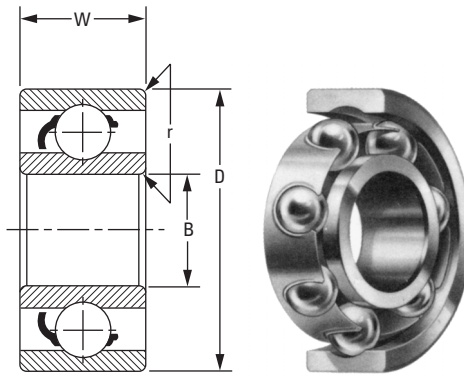


TABLE 16. RADIAL RETAINER OPEN BEARINGS

Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
					Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm			in. mm	lbf N				in. mm	in. mm	in. mm	oz. g		
0.0400 1.016	0.1250 3.175	0.0469 1.191	2	C	5	0.025 0.64	13 58	2 9	4 18	0.059 1.50	0.063 1.60	0.102 2.59	0.106 2.69	0.003 0.08	0.001 0.03
0.0469 1.191	0.1562 3.967	0.0625 1.588	25	C, R	6	1/32 0.79	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.123 3.12	0.131 3.33	0.003 0.08	0.003 0.09
0.0550 1.397	0.1875 4.763	0.0781 1.984	3	C	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.159 4.04	0.165 4.19	0.003 0.08	0.005 0.14
				R	6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.148 3.76	0.160 4.06	0.003 0.08	0.006 0.17
0.0781 1.984	0.2500 6.350	0.0937 2.380	4	C	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.215 5.46	0.224 5.69	0.003 0.08	0.011 0.31
				MC	7	0.039 1.00	42 187	9 40	23 102						
				R, MCK	8	0.039 1.00	46 205	10 44	26 116	0.125 3.18	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.012 0.34
0.0937 2.380	0.1875 4.763	0.0625 1.588	3332	C, MCK, MCD	7	1/32 0.79	26 116	5 22	15 67	0.114 2.90	0.120 3.05	0.164 4.17	0.168 4.27	0.003 0.08	0.003 0.09
				R	8	1/32 0.79	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.161 4.09	0.167 4.24	0.003 0.08	0.003 0.09
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.271 6.88	0.284 7.21	0.005 0.13	0.021 0.60
0.1250 3.175	0.2500 6.350	0.0937 2.380	418	C, MC	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.009 0.26
				R, MCK	8	0.039 1.00	46 205	10 44	26 116	0.153 3.89	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.009 0.26
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.271 6.88	0.284 7.21	0.003 0.08	0.018 0.51
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.033 0.94
0.1250 3.175	0.3750 9.525	0.1562 3.980	R2	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.298 7.57	0.324 8.23	0.012 0.30	0.045 1.28
0.1250 3.175	0.5000 12.700	0.1719 4.366	R2A	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.298 7.57	0.399 10.13	0.012 0.30	0.115 3.26

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

Continued on next page.



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Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight oz. g
					Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm				in. mm		lbf N			in. mm	in. mm	in. mm		
0.1562 3.967	0.3125 7.938	0.1094 2.779	5532	C, R, MCK, MC	7	3/64 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.017 0.48
0.1575 4.000	0.6299 16.000	0.1969 5.000	34	R	6	1/8 3.18	268 1192	68 302	108 480	0.234 5.94	0.294 7.47	0.493 12.52	0.553 14.05	0.012 0.30	0.180 5.10
0.1875 4.763	0.3125 7.938	0.1094 2.779	5632	C, R, MCK, MC	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.013 0.37
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	C, R, MCK, MC	8	1/16 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.329 8.36	0.345 8.76	0.003 0.08	0.027 0.77
0.1875 4.763	0.3750 9.525	0.1562 3.967	B50	C	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.329 8.36	0.005 0.13	0.042 1.19
0.1875 4.763	0.5000 12.700	0.1094 2.779	A245	C	11	0.039 1.00	53 236	16 71	40 178	0.243 6.17	0.289 7.34	0.342 8.69	0.422 10.72	0.008 0.20	0.070 1.98
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	C, R, MCK, MC	7	3/32 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.416 10.57	0.446 11.33	0.012 0.30	0.075 2.13
0.1969 5.000	0.6299 16.000	0.1969 5.000	345	R	6	1/8 3.18	268 1192	68 302	108 480	0.258 6.55	0.294 7.47	0.493 12.52	0.553 14.05	0.012 0.30	0.170 4.82
0.2362 6.000	0.7480 19.000	0.2362 6.000	36	R, MC	6	9/64 3.57	332 1477	95 423	139 618	0.318 8.08	0.385 9.78	0.596 15.14	0.665 16.89	0.012 0.30	0.285 8.08
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	C, MCK	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.342 8.69	0.350 8.89	0.003 0.08	0.021 0.60
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	C, MC	10	1/16 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.430 10.92	0.454 11.53	0.010	0.054
				R	11	1/16 1.59	127 565	43 191	89 396					0.025	0.055
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	C, R, MCK, MC	8	3/32 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.510 12.95	0.558 14.17	0.012 0.30	0.152 4.31
0.2500 6.350	0.7500 19.050	0.2188 5.558	R4A	R, MC	6	9/64 3.57	332 1477	95 423	139 618	0.331 8.41	0.385 9.78	0.596 15.14	0.662 16.81	0.016 0.41	0.263 7.46
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	C, R, MCK, MC	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.450 11.43	0.462 11.73	0.005 0.13	0.048 1.36
0.3150 8.000	0.8661 22.000	0.2756 7.000	38	R, MC	7	5/32 3.97	447 1988	139 618	213 947	0.396 10.06	0.462 11.73	0.692 17.58	0.775 19.69	0.012 0.30	0.432 12.25
0.3750 9.525	0.8750 22.225	0.2188 5.558	R6	R, MCK	7	5/32 3.97	577 2567	209 930	267 1188	0.452 11.48	0.519 13.18	0.745 18.92	0.804 20.42	0.016 0.41	0.309
		0.2812 7.142		MC											0.384
0.5000 12.700	1.1250 28.575	0.2500 6.350	R8	R	10	5/32 3.97	904 4021	489 2175	205 912	0.615 15.62	0.739 18.77	0.974 24.74	1.045 26.54	0.016 0.41	0.630 17.86

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER SHIELDED BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

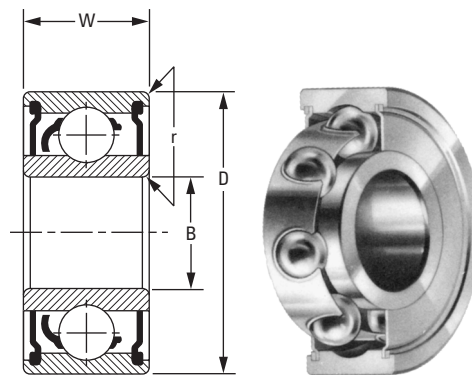


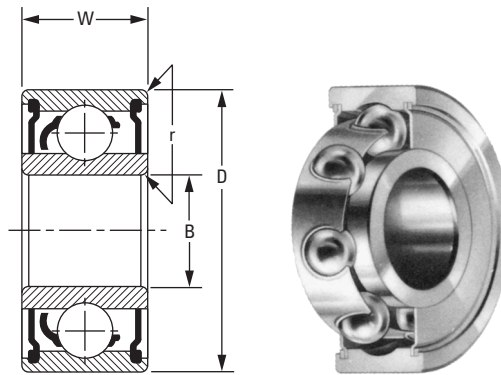
TABLE 17. RADIAL RETAINER SHIELDED BEARINGS

Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
					Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm			in. mm	lbf N				in. mm	in. mm	in. mm	oz. g		
0.0469 1.191	0.1562 3.967	0.0937 2.380	25	C	6	1/32 0.79	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.123 3.12	0.131 3.33	0.003 0.08	0.005 0.14
0.0550 1.397	0.1875 4.763	0.1094 2.779	3	C	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.159 4.04	0.165 4.19	0.003 0.08	0.007 0.20
				R	6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.148 3.76	0.160 4.06	0.003 0.08	0.008 0.23
0.0781 1.984	0.2500 6.350	0.1406 3.571	4	C	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.215 5.46	0.224 5.69	0.003 0.08	0.016 0.45
				MC	7	0.039 1.00	42 187	9 40	23 102	0.125 3.18	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.012 0.34
				R, MCK	8	0.039 1.00	46 205	10 44	26 116						0.019 0.54
0.0937 2.380	0.1875 4.763	0.0937 2.380	3332	C	8	0.025 0.64	20 89	4 18	8 36	0.114 2.90	0.120 3.05	0.157 3.99	0.168 4.27	0.003 0.08	0.006 0.17
				R	8	1/32 0.79	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.161 4.09	0.167 4.24	0.003 0.08	0.005 0.14
0.0937 2.380	0.3125 7.938	0.1406 3.571	5	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.271 6.88	0.284 7.21	0.005 0.13	0.027 0.77
0.1250 3.175	0.2500 6.350	0.1094 2.779	418	C, MC ⁽²⁾	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.011 0.31
				R, MCK	8	0.039 1.00	46 205	10 44	26 116						
0.1250 3.175	0.3125 7.938	0.1406 3.571	518	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.271 6.88	0.284 7.21	0.003 0.08	0.024 0.68
0.1250 3.175	0.3750 9.525	0.1406 3.571	618	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.044 1.25
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.298 7.57	0.324 8.23	0.012 0.30	0.047 1.33
0.1250 3.175	0.5000 12.700	0.1719 4.366	R2A	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.298 7.57	0.399 10.13	0.012 0.30	0.117 3.32
0.1562 3.967	0.3125 7.938	0.1250 3.175	5532	C, R, MCK, MC ⁽²⁾	7	3/64 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.021 0.60

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Single shield only for indicated retainer.

Continued on next page.



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Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight oz. g
					Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm				in. mm		lbf N			in. mm	in. mm	in. mm	oz. g	
0.1575 4.000	0.6299 16.000	0.1969 5.000	34	R	6	1/8 3.18	268 1192	68 302	108 480	0.218 5.54	0.252 6.40	0.493 12.52	0.553 14.05	0.012 0.30	0.187 5.30
0.1875 4.763	0.3125 7.938	0.1250 3.175	5632	C, R, MCK, MC ⁽²⁾	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.016 0.45
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	C, R, MCK, MC ⁽²⁾	8	1/16 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.329 8.36	0.345 8.76	0.003 0.08	0.029 0.82
0.1875 4.763	0.5000 12.700	0.1960 4.978	R3	C, R, MCK, MC	7	3/32 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.416 10.57	0.446 11.33	0.012 0.30	0.097 2.75
0.1969 5.000	0.6299 16.000	0.1969 5.000	345	R	6	1/8 3.18	268 1192	68 302	108 480	0.248 6.30	0.252 6.40	0.493 12.52	0.553 14.05	0.012 0.30	0.177 5.02
0.2362 6.000	0.7480 19.000	0.2362 6.000	36	R, MC ⁽²⁾	6	9/64 3.57	332 1477	95 423	139 618	0.298 7.57	0.337 8.56	0.596 15.14	0.665 16.89	0.012 0.30	0.298 8.45
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	C, MCK	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.342 8.69	0.350 8.89	0.003 0.08	0.022 0.62
0.2500 6.350	0.5000 12.700	0.1875 4.763	814	C, MC	10	1/16 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.430 10.92	0.454 11.53	0.010 0.25	0.083 2.35
				R	11	1/16 1.59	127 565	43 191	89 396						
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	C, R, MCK, MC	8	3/32 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.510 12.95	0.558 14.17	0.012 0.30	0.159 4.51
0.2500 6.350	0.7500 19.050	0.2812 7.142	R4A	R, MC	6	9/64 3.57	332 1477	95 423	139 618	0.331 8.41	0.385 9.78	0.596 15.14	0.662 16.81	0.016 0.41	0.341 9.67
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	C, R, MCK, MC	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.450 11.43	0.462 11.73	0.005 0.13	0.052 1.47
0.3150 8.000	0.8661 22.000	0.2756 7.000	38	R, MC ⁽²⁾	7	5/32 3.97	447 1988	139 618	213 947	0.380 9.65	0.411 10.44	0.692 17.58	0.775 19.69	0.012 0.30	0.457 12.96
0.3750 9.525	0.8750 22.225	0.2812 7.142	R6	R, MCK, MC	7	5/32 3.97	577 2567	209 930	267 1188	0.452 11.48	0.519 13.18	0.745 18.92	0.804 20.42	0.016 0.41	0.408 11.57
0.5000 12.700	1.1250 28.575	0.3125 7.938	R8	R	10	5/32 3.97	904 4021	489 2175	205 912	0.601 15.27	0.678 17.22	0.974 24.74	1.045 26.54	0.016 0.41	0.810 22.96

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Single shield only for indicated retainer.

RADIAL RETAINER FLANGED OPEN BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

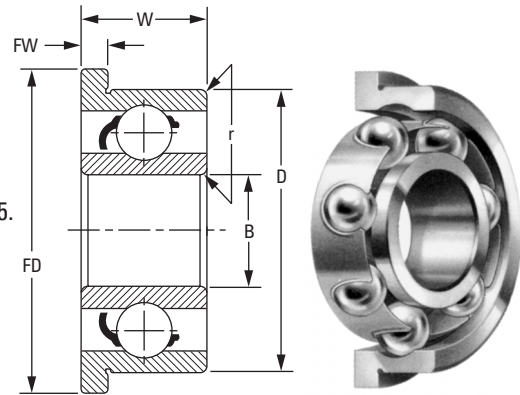
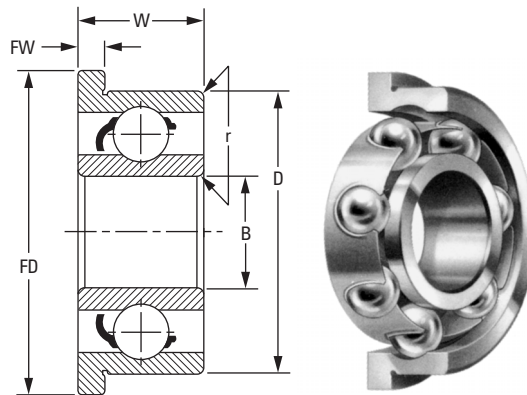


TABLE 18. RADIAL RETAINER FLANGED OPEN BEARINGS

Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
					Dia. FD	Width FW	Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.			
in. mm	in. mm	in. mm			in. mm		in. mm		lbf N			in. mm	in. mm	oz. g	
0.0400 1.016	0.1250 3.175	0.0469 1.191	2	C	0.171 4.34	0.013 0.33	5	0.025 0.64	13 58	2 9	4 18	0.059 1.50	0.063 1.60	0.003 0.08	0.002 0.06
0.0469 1.191	0.1562 3.967	0.0625 1.588	25	C	0.203 5.16	0.013 0.33	6	1/32 0.790	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.003 0.08	0.004 0.11
0.0550 1.397	0.1875 4.763	0.0781 1.984	3	C	0.234 5.94	0.023 0.58	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.003 0.08	0.007 0.20
				R			6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.003 0.08	0.007 0.20
0.0781 1.984	0.2500 6.350	0.0937 2.380	4	C	0.296 7.52	0.023 0.58	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.003 0.08	0.013 0.37
				R, MCK			8	0.039 1.00	46 205	10 44	26 116				
				MC			7	0.039 1.00	42 187	9 40	23 102	0.125 3.18	0.124 3.15	0.003 0.08	0.014 0.40
0.0937 2.380	0.1875 4.763	0.0625 1.588	3332	C, MCK, MCD	0.234 5.94	0.018 0.46	7	1/32 0.79	26 116	5 22	15 67	0.114 2.90	0.120 3.05	0.003 0.08	0.005 0.14
				R			8	1/32 0.79	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.003 0.08	0.005 0.14
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	C, R, MCK, MC	0.359 9.12	0.023 0.58	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.005 0.13	0.023 0.65
0.1250 3.175	0.2500 6.350	0.0937 2.380	418	C, MC	0.296 7.52	0.023 0.58	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.003 0.08	0.011 0.31
				R, MCK			8	0.039 1.00	46 205	10 44	26 116				
0.1250 3.175	0.3125 7.938	0.1094 2.771	518	C, R, MCK, MC	0.359 9.12	0.023 0.58	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.003 0.08	0.020 0.57
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	C, R, MCK, MC	0.422 10.72	0.023 0.58	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.005 0.13	0.036 1.02

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight oz. g
					Dia. FD	Width FW	Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.			
in. mm	in. mm	in. mm			in. mm		in. mm		lbf N			in. mm	in. mm		
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	C, R, MCK, MC	0.440 11.18	0.030 0.76	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.012 0.30	0.050 1.42
0.1562 3.967	0.3125 7.938	0.1094 2.779	5532	C, R, MCK, MC	0.359 9.12	0.023 0.58	7	3/64 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.003 0.08	0.020 0.57
0.1875 4.763	0.3125 7.938	0.1094 2.779	5632	C, R, MCK, MC	0.359 9.12	0.023 0.58	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.003 0.08	0.016 0.45
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	C, R, MCK, MC	0.422 10.72	0.023 0.58	8	1/16 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.003 0.08	0.030 0.85
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	C, R, MCK, MC	0.565 14.35	0.042 1.07	7	3/32 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.012 0.30	0.085 2.41
0.2500 6.350	0.3750 9.525	0.1251 3.178	614	C, MCK	0.422 10.72	0.023 0.58	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.003 0.08	0.024 0.68
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	C, MC	0.547 13.89	0.023 0.58	10	1/16 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.010 0.25	0.058 1.64
				R	0.547 13.89	0.023 0.58	11	1/16 1.59	127 565	43 191	89 396				0.059 1.67
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	C, R, MCK, MC	0.690 17.53	0.042 1.07	8	3/32 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.012 0.30	0.165 4.68
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	C, R, MCK, MC	0.547 13.89	0.031 0.79	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.005 0.13	0.054 1.53
0.3125 7.938	0.5000 12.700	0.1094 2.779	E685	R	0.547 13.89	0.022 0.56	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.010 0.25	0.039 1.11
0.3750 9.525	0.8750 22.225	0.2812 7.142	R6	R, MCK, MC	0.969 24.61	0.062 1.57	7	5/32 3.97	577 2567	209 930	267 1188	0.452 11.48	0.519 13.18	0.016 0.41	0.422 11.96

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER FLANGED SHIELDED BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

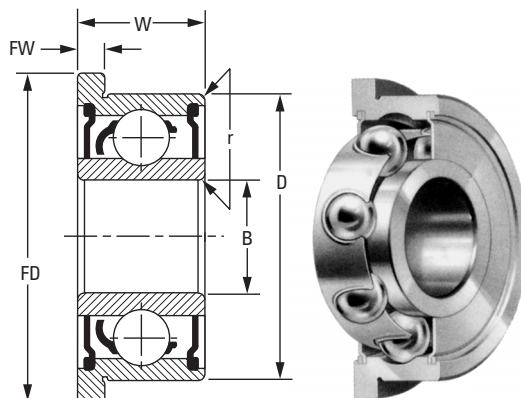


TABLE 19. RADIAL RETAINER FLANGED SHIELDED BEARINGS

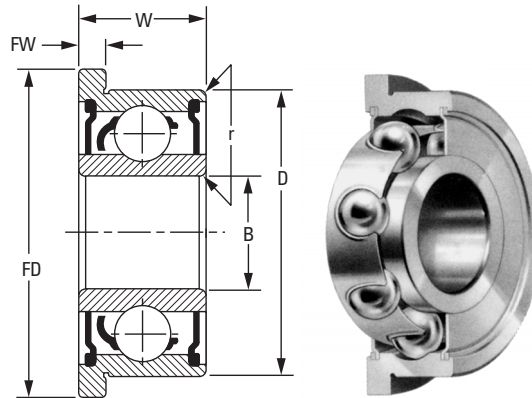
Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
					Dia. FD	Width FW	Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min.	Shaft Max.		
in. mm	in. mm	in. mm			in. mm	in. mm			lbf N			in. mm	in. mm	oz. g	
0.0469 1.191	0.1562 3.967	0.0937 2.380	25	C	0.203 5.16	0.031 0.79	6	1/32 0.79	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.003 0.08	0.007 0.20
0.0550 1.397	0.1875 4.763	0.1094 2.779	3	C	0.234 5.94	0.031 0.79	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.003 0.08	0.008 0.23
				R			6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.003 0.08	0.010 0.28
0.0781 1.984	0.2500 6.350	0.1406 3.571	4	C	0.296 7.52	0.031 0.79	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.003 0.08	0.016 0.45
				R			8	0.039 1.00	46 205	10 44	26 116				
				MC			7	0.039 1.00	42 187	9 40	23 102	0.125 3.18	0.165 4.19	0.003 0.08	0.014 0.40
0.0937 2.380	0.1875 4.763	0.0937 2.380	3332	C	0.234 5.94	0.031 0.79	8	0.025 0.64	20 89	4 18	8 36	0.114 2.90	0.120 3.05	0.003 0.08	0.007 0.20
				R			8	1/32 0.790	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.003 0.08	0.007 0.20
0.0937 2.380	0.3125 7.938	0.1406 3.571	5	C, R, MCK, MC	0.359 9.12	0.031 0.79	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.005 0.13	0.027 0.77
0.1250 3.175	0.2500 6.350	0.1094 2.779	418	C, MC ⁽²⁾	0.296 7.52	0.031 0.79	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.003 0.08	0.014 0.40
				R, MCK			8	0.039 1.00	46 205	10 44	26 116				
0.1250 3.175	0.3125 7.938	0.1406 3.571	518	C, R, MCK, MC	0.359 9.12	0.031 0.79	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.003 0.08	0.027 0.77
0.1250 3.175	0.3750 9.525	0.1406 3.571	618	C, R, MCK, MC	0.422 10.72	0.031 0.79	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.005 0.13	0.042 1.19

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Available with single shield opposite flange side only for indicated retainer.

⁽³⁾Available with single shield flange only for indicated retainer.

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Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
					Dia. FD	Width FW	Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft			
in. mm	in. mm	in. mm			in. mm	in. mm		in. mm	lbf N			in. mm	in. mm	oz. g	
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	C, R, MCK, MC	0.440 11.18	0.030 0.76	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.012 0.30	0.052 1.47
0.1562 3.967	0.3125 7.938	0.1250 3.175	5532	C, R, MCK, MC ⁽³⁾	0.359 9.12	0.036 0.91	7	3/64 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.003 0.08	0.020 0.57
0.1875 4.763	0.3125 7.938	0.1250 3.175	5632	C, R, MCK, MC ⁽³⁾	0.359 9.12	0.036 0.91	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.003 0.08	0.020 0.57
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	C, R, MCK, MC ⁽³⁾	0.422 10.72	0.031 0.79	8	1/16 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.003 0.08	0.025 0.71
0.1875 4.763	0.5000 12.700	0.1960 4.978	R3	C, R, MCK, MC	0.565 14.35	0.042 1.07	7	3/32 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.012 0.30	0.108 3.06
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	C, MCK	0.422 10.72	0.036 0.91	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.003 0.08	0.019 0.54
0.2500 6.350	0.5000 12.700	0.1875 4.763	814	C, MC	0.547 13.89	0.045 1.14	10	1/16 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.010 0.25	0.091 2.58
				11			1/16 1.59	127 565	43 191	89 396					
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	C, R, MCK, MC	0.690 17.53	0.042 1.07	8	3/32 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.012 0.30	0.172 4.88
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	C, R, MCK, MC	0.547 13.89	0.031 0.79	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.005 0.13	0.038 1.08
0.3750 9.525	0.8750 22.225	0.2812 7.142	R6	R, MCK, MC	0.969 24.61	0.062 1.57	7	5/32 3.97	577 2567	209 930	267 1188	0.452 11.48	0.519 13.18	0.016 0.41	0.431 12.22

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Available with single shield opposite flange side only for indicated retainer.

⁽³⁾Available with single shield flange only for indicated retainer.

RADIAL RETAINER EXTENDED INNER-RING OPEN BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

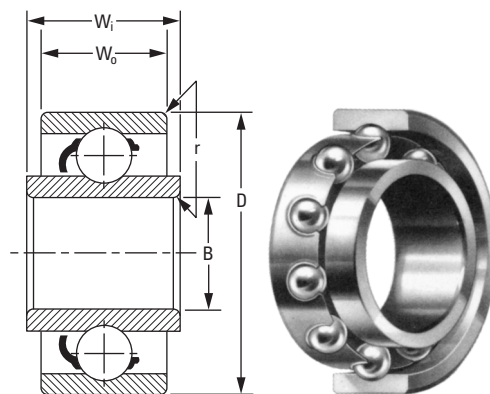


TABLE 20. RADIAL RETAINER EXTENDED INNER-RING OPEN BEARINGS

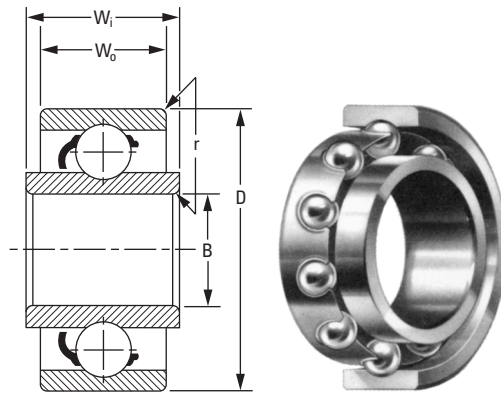
Bore B	O.D. D	Width		Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight		
		W _o	W _i			Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.	Housing Min. Max.				
in. mm	in. mm	in. mm	in. mm			in. mm		lbf N			in. mm	in. mm	in. mm	oz. g		
0.0400 1.016	0.1250 3.175	0.0469 1.191	0.0781 1.984	2	C	5	0.025 0.64	13 58	2 9	4 18	0.059 1.50	0.063 1.60	0.102 2.59	0.106 2.69	0.003 0.08	0.002 0.06
0.0469 1.191	0.1562 3.967	0.0625 1.588	0.0937 2.380	25	C	6	1/32 0.790	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.123 3.12	0.131 3.33	0.003 0.08	0.003 0.09
0.0550 1.397	0.1875 4.763	0.0781 1.984	0.1094 2.779	3	C	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.159 4.04	0.165 4.19	0.003 0.08	0.006 0.17
					R	6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.148 3.76	0.160 4.06	0.003 0.08	0.006 0.17
0.0781 1.984	0.2500 6.350	0.0937 2.380	0.1250 3.175	4	C	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.215 5.46	0.224 5.69	0.003 0.08	0.012 0.34
					R	8	0.039 1.00	46 205	10 44	26 116	0.125 3.18	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.015 0.43
					MC	7	0.039 1.00	42 187	9 40	23 102						
0.0937 2.380	0.1875 4.763	0.0625 1.588	0.0937 2.380	3332	C, MCK, MCD	7	1/32 0.79	26 116	5 22	15 67	0.114 2.90	0.120 3.05	0.164 4.17	0.168 4.27	0.003 0.08	0.004 0.11
					R	8	1/32 0.79	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.161 4.09	0.167 4.24		
0.0937 2.380	0.3125 7.938	0.1094 2.779	0.1406 3.571	5	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.271 6.88	0.284 7.21	0.005 0.13	0.023 0.65
0.1250 3.175	0.2500 6.350	0.0937 2.380	0.1250 3.175	418	C, MC	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.010 0.28
					R, MCK	8	0.039 1.00	46 205	10 44	26 116						
0.1250 3.175	0.3125 7.938	0.1094 2.779	0.1406 3.571	518	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.271 6.88	0.284 7.21	0.003 0.08	0.019 0.54

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

Continued on next page.

MINIATURE AND INSTRUMENT BALL BEARINGS

RADIAL RETAINER EXTENDED INNER-RING OPEN BEARINGS



Continued from previous page.

Bore B	O.D. D	Width W ₀	Width W ₁	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight		
						Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.	Housing Min. Max.				
in. mm	in. mm	in. mm	in. mm			in. mm		lbf N			in. mm	in. mm	in. mm	oz. g		
0.1250 3.175	0.3750 9.525	0.1094 2.779	0.1406 3.571	618	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.036 1.02
0.1250 3.175	0.3750 9.525	0.1562 3.967	0.1875 4.763	R2	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.298 7.57	0.324 8.23	0.012 0.30	0.047 1.33
0.1562 3.967	0.3125 7.938	0.1094 2.779	0.1406 3.571	5532	C, R, MCK, MC	7	3/64 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.020 0.57
0.1875 4.763	0.3125 7.938	0.1094 2.779	0.1406 3.571	5632	C,R,MCK, MC	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.015 0.43
0.1875 4.763	0.3750 9.525	0.1250 3.175	0.1562 3.967	6316	C, R, MCK, MC	8	1/16 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.329 8.36	0.345 8.76	0.003 0.08	0.029 0.82
0.1875 4.763	0.5000 12.700	0.1562 3.967	0.1875 4.763	R3	C, R, MCK, MC	7	3/32 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.416 10.57	0.446 11.33	0.012 0.30	0.080 2.27
0.2500 6.350	0.3750 9.525	0.1250 3.175	0.1562 3.967	614	C, MCK	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.342 8.69	0.350 8.89	0.003 0.08	0.023 0.65
0.2500 6.350	0.5000 12.700	0.1250 3.175	0.1562 3.967	814	C, MC	10	1/16 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.430 10.92	0.454 11.53	0.010 0.25	0.060 1.70
					R	11	1/16 1.59	127 565	43 191	89 396						
0.2500 6.350	0.6250 15.875	0.1960 4.978	0.2272 5.771	R4	C, R, MCK, MC	8	3/32 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.510 12.95	0.558 14.17	0.012 0.30	0.160 4.54
0.3125 7.938	0.5000 12.700	0.1562 3.967	0.1875 4.763	8516	C, R, MCK, MC	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.450 11.43	0.462 11.73	0.005 0.13	0.052 1.47

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER EXTENDED INNER-RING SHIELDED BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

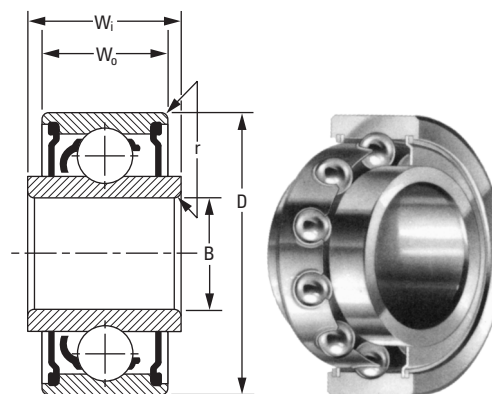


TABLE 21. RADIAL RETAINER EXTENDED INNER-RING SHIELDED BEARINGS

Bore B	O.D. D	Width W _o	Width W _i	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight		
						Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.	Housing Min. Max.				
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N	in. mm	in. mm	in. mm	oz. g					
0.0469 1.191	0.1562 3.967	0.0937 2.380	0.1250 3.175	25	C	6	1/32 0.79	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.123 3.12	0.131 3.33	0.003 0.08	0.005 0.14
0.0550 1.397	0.1875 4.763	0.1094 2.779	0.1406 3.571	3	C	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.159 4.04	0.165 4.19	0.003 0.08	0.008 0.23
					R	6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.148 3.76	0.160 4.06	0.003 0.08	0.009 0.26
0.0781 1.984	0.2500 6.350	0.1406 3.571	0.1718 4.364	4	C	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.215 5.46	0.224 5.69	0.003 0.08	0.017 0.48
					R, MCK	8	0.039 1.00	46 205	10 44	26 116	0.125 3.18	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.021 0.60
					MC	7	0.039 1.00	42 187	9 40	23 102						0.018 0.51
0.0937 2.380	0.1875 4.763	0.0937 2.380	0.1250 3.175	3332	C	8	0.025 0.64	20 89	4 18	8 36	0.114 2.90	0.120 3.05	0.157 3.99	0.168 4.27	0.003 0.08	0.007 0.20
					R	8	1/32 0.790	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.161 4.09	0.167 4.24	0.003 0.08	0.006 0.17
0.0937 2.380	0.3125 7.938	0.1406 3.571	0.1718 4.364	5	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.271 6.88	0.284 7.21	0.005 0.13	0.030 0.85
0.1250 3.175	0.2500 6.350	0.1094 2.779	0.1406 3.571	418	C, MC	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.013 0.37
					R, MCK	8	0.039 1.00	46 205	10 44	26 116						
0.1250 3.175	0.3125 7.938	0.1406 3.571	0.1718 4.364	518	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.271 6.88	0.284 7.21	0.003 0.08	0.025 0.71
0.1250 3.175	0.3750 9.525	0.1406 3.571	0.1718 4.364	618	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.047 1.33

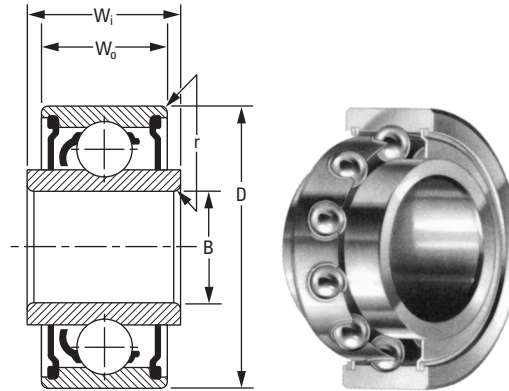
⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Available with single shield opposite flange side only for indicated retainer.

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MINIATURE AND INSTRUMENT BALL BEARINGS

RADIAL RETAINER EXTENDED INNER-RING SHIELDED BEARINGS



Continued from previous page.

Bore B	O.D. D	Width		Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
		W _o	W _i			Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm				in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
0.1250 3.175	0.3750 9.525	0.1562 3.967	0.1875 4.763	R2	C, R, MCK, MC	7	¹ / ₁₆ 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.298 7.57	0.324 8.23	0.012 0.30	0.049 1.39
0.1562 3.967	0.3125 7.938	0.1250 3.175	0.1562 3.967	5532	C, R, MCK, MC	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.024 0.68
0.1875 4.763	0.3125 7.938	0.1250 3.175	0.1562 3.967	5632	C, R, MCK, MC	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.018 0.51
0.1875 4.763	0.3750 9.525	0.1250 3.175	0.1562 3.967	6316	C, R, MCK ⁽²⁾ , MC ⁽²⁾	8	¹ / ₁₆ 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.329 8.36	0.345 8.76	0.003 0.08	0.032 0.91
0.1875 4.763	0.5000 12.700	0.1960 4.978	0.2272 5.771	R3	C, R, MCK, MC	7	³ / ₃₂ 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.416 10.57	0.446 11.33	0.012 0.30	0.102 2.89
0.2500 6.350	0.3750 9.525	0.1250 3.175	0.1562 3.967	614	C, MCK	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.342 8.69	0.350 8.89	0.003 0.08	0.024 0.68
0.2500 6.350	0.5000 12.700	0.1875 4.763	0.2187 5.555	814	C	10	¹ / ₁₆ 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.430 10.92	0.454 11.53	0.010 0.25	0.088 2.49
						11	¹ / ₁₆ 1.59	127 565	43 191	89 396						0.089 2.52
0.2500 6.350	0.6250 15.875	0.1960 4.978	0.2272 5.771	R4	C, R, MCK, MC	8	³ / ₃₂ 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.510 12.95	0.558 14.17	0.012 0.30	0.167 4.73
0.3125 7.938	0.5000 12.700	0.1562 3.967	0.1875 4.763	8516	C, R, MCK, MC	11	¹ / ₁₆ 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.450 11.43	0.462 11.73	0.005 0.13	0.056 1.59

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Available with single shield flange only for indicated retainer.

RADIAL RETAINER FLANGED EXTENDED INNER-RING OPEN BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

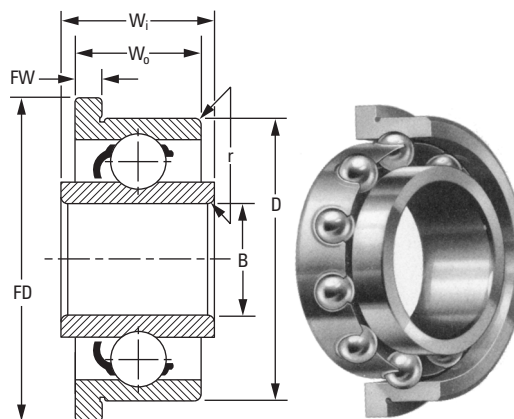


TABLE 22. RADIAL RETAINER FLANGED EXTENDED INNER-RING OPEN BEARINGS

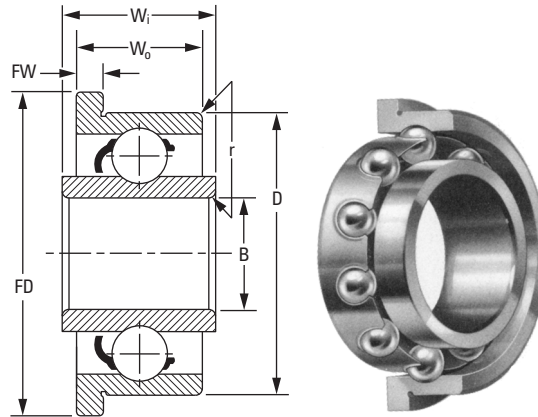
Bore B	O.D. D	Width W ₀	Width W ₁	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
						Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.			
in. mm	in. mm	in. mm	in. mm			in. mm	in. mm	in. mm	in. mm	lbf N			in. mm	in. mm	oz. g	
0.0400 1.016	0.1250 3.175	0.0469 1.191	0.0781 1.984	2	C	0.171 4.34	0.013 0.33	5	0.025 0.64	13 58	2 9	4 18	0.059 1.50	0.063 1.60	0.003 0.08	0.002 0.06
0.0469 1.191	0.1562 3.967	0.0625 1.588	0.0937 2.380	25	C	0.203 5.16	0.013 0.33	6	1/32 0.79	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.003 0.08	0.004 0.11
0.0550 1.397	0.1875 4.763	0.0781 1.984	0.1094 2.779	3	C	0.234 5.94	0.023 0.58	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.003 0.08	0.007 0.20
					R			6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.003 0.08	0.007 0.20
0.0781 1.984	0.2500 6.350	0.0937 2.380	0.1250 3.175	4	C	0.296 7.52	0.023 0.58	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.003 0.08	0.014 0.40
					R			8	0.039 1.00	46 205	10 44	26 116				
					MC			7	0.039 1.00	42 187	9 40	23 102				
0.0937 2.380	0.1875 4.763	0.0625 1.588	0.0937 2.380	3332	C, MCK, MCD	0.234 5.94	0.018 0.46	7	1/32 0.79	26 116	5 22	15 67	0.114 2.90	0.120 3.05	0.003 0.08	0.005 0.14
					R			8	1/32 0.79	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.003 0.08	0.005 0.14
0.0937 2.380	0.3125 7.938	0.1094 2.779	0.1406 3.571	5	C, R, MCK, MC	0.359 9.12	0.023 0.58	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.005 0.13	0.025 0.71
0.1250 3.175	0.2500 6.350	0.0937 2.380	0.1250 3.175	418	C, MC	0.296 7.52	0.023 0.58	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.003 0.08	0.012 0.34
					R, MCK			8	0.039 1.00	46 205	10 44	26 116				
0.1250 3.175	0.3125 7.938	0.1094 2.779	0.1406 3.571	518	C, R, MCK, MC	0.359 9.12	0.023 0.58	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.003 0.08	0.022 0.62
0.1250 3.175	0.3750 9.525	0.1094 2.779	0.1406 3.571	618	C, R, MCK, MC	0.422 10.72	0.023 0.58	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.005 0.13	0.039 1.11

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

Continued on next page.

MINIATURE AND INSTRUMENT BALL BEARINGS

RADIAL RETAINER FLANGED EXTENDED INNER-RING OPEN BEARINGS



Continued from previous page.

Bore B	O.D. D	Width W ₀	Width W ₁	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
						Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.			
in. mm	in. mm	in. mm	in. mm			in. mm			in. mm	lbf N			in. mm	in. mm	oz. g	
0.1250 3.175	0.3750 9.525	0.1562 3.967	0.1875 4.763	R2	C, R, MCK, MC	0.440 11.18	0.030 0.76	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.012 0.30	0.053 1.50
0.1562 3.967	0.3125 7.938	0.1094 2.779	0.1406 3.571	5532	C, R, MCK, MC	0.359 9.12	0.023 0.58	7	3/64 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.003 0.08	0.023 0.65
0.1875 4.763	0.3125 7.938	0.1094 2.779	0.1406 3.571	5632	C, R, MCK, MC	0.359 9.12	0.023 0.58	7	3/64 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.003 0.08	0.017 0.48
0.1875 4.763	0.3750 9.525	0.1250 3.175	0.1562 3.967	6316	C, R, MCK, MC	0.422 10.72	0.023 0.58	8	1/16 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.003 0.08	0.033 0.94
0.1875 4.763	0.5000 12.700	0.1562 3.967	0.1875 4.763	R3	C, R, MCK, MC	0.565 14.35	0.042 1.07	7	3/32 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.012 0.30	0.089 2.52
0.2500 6.350	0.3750 9.525	0.1250 3.175	0.1562 3.967	614	C, MCK	0.422 10.72	0.023 0.58	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.003 0.08	0.026 0.74
0.2500 6.350	0.5000 12.700	0.1250 3.175	0.1562 3.967	814	C, MC	0.547 13.89	0.023 0.58	10	1/16 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.010 0.25	0.064 1.81
					R			11	1/16 1.59	127 565	43 191	89 396				
0.2500 6.350	0.6250 15.875	0.1950 4.953	0.2272 5.771	R4	C, R, MCK, MC	0.690 17.53	0.042 1.07	8	3/32 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.012 0.30	0.172 4.88
0.3125 7.938	0.5000 12.700	0.1562 3.967	0.1875 4.763	8516	C, R, MCK, MC	0.547 13.89	0.031 0.79	11	1/16 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.005 0.13	0.057 1.62

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER FLANGED EXTENDED INNER-RING SHIELDED BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

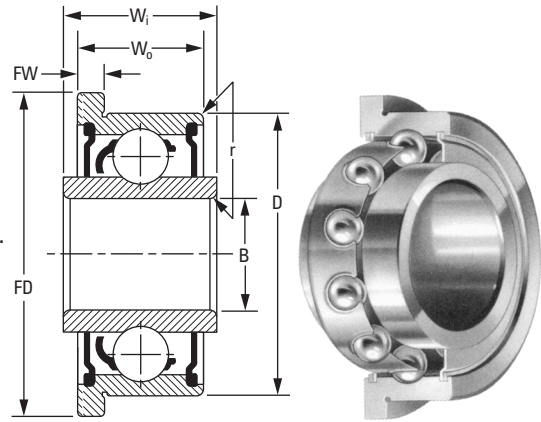


TABLE 23. RADIAL RETAINER FLANGED EXTENDED INNER-RING SHIELDED BEARINGS

Bore B	O.D. D	Width W ₀	Width W ₁	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight				
						Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.							
in. mm	in. mm	in. mm	in. mm			in. mm	in. mm	in. mm	in. mm	lbf N			in. mm	in. mm	oz. g					
0.0469 1.191	0.1562 3.967	0.0937 2.380	0.1250 3.175	25	C	0.203 5.16	0.031 0.79	6	1/32 0.79	22 98	4 18	11 49	0.070 1.78	0.076 1.93	0.003 0.08	0.007 0.20				
0.0550 1.397	0.1875 4.763	0.1094 2.779	0.1406 3.571	3	C	0.234 5.94	0.031 0.79	5	3/64 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.003 0.08	0.010 0.28				
					R			6	0.039 1.00	35 156	7 31	17 76	0.081 2.06	0.091 2.31	0.003 0.08	0.012 0.34				
0.0781 1.984	0.2500 6.350	0.1406 3.571	0.1718 4.364	4	C	0.296 7.52	0.031 0.79	5	1/16 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.003 0.08	0.021 0.60				
					R, MCK			8	0.039 1.00	46 205	10 44	26 116					0.125 3.18	0.165 4.19	0.003 0.08	0.026 0.74
					MC			7	0.039 1.00	42 187	9 40	23 102								
0.0937 2.380	0.1875 4.763	0.0937 2.380	0.1250 3.175	3332	C	0.234 5.94	0.031 0.79	8	0.025 0.64	20 89	4 18	8 36	0.114 2.90	0.120 3.05	0.003 0.08	0.010 0.28				
					R			8	1/32 0.790	29 129	6 27	17 76	0.113 2.87	0.116 2.95	0.003 0.08	0.009 0.26				
0.0937 2.380	0.3125 7.938	0.1406 3.571	0.1718 4.364	5	C, R, MCK, MC	0.359 9.12	0.031 0.79	6	1/16 1.59	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.005 0.13	0.039 1.11				
0.1250 3.175	0.2500 6.350	0.1094 2.779	0.1406 3.571	418	C, MC ⁽²⁾	0.296 7.52	0.031 0.79	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.003 0.08	0.019 0.54				
					R, MCK			8	0.039 1.00	46 205	10 44	26 116								
0.1250 3.175	0.3125 7.938	0.1406 3.571	0.1718 4.364	518	C, R, MCK, MC	0.359 9.12	0.031 0.79	6	1/16 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.003 0.08	0.037 1.05				
0.1250 3.175	0.3750 9.525	0.1406 3.571	0.1718 4.364	618	C, R, MCK, MC	0.422 10.72	0.031 0.79	7	1/16 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.005 0.13	0.063 1.79				
0.1250 3.175	0.3750 9.525	0.1562 3.967	0.1875 4.763	R2	C, R, MCK, MC	0.440 11.18	0.030 0.76	7	1/16 1.59	94 418	23 102	49 218	0.176 4.47	0.201 5.11	0.012 0.30	0.068 1.93				

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

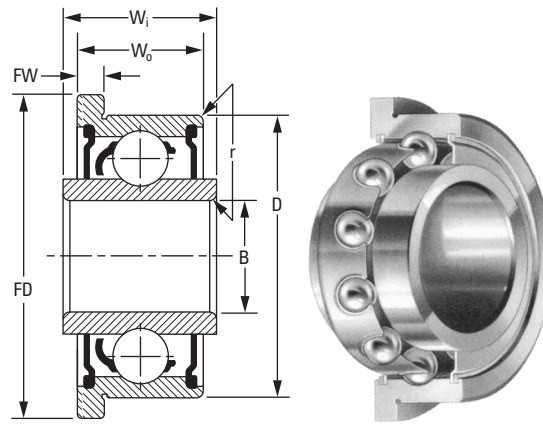
⁽²⁾Available with single shield opposite flange side only for indicated retainer.

⁽³⁾Available with single shield flange only for indicated retainer.

Continued on next page.

MINIATURE AND INSTRUMENT BALL BEARINGS

RADIAL RETAINER FLANGED EXTENDED INNER-RING SHIELDED BEARINGS



Continued from previous page.

Bore B	O.D. D	Width W ₀	Width W ₁	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
						Dia.	Width	Number	Dia.	Dynamic	Static Radial	Static Thrust	Shaft			
						FD	FW	n	d	C	R _s	T _s	Min.	Max.		
in. mm	in. mm	in. mm	in. mm			in. mm	in. mm		in. mm	lbf N			in. mm	in. mm	oz. g	
0.1562 3.967	0.3125 7.938	0.1250 3.175	0.1562 3.967	5532	C, R, MCK, MC ⁽³⁾	0.359 9.12	0.036 0.91	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.003 0.08	0.035 0.99
0.1875 4.763	0.3125 7.938	0.1250 3.175	0.1562 3.967	5632	C, R, MCK, MC ⁽³⁾	0.359 9.12	0.036 0.91	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.003 0.08	0.029 0.82
0.1875 4.763	0.3750 9.525	0.1250 3.175	0.1562 3.967	6316	C, R, MCK, MC ⁽³⁾	0.422 10.72	0.031 0.79	8	¹ / ₁₆ 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.003 0.08	0.051 1.45
0.1875 4.763	0.5000 12.700	0.1960 4.978	0.2272 5.771	R3	C, R, MCK, MC	0.565 14.35	0.042 1.07	7	³ / ₃₂ 2.38	181 805	50 222	89 396	0.242 6.15	0.272 6.91	0.012 0.30	0.157 4.45
0.2500 6.350	0.3750 9.525	0.1250 3.175	0.1562 3.967	614	C, MCK	0.422 10.72	0.036 0.91	11	0.039 1.00	53 236	16 71	40 178	0.277 7.04	0.289 7.34	0.003 0.08	0.039 1.11
0.2500 6.350	0.5000 12.700	0.1875 4.763	0.2187 5.555	814	C, MC R	0.547 13.89	0.045 1.14	10	¹ / ₁₆ 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.010 0.25	0.121 3.43
								11	¹ / ₁₆ 1.59	127 565	43 191	89 396				0.122 3.46
0.2500 6.350	0.6250 15.875	0.1960 4.978	0.2272 5.771	R4	C, R, MCK, MC	0.690 17.53	0.042 1.07	8	³ / ₃₂ 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.012 0.30	0.251 7.12
0.3125 7.938	0.5000 12.700	0.1562 3.967	0.1875 4.763	8516	C, R, MCK, MC	0.547 13.89	0.031 0.79	11	¹ / ₁₆ 1.59	121 538	43 191	91 405	0.350 8.89	0.362 9.19	0.005 0.13	0.100 2.83

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Available with single shield opposite flange side only for indicated retainer.

⁽³⁾Available with single shield flange side for indicated retainer.

RADIAL RETAINER SEALED BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

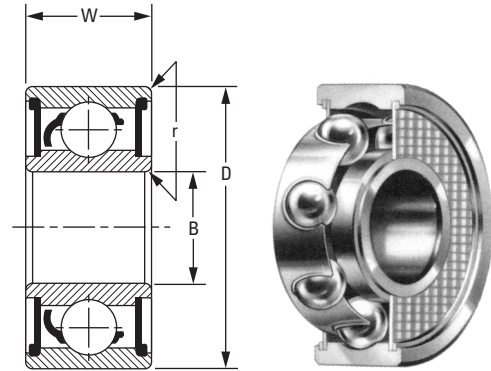


TABLE 24. RADIAL RETAINER SEALED BEARINGS

Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight oz. g
					Number n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm	in. mm	in. mm		
0.0937 2.380	0.3125 7.938	0.1406 3.571	5	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.130 3.30	0.156 3.96	0.271 6.88	0.284 7.21	0.005 0.13	0.025 0.71
0.1250 3.175	0.2500 6.350	0.1094 2.779	418	C	7	0.039 1.00	42 187	9 40	23 102	0.143 3.63	0.145 3.68	0.220 5.59	0.226 5.74	0.003 0.08	0.010 0.28
				R, MCK	8	0.039 1.00	46 205	10 44	26 116						
0.1250 3.175	0.3125 7.938	0.1406 3.571	518	C, R, MCK, MC	6	1/16 1.59	81 360	19 85	40 178	0.154 3.91	0.156 3.96	0.271 6.88	0.284 7.21	0.003 0.08	0.021 0.60
0.1250 3.175	0.3750 9.525	0.1406 3.571	618	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.160 4.06	0.177 4.50	0.298 7.57	0.333 8.46	0.005 0.13	0.039 1.11
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.166 4.22	0.177 4.50	0.298 7.57	0.324 8.23	0.012 0.30	0.043 1.22
0.1250 3.175	0.5000 12.700	0.1719 4.366	R2A	C, R, MCK, MC	7	1/16 1.59	94 418	23 102	49 218	0.166 4.22	0.177 4.50	0.298 7.57	0.399 10.13	0.012 0.30	0.113 3.20
0.1562 3.967	0.3125 7.938	0.1250 3.175	5532	C, R, MCK	7	3/64 1.19	56 249	14 62	35 156	0.188 4.78	0.207 5.26	0.285 7.24	0.290 7.37	0.003 0.08	0.018 0.51
0.1875 4.763	0.3125 7.938	0.1250 3.175	5632	C, R, MCK	7	3/64 1.19	56 249	14 62	35 156	0.206 5.23	0.207 5.26	0.285 7.24	0.290 7.37	0.003 0.08	0.014 0.40
0.1875 4.763	0.5000 12.700	0.1960 4.978	R3	C, R, MCK, MC	7	3/32 2.38	181 805	50 222	89 396	0.232 5.89	0.248 6.30	0.416 10.57	0.446 11.33	0.012 0.30	0.090 2.55
0.2500 6.350	0.5000 12.700	0.1875 4.763	814	C, MC	10	1/16 1.59	120 534	39 173	81 360	0.293 7.44	0.312 7.92	0.430 10.92	0.454 11.53	0.010 0.25	0.078 2.21
				R	11	1/16 1.59	127 565	43 191	89 396						0.079 2.24
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	C, R, MCK, MC	8	3/32 2.38	209 930	63 280	114 507	0.307 7.80	0.341 8.66	0.510 12.95	0.558 14.17	0.012 0.30	0.127 3.60
0.2500 6.350	0.7500 19.050	0.2812 7.142	R4A	R	6	9/64 3.57	332 1477	95 423	139 618	0.310 7.87	0.333 8.46	0.596 15.14	0.662 16.81	0.016 0.41	0.318 9.02
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	C, R, MCK	11	1/16 1.59	121 538	43 191	91 405	0.345 8.76	0.348 8.84	0.450 11.43	0.462 11.73	0.005 0.13	0.048 1.36
0.3750 9.525	0.8750 22.225	0.2812 7.142	R6	R, MCK, MC	7	5/32 3.97	577 2567	209 930	267 1188	0.443 11.25	0.450 11.43	0.745 18.92	0.804 20.42	0.016 0.41	0.368 10.43
0.5000 12.700	1.1250 28.575	0.3125 7.938	R8	R	10	5/32 3.97	904 4021	489 2175	205 912	0.602 15.29	0.678 17.22	0.974 24.74	1.045 26.54	0.016 0.41	0.734 20.81

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER FLANGED SEALED BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

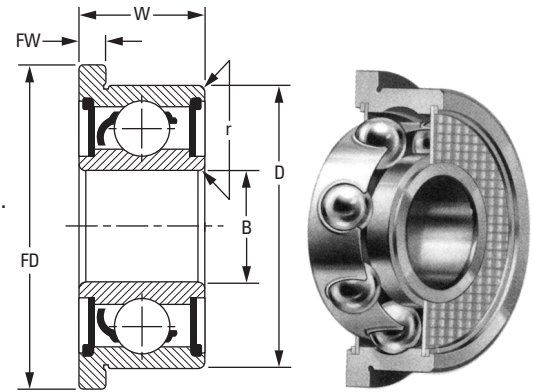


TABLE 25. RADIAL RETAINER FLANGED SEALED BEARINGS

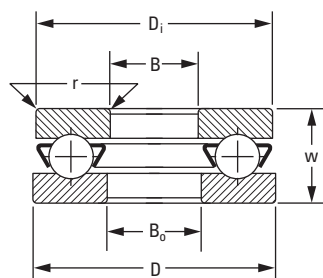
Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight oz. g
					Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.			
in. mm	in. mm	in. mm			in. mm		in. mm		lbf N			in. mm	in. mm		
0.0937 2.380	0.3125 7.938	0.1406 3.571	5	C, R, MCK, MC	0.359 9.12	0.031 0.79	6	1/16 1.59	81 360	19 85	40 178	0.130 3.30	0.156 3.96	0.005 0.13	0.028 0.79
0.1250 3.175	0.2500 6.350	0.1094 2.779	418	C	0.296 7.52	0.031 0.79	7	0.039 1.00	42 187	9 40	23 102	0.143 3.63	0.145 3.68	0.003 0.08	0.012 0.34
				R, MCK			8	0.039 1.00	46 205	10 44	26 116				
0.1250 3.175	0.3125 7.938	0.1406 3.571	518	C, R, MCK, MC	0.359 9.12	0.031 0.79	6	1/16 1.59	81 360	19 85	40 178	0.154 3.91	0.156 3.96	0.003 0.08	0.025 0.71
0.1250 3.175	0.3750 9.525	0.1406 3.571	618	C, R, MCK, MC	0.422 10.72	0.031 0.79	7	1/16 1.59	94 418	23 102	49 218	0.160 4.06	0.177 4.50	0.005 0.13	0.044 1.25
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	C, R, MCK, MC	0.440 11.18	0.030 0.76	7	1/16 1.59	94 418	23 102	49 218	0.166 4.22	0.177 4.50	0.012 0.30	0.049 1.39
0.1562 3.967	0.3125 7.938	0.1250 3.175	5532	C, R, MCK	0.359 9.12	0.036 0.91	7	3/64 1.19	56 249	14 62	35 156	0.188 4.78	0.207 5.26	0.003 0.08	0.022 0.62
0.1875 4.763	0.3125 7.938	0.1250 3.175	5632	C, R, MCK	0.359 9.12	0.036 0.91	7	3/64 1.19	56 249	14 62	35 156	0.206 5.23	0.207 5.26	0.003 0.08	0.018 0.51
0.1875 4.763	0.5000 12.700	0.1960 4.978	R3	C, R, MCK, MC	0.565 14.35	0.042 1.07	7	3/32 2.38	181 805	50 222	89 396	0.232 5.89	0.248 6.30	0.012 0.30	0.100 2.83
0.2500 6.350	0.5000 12.700	0.1875 4.763	814	C, MC	0.547 13.89	0.045 1.14	10	1/16 1.59	120 534	39 173	81 360	0.293 7.44	0.312 7.92	0.010 0.25	0.086 2.44
				R			11	1/16 1.59	127 565	43 191	89 396				
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	C, R, MCK, MC	0.690 17.53	0.042 1.07	8	3/32 2.38	209 930	63 280	114 507	0.307 7.80	0.341 8.66	0.012 0.30	0.163 4.62
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	C, R, MCK	0.547 13.89	0.031 0.79	11	1/16 1.59	121 538	43 191	91 405	0.345 8.76	0.348 8.84	0.005 0.13	0.052 1.47
0.3750 9.525	0.8750 22.225	0.2812 7.142	R6	R, MCK, MC	0.969 24.61	0.062 1.57	7	5/32 3.97	577 2567	209 930	267 1188	0.443 11.25	0.450 11.43	0.016 0.41	0.397 11.25

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

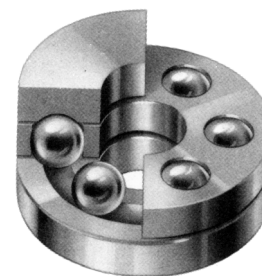
THRUST BEARINGS

STANDARD SPECIFICATIONS

Material AISI 440C stainless-steel rings and balls.
Lubrication Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).



Stamped stainless-steel retainer shown.



Machined-style retainer shown.

TABLE 26. THRUST BEARINGS

Bore B	O.D. D	Width W	Chassis	Di	Bo	Radius ⁽¹⁾ r	Ball Complement		Load Ratings		Approx. Weight
							Number n	Diameter d	Dynamic C	Static Thrust Ts	
in. mm	in. mm	in. mm		in. mm	in. mm	in. mm		in. mm	lbf N		oz. g
STAMPED STAINLESS-STEEL RETAINERS											
0.0937 2.380	0.2500 6.350	0.0937 2.380	4T	0.2480 6.299	0.0957 2.431	0.005 0.13	8	3/64 1.19	159 707	89 396	0.014 0.40
0.1250 3.175	0.3125 7.938	0.1250 3.175	5T	0.3105 7.887	0.1270 3.226	0.008 0.20	8	1/16 1.59	272 1210	156 694	0.025 0.71
0.1875 4.763	0.3750 9.525	0.1500 3.810	6T	0.3730 9.474	0.1895 4.813	0.008 0.20	8	1/16 1.59	250 1112	173 770	0.040 1.13
0.1250 3.175	0.4375 11.113	0.1500 3.810	7T	0.4355 11.062	0.1270 3.226	0.008 0.20	10	1/16 1.59	289 1286	232 1032	0.096 2.72
MACHINED STAINLESS-STEEL RETAINERS											
0.1250 3.175	0.3125 7.938	0.1250 3.175	A722	0.3105 7.887	0.1270 3.226	0.008 0.20	8	1/16 1.59	272 1210	156 694	0.029 0.82
0.1875 4.763	0.3750 9.525	0.1500 3.810	A721	0.3730 9.474	0.1895 4.813	0.008 0.20	8	1/16 1.59	250 1112	173 770	0.047 1.33
0.1250 3.175	0.4375 11.113	0.1875 4.763	A680	0.4355 11.062	0.1270 3.226	0.008 0.20	6	3/32 2.38	484 2153	238 1059	0.097 2.75

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

PIVOT BEARINGS

TYPE PR AND A STANDARD SPECIFICATIONS

Material AISI 440C stainless-steel rings and balls.
Lubrication Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).

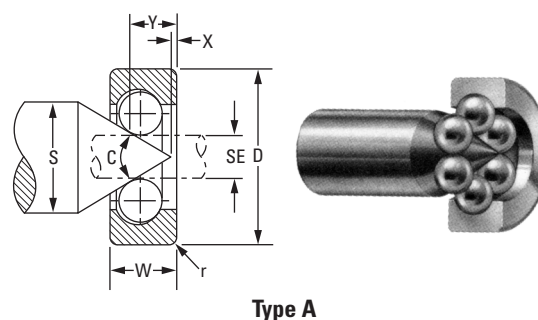
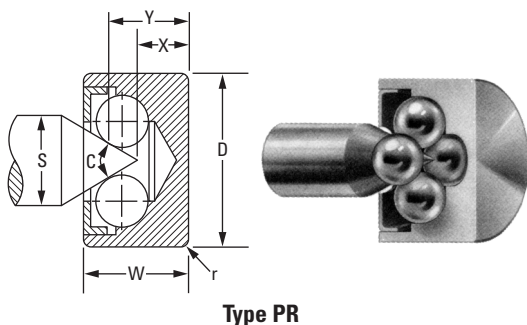


TABLE 27. PIVOT BEARINGS

D	W	Chassis	S	SE	X	Y	Pivot Angle C	Radius ⁽¹⁾ r	Ball Complement		Load Ratings Static Thrust T _s	Approx. Weight
									Number n	Diameter d		
in. mm	in. mm		in. mm	in. mm	in. mm	in. mm		in. mm	in. mm	lb N	oz. g	
TYPE PR												
0.0590 1.499	0.0472 1.199	15PR	0.020 0.51		0.026 0.66	0.034 0.86	60	0.003 0.08	4	1/64 0.40	.2 1	0.0004 0.01
0.1181 3.000	0.0709 1.801	3PR	0.030 0.76		0.037 0.94	0.054 1.37	60	0.004 0.10	4	1/32 0.79	1 4	0.003 0.08
0.1575 4.001	0.0945 2.400	4PR	0.040 1.02		0.049 1.24	0.074 1.88	60	0.005 0.13	4	3/64 1.19	2 9	0.006 0.18
0.1968 4.999	0.1181 3.000	5PR	0.050 1.27		0.059 1.50	0.091 2.31	60	0.006 0.15	4	1/16 1.59	3.5 16	0.012 0.33
0.2953 7.501	0.1772 4.501	75PR	0.075 1.91		0.090 2.29	0.138 3.51	60	0.008 0.20	4	3/32 2.38	8 36	0.042 1.20
0.3937 10.000	0.2362 5.999	10PR	0.100 2.54		0.118 3.00	0.182 4.62	60	0.008 0.20	4	1/8 3.175	14 62	0.099 2.80
TYPE A												
0.1250 3.175	0.0469 1.191	2A	0.042 1.07	0.032 0.81	0.001 0.03	0.034 0.86	60	0.003 0.08	6	1/32 0.79	2 9	0.002 0.06
0.1875 4.763	0.0700 1.778	3A	0.062 1.57	0.048 1.22	0.003 0.08	0.051 1.30	60	0.005 0.13	6	3/64 1.19	4 18	0.010 0.28
0.2500 6.350	0.0937 2.380	4A	0.085 2.16	0.065 1.65	0.002 0.05	0.066 1.68	60	0.008 0.20	6	1/16 1.59	7 31	0.014 0.40
0.3750 9.525	0.1406 3.571	6A	0.124 3.15	0.094 2.39	0.006 0.15	0.098 2.49	60	0.010 0.25	6	3/32 2.38	16 71	0.050 1.42
0.3750 9.525	0.1406 3.571	6A7B	0.150 3.81	0.125 3.18	0.014 0.36	0.104 2.64	60	0.010 0.25	7	3/32 2.38	20 89	0.046 1.30

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

HIGH-SPEED ANGULAR-CONTACT NON-SEPARABLE BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

NOTE: Not all available contact angle ranges listed. Contact your Timken engineer for additional information.

NOTE: Not all miniature angular-contact sizes available in all configurations. Contact your Timken engineer for additional information.

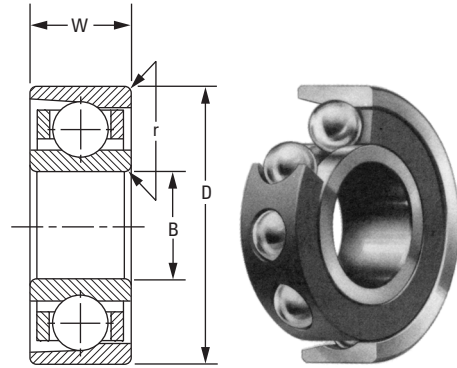


TABLE 28. HIGH-SPEED ANGULAR-CONTACT NON-SEPARABLE BEARINGS

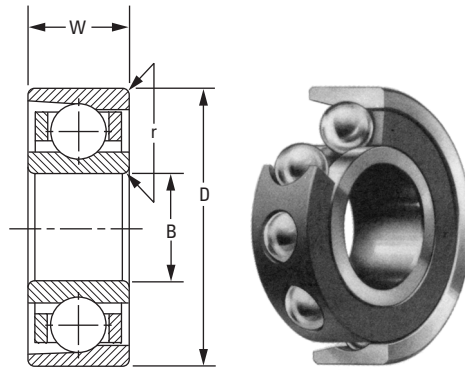
Bore B	O.D. D	Width W	Chassis	Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight								
				No. n	Dia. d	From	To	From	To	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.	Housing Min. Max.										
in. mm	in. mm	in. mm		in. mm	in. mm					lbf N	in. mm	in. mm	in. mm	oz. g										
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	7	1/16 1.59	0.0002	0.0005	9	14	89	21	37	0.138	0.160	0.248	0.275	0.005	0.022						
						0.0005	0.0009	14	19	88	19	43							3.51	4.06	6.30	6.99	0.13	0.62
						0.0009	0.0013	19	23	87	17	49												
0.1250 3.175	0.2500 6.350	0.0937 2.380	418	8	0.039 1.00	0.0002	0.0005	12	19	45	11	24	0.153	0.165	0.220	0.229	0.003	0.010						
						0.0005	0.0008	19	24	44	9	28							3.86	4.19	5.59	5.82	0.08	0.28
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	7	1/16 1.59	0.0002	0.0005	9	14	91	22	39	0.163	0.178	0.267	0.283	0.003	0.017						
						0.0005	0.0009	14	19	90	20	45							4.14	4.52	6.78	7.19	0.08	0.48
						0.0009	0.0013	19	23	89	17	51												
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	7	1/16 1.59	0.0002	0.0005	9	15	93	23	43	0.167	0.201	0.298	0.333	0.005	0.031						
						0.0005	0.0009	15	20	92	21	49							4.24	5.11	7.57	8.46	0.13	0.88
						0.0009	0.0013	20	24	91	18	33												
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	8	1/16 1.59	0.0002	0.0005	11	17	114	32	61	0.178	0.203	0.293	0.322	0.012	0.044						
						0.0005	0.0009	17	23	112	29	43							4.52	5.16	7.44	8.18	0.30	1.25
						0.0009	0.0013	23	28	109	26	25												

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

Continued on next page.

MINIATURE AND INSTRUMENT BALL BEARINGS

HIGH-SPEED ANGULAR-CONTACT NON-SEPARABLE BEARINGS



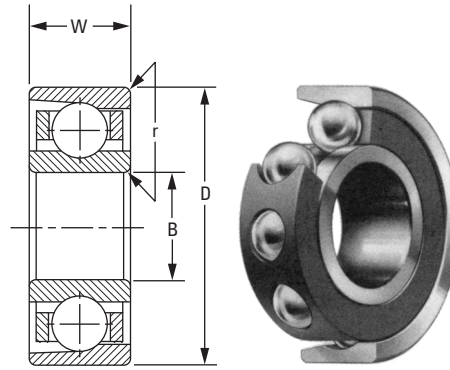
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Bore	O.D.	Width	Chassis	Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾	Approx. Weight	
				No.	Dia.	From	To	From	To	Dynamic	Static Radial	Static Thrust	Shaft		Housing				
B	D	W		n	d					C	R _s	T _s	Min.	Max.	Min.	Max.	r	oz.	
in.	in.	in.			in.	in.	mm			lbf	N		in.	mm	in.	mm	in.	mm	g
0.1575 4.000	0.6299 16.000	0.1969 5.000	34	8	1/8 3.18	0.00045	0.00085	13	18	421	141	145	0.236	0.300	0.488	0.548	0.012	0.177	
						0.011	0.022	18	21	1873	627	645							
						0.00085	0.00125	18	21	417	132	111							
						0.022	0.032	21	25	1855	587	494	5.99	7.62	12.40	13.92	0.30	5.02	
						0.00125	0.00165	21	25	413	125	81							
						0.032	0.042	21	25	1837	556	360							
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	8	3/32 2.38	0.0002	0.0005	7	12	203	56	91	0.253	0.277	0.410	0.443	0.012	0.072	
						0.005	0.013	12	16	202	52	102							
						0.0009	0.0013	16	19	200	47	113							
						0.023	0.033	16	19	890	209	503							
						0.0013	0.0017	19	21	198	44	124							
						0.033	0.043	19	21	881	196	552							
0.0017	0.0021	21	24	197	41	134	6.43	7.04	10.41	11.25	0.30	2.04							
						0.043	0.053	21	24	876	182	596							
						0.0021	0.0025	24	26	195	39	135							
						0.053	0.064	24	26	867	173	601							
0.1969 5.000	0.6299 16.000	0.1969 5.000	345	8	1/8 3.18	0.00045	0.00085	13	18	421	141	145	0.264	0.300	0.488	0.548	0.012	0.167	
						0.011	0.022	18	21	1873	627	645							
						0.00085	0.00125	18	21	417	132	111							
						0.022	0.032	21	25	1855	587	494	6.71	7.62	12.40	13.92	0.30	4.73	
						0.00125	0.00165	21	25	413	125	81							
						0.032	0.042	21	25	1837	556	360							
0.2362 6.000	0.7480 19.000	0.2362 6.000	36	8	9/64 3.57	0.00025	0.00065	11	17	614	248	128	0.318	0.385	0.596	0.662	0.012	0.276	
						0.006	0.017	17	22	606	234	93							
						0.017	0.027	17	22	2696	1041	414							
						0.00065	0.00105	17	22	606	234	93	8.08	9.78	15.14	16.81	0.30	7.82	
						0.017	0.027	17	22	2696	1041	414							
						0.00105	0.00145	22	26	597	223	63							
						0.027	0.037	22	26	2656	992	280							
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	10	1/16 1.59	0.0002	0.0005	9	15	120	39	72	0.302	0.335	0.430	0.454	0.010	0.051	
						0.005	0.013	15	20	534	173	320							
						0.0005	0.0009	15	20	118	35	83							
						0.013	0.023	15	20	525	156	369	7.67	8.51	10.92	11.53	0.25	1.45	
						0.0009	0.0013	20	24	115	31	68							
						0.023	0.033	20	24	512	138	302							

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

continued on next page

HIGH-SPEED ANGULAR-CONTACT NON-SEPARABLE BEARINGS



Continued from previous page.

Bore B	O.D. D	Width W	Chassis	Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
				No. n	Dia. d	From	To	From	To	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
				in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	lbf N	lbf N	lbf N	Min. in. mm	Max. in. mm	Min. in. mm	Max. in. mm		
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	9	3/32 2.38	0.0002	0.0005	7	12	227	71	114	0.320	0.371	0.504	0.556	0.012	0.148
						0.005	0.013			1010	316	507						
						0.0005	0.0009	12	16	225	65	128						
						0.013	0.023			1001	289	569						
						0.0009	0.0013	16	19	223	60	141						
						0.023	0.033			992	267	627						
0.0013	0.0017	19	21	220	56	154												
0.033	0.043			979	249	685												
0.0017	0.0021	21	24	218	52	165												
0.043	0.053			970	231	734												
0.0021	0.0025	24	26	215	49	173												
0.053	0.064			956	218	770												
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	11	1/16 1.59	0.0002	0.0005	9	15	127	43	81	0.351	0.363	0.449	0.467	0.005	0.044
						0.005	0.013			565	191	360						
						0.0005	0.0009	15	20	125	39	92						
0.013	0.023			556	173	409												
0.0009	0.0013	20	24	122	35	104												
0.023	0.033			543	156	463												
0.3150 8.000	0.8661 22.000	0.2756 7.000	38	9	5/32 3.97	0.0004	0.0008	11	16	749	306	264	0.396	0.462	0.692	0.771	0.012	0.416
						0.010	0.020			3332	1361	1174						
						0.0008	0.0012	16	20	741	291	215						
0.020	0.030			3296	1294	956												
0.0012	0.0016	20	23	733	277	169												
0.030	0.041			3261	1232	752												
0.3750 9.525	0.8750 22.225	0.2188 5.558	R6	9	5/32 3.97	0.0002	0.0006	7	13	687	269	351	0.464	0.519	0.745	0.793	0.016	0.309
						0.005	0.015			3056	1197	1561						
						0.0006	0.0010	13	17	681	255	301						
0.015	0.025			3029	1134	1339												
0.0010	0.0014	17	20	674	242	253												
0.025	0.036			2998	1076	1125												

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

HIGH-SPEED ANGULAR-CONTACT FLANGED NON-SEPARABLE BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

NOTE: Not all available contact angle ranges listed. Contact your Timken engineer for additional information.

NOTE: Not all miniature angular-contact sizes available in all configurations. Contact your Timken engineer for additional information.

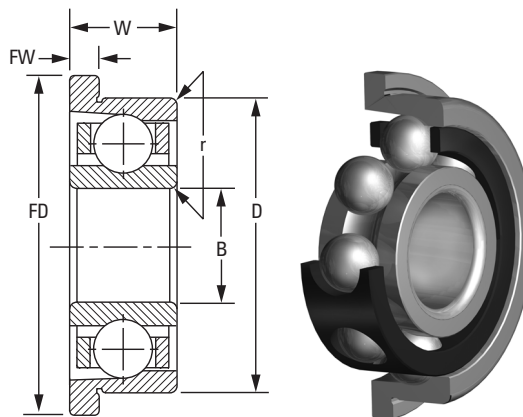


TABLE 29. HIGH-SPEED ANGULAR-CONTACT FLANGED NON-SEPARABLE BEARINGS

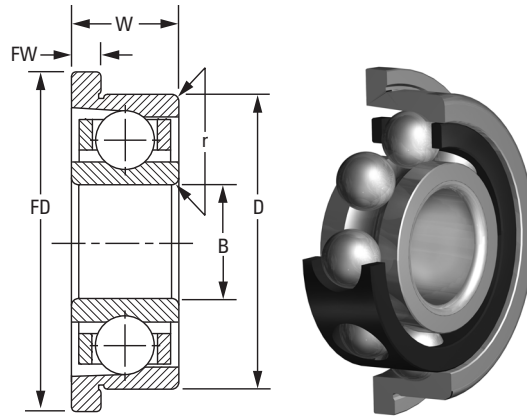
Bore	O.D.	Width	Chassis	Flange		Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾	Approx. Weight
				Dia.	Width	No.	Dia.	From	To	From	To	Dynamic	Static Radial	Static Thrust	Min.	Max.		
B	D	W		FD	FW	n	d					C	R _s	T _s			r	
in. mm	in. mm	in. mm		in. mm	in. mm		in. mm	in. mm				lbf N			in. mm	in. mm	oz. g	
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	0.359 9.12	0.023 0.58	7	1/16 1.59	0.0002 0.005	0.0005 0.013	9	14	89 396	21 93	37 165	0.138 3.51	0.160 4.06	0.005 0.13	0.024 0.68
								0.0005 0.013	0.0009 0.023	14	19	88 391	19 85	43 191				
								0.0009 0.023	0.0013 0.033	19	23	87 387	17 76	49 218				
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	0.359 9.12	0.023 0.58	7	1/16 1.59	0.0002 0.005	0.0005 0.013	9	14	91 405	22 98	39 173	0.163 4.14	0.178 4.52	0.003 0.08	0.020 0.57
								0.0005 0.013	0.0009 0.023	14	19	90 400	20 89	45 200				
								0.0009 0.023	0.0013 0.033	19	23	89 396	17 76	51 227				
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	0.422 10.72	0.023 0.58	7	1/16 1.59	0.0002 0.005	0.0005 0.013	9	15	93 414	23 102	43 191	0.167 4.24	0.201 5.11	0.005 0.13	0.034 0.96
								0.0005 0.013	0.0009 0.023	15	20	92 409	21 93	49 218				
								0.0009 0.023	0.0013 0.033	20	24	91 405	18 80	33 147				
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	0.440 11.18	0.030 0.76	8	1/16 1.59	0.0002 0.005	0.0005 0.013	11	17	114 507	32 142	61 271	0.178 4.52	0.203 5.16	0.012 0.30	0.050 1.42
								0.0005 0.013	0.0009 0.023	17	23	112 498	29 129	43 191				
								0.0009 0.023	0.0013 0.033	23	28	109 485	26 116	25 111				

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

Continued on next page.

MINIATURE AND INSTRUMENT BALL BEARINGS

HIGH-SPEED ANGULAR-CONTACT FLANGED NON-SEPARABLE BEARINGS



Continued from previous page.

Bore B	O.D. D	Width W	Chassis	Flange		Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
				Dia. FD	Width FW	No. n	Dia. d	From	To	From	To	Dynamic C	Static Radial R _s	Static Thrust T _s	Min.	Max.		
in. mm	in. mm	in. mm		in. mm	in. mm	in. mm	in. mm	in. mm	in. mm	From	To	lbf N	lbf N	lbf N	in. mm	in. mm	oz. g	
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	0.565 14.35	0.042 1.07	8	3/32 2.38	0.0002	0.0005	7	12	203	56	91	0.253 6.43	0.277 7.04	0.012 0.30	0.083 2.35
								0.005	0.013	12	16	903	249	405				
								0.0009	0.0013	16	19	202	52	102				
								0.023	0.033	19	21	899	231	454				
								0.0013	0.0017	21	24	200	47	113				
								0.033	0.043	24	26	890	209	503				
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	0.547 13.89	0.023 0.58	10	1/16 1.59	0.0002	0.0005	9	15	120	39	72	0.302 7.67	0.335 8.51	0.010 0.25	0.055 1.56
								0.005	0.009	15	20	202	52	102				
								0.0009	0.0013	20	24	899	231	454				
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	0.690 17.53	0.042 1.07	9	3/32 2.38	0.0002	0.0005	7	12	227	71	114	0.320 8.13	0.371 9.42	0.012 0.30	0.160 4.54
								0.005	0.009	12	16	1010	316	507				
								0.0009	0.0013	16	19	225	65	128				
								0.023	0.033	19	21	1001	289	569				
								0.0013	0.0017	21	24	223	60	141				
								0.033	0.043	24	26	992	267	627				
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	0.547 13.89	0.031 0.79	11	1/16 1.59	0.0002	0.0005	9	15	127	43	81	0.351 8.92	0.363 9.22	0.005 0.13	0.049 1.39
								0.005	0.009	15	20	565	191	360				
								0.0009	0.0013	20	24	125	39	92				

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

HIGH-SPEED ANGULAR-CONTACT SEPARABLE BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

NOTE: Not all available contact angle ranges listed. Contact your Timken engineer for additional information.

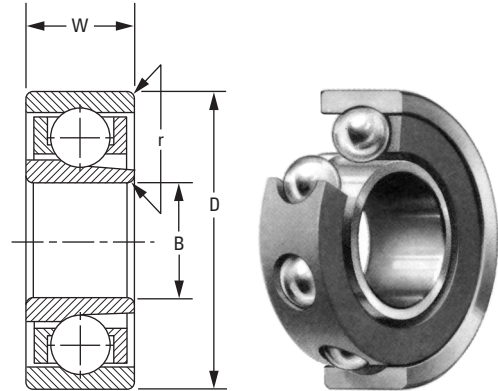
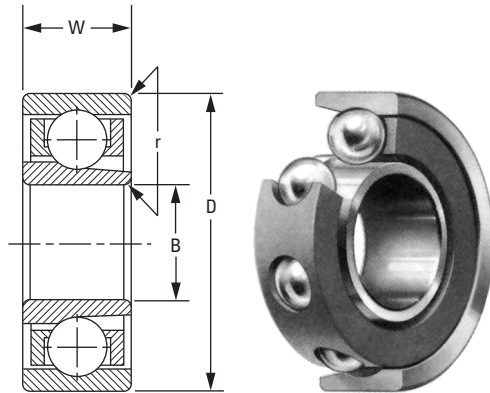


TABLE 30. HIGH-SPEED ANGULAR-CONTACT SEPARABLE BEARINGS

Bore B	O.D. D	Width W	Chassis	Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
				No. n	Dia. d	From	To	From	To	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
													Min.	Max.	Min.	Max.		
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	6	^{1/16} 1.59	0.0004 0.010	0.0010 0.025	12.5	19.5	79 351	16 71	37 165	0.135 3.43	0.160 4.06	0.248 6.30	0.275 6.99	0.005 0.13	0.022 0.62
						0.0010 0.025	0.0018 0.046	19.5	26.5	78 347	15 67	45 200						
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	7	^{1/16} 1.59	0.0004 0.010	0.0010 0.025	12.5	19.5	90 400	20 89	45 200	0.165 4.19	0.179 4.55	0.267 6.78	0.283 7.19	0.003 0.08	0.019 0.54
						0.0010 0.025	0.0018 0.046	19.5	26.5	87 387	16 71	55 245						
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	7	^{1/16} 1.59	0.0004 0.010	0.0010 0.025	13	21	92 409	21 93	50 222	0.165 4.19	0.200 5.08	0.298 7.57	0.333 8.46	0.005 0.13	0.033 0.94
						0.0010 0.025	0.0018 0.046	21	28	89 396	17 76	27 120						
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	7	^{1/16} 1.59	0.0004 0.010	0.0010 0.025	12	19	85 378	18 80	38 169	0.177 4.50	0.202 5.13	0.293 7.44	0.321 8.15	0.012 0.31	0.046 1.30
						0.0010 0.025	0.0018 0.046	19	25	83 369	15 67	47 209						
0.1575 4.000	0.6299 16.000	0.1969 5.000	34	6	^{1/8} 3.18	0.0005 0.013	0.0013 0.033	12.5	19.5	213 947	41 182	63 280	0.236 5.99	0.300 7.62	0.488 12.40	0.548 13.92	0.012 0.31	0.175 4.96
					0.0013 0.033	0.0021 0.053	13	17	211 939	37 165	75 334							
					0.0021 0.053	0.0029 0.074	17	20	208 925	37 165	86 383							
					0.0029 0.074	0.0035 0.089	20	22	206 916	37 165	94 418							
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	7	^{3/32} 2.38	0.0004 0.010	0.0012 0.030	10	18	184 818	44 196	92 409	0.248 6.30	0.277 7.04	0.410 10.41	0.443 11.25	0.012 0.31	0.074 2.10
					0.0012 0.030	0.0020 0.051	18	23	180 801	38 169	111 494							
					0.0020 0.051	0.0025 0.064	23	26	176 783	34 151	124 552							

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width W	Chassis	Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight oz. g		
				No. n	Dia. d	From	To	From	To	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.	Housing Min. Max.				
				in. mm	in. mm	in. mm		lbf N			in. mm	in. mm	in. mm	oz. g				
0.1969 5.000	0.6299 16.000	0.1969 5.000	345	6	1/8 3.18	0.0006 0.015	0.0014 0.036	11	16.5	263 1170	61 271	120 534	0.262 6.65	0.300 7.62	0.488 12.40	0.548 13.92	0.012 0.31	0.165 4.68
						0.0014 0.036	0.0022 0.056	16.5	21	258 1148	54 240	140 623						
0.2362 6.000	0.7480 19.000	0.2362 6.000	36	6	9/64 3.57	0.0005 0.013	0.0013 0.033	8	12.5	280 1246	59 262	89 396	0.318 8.08	0.385 9.78	0.596 15.14	0.662 16.81	0.012 0.31	0.275 7.80
						0.0013 0.033	0.0021 0.053	12.5	16	277 1232	52 231	104 463						
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	10	1/16 1.59	0.0004 0.010	0.0010 0.025	13	21	118 525	35 156	83 369	0.302 7.67	0.335 8.51	0.430 10.92	0.454 11.53	0.010 0.25	0.053 1.50
						0.0010 0.025	0.0018 0.046	21	28	114 507	29 129	48 214						
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	8	3/32 2.38	0.0004 0.010	0.0012 0.030	10	18	207 921	57 254	116 516	0.320 8.13	0.371 9.42	0.504 12.80	0.556 14.12	0.012 0.31	0.152 4.31
						0.0012 0.030	0.0020 0.051	18	23	203 903	49 218	139 618						
						0.0020 0.051	0.0025 0.064	23	26	199 885	44 196	155 689						
0.3150 8.000	0.8661 22.000	0.2756 7.000	38	7	5/32 3.97	0.0008 0.020	0.0016 0.041	11	15.5	453 2015	121 538	232 1032	0.396 10.06	0.462 11.73	0.692 17.58	0.771 19.58	0.012 0.31	0.417 11.82
						0.0016 0.041	0.0024 0.061	15.5	19	447 1988	109 485	263 1170						

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

HIGH-SPEED ANGULAR-CONTACT FLANGED SEPARABLE BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

NOTE: Not all available contact angle ranges listed. Contact your Timken engineer for additional information.

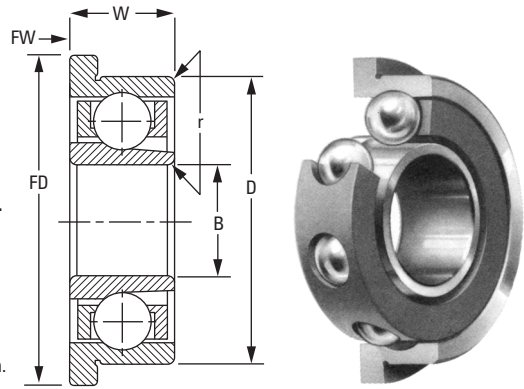


TABLE 31. HIGH-SPEED ANGULAR-CONTACT FLANGED SEPARABLE BEARINGS

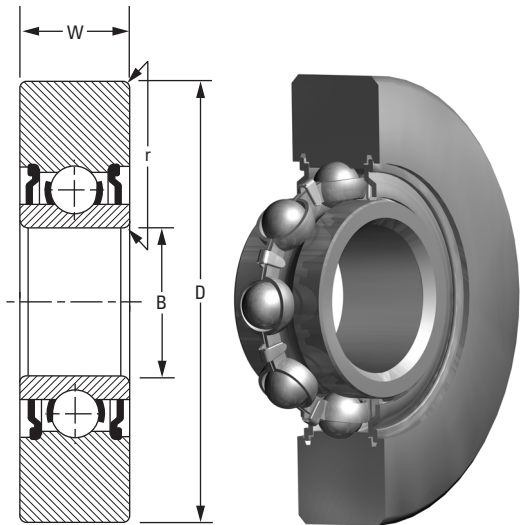
Bore	O.D.	Width	Chassis	Flange		Ball Complement		Radial Play		Reference Contact Angle		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾	Approx. Weight
				Dia.	Width	No.	Dia.	From	To	From	To	Dynamic	Static Radial	Static Thrust	Min.	Max.		
B	D	W		FD	FW	n	d					C	R _s	T _s			r	
in. mm	in. mm	in. mm		in. mm	in. mm		in. mm	in. mm				lbf N			in. mm	in. mm	oz. g	
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	0.359 9.12	0.023 0.58	6	1/16 1.59	0.0004 0.010	0.0010 0.025	12.5	19.5	79 351	16 71	37 165	0.135 3.43	0.160 4.06	0.005 0.13	0.022 0.62
								0.0010 0.025	0.0018 0.046	19.5	26.5	78 347	15 67	45 200				
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	0.359 9.12	0.023 0.58	7	1/16 1.59	0.0004 0.010	0.0010 0.025	12.5	19.5	90 400	20 89	45 200	0.165 4.19	0.179 4.55	0.003 0.08	0.019 0.54
								0.0010 0.025	0.0018 0.046	19.5	26.5	87 387	16 71	55 245				
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	0.422 10.72	0.023 0.58	7	1/16 1.59	0.0004 0.010	0.0010 0.025	13	21	92 409	21 93	50 222	0.165 4.19	0.200 5.08	0.005 0.13	0.033 0.94
								0.0010 0.025	0.0018 0.046	21	28	89 396	17 76	27 120				
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	0.440 11.18	0.030 0.76	7	1/16 1.59	0.0004 0.010	0.0010 0.025	12	19	85 378	18 80	38 169	0.177 4.50	0.202 5.13	0.012 0.31	0.046 1.30
								0.0010 0.025	0.0018 0.046	19	25	83 369	15 67	47 209				
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	0.565 14.35	0.042 1.07	7	3/32 2.38	0.0004 0.010	0.0012 0.030	10	18	184 818	44 196	92 409	0.248 6.30	0.277 7.04	0.012 0.31	0.074 2.10
								0.0012 0.030	0.0020 0.051	18	23	180 801	38 169	111 494				
								0.0020 0.051	0.0025 0.064	23	26	176 783	34 151	124 552				
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	0.547 13.89	0.023 0.58	10	1/16 1.59	0.0004 0.010	0.0010 0.025	13	21	118 525	35 156	83 369	0.302 7.67	0.335 8.51	0.010 0.25	0.053 1.50
								0.0010 0.025	0.0018 0.046	21	28	114 507	29 129	48 214				
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	0.690 17.53	0.042 1.07	8	3/32 2.38	0.0004 0.010	0.0012 0.030	10	18	207 921	57 254	116 516	0.320 8.13	0.371 9.42	0.012 0.31	0.152 4.31
								0.0012 0.030	0.0020 0.051	18	23	203 903	49 218	139 618				
								0.0020 0.051	0.0025 0.064	23	26	199 885	44 196	155 689				

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

MODIFIED DIMENSION SHIELDED RADIAL-RETAINER BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.



NOTE: Not all bearings in this table are cross-representative of flange shown. Contact your Timken engineer for more information.

TABLE 32. MODIFIED DIMENSION SHIELDED RADIAL-RETAINER BEARINGS

Bore B	O.D. D	Width W	Chassis	Std. Retainer Options	No. of Shields	Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight		
						No. n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.	Housing Min. Max.				
in. mm	in. mm	in. mm				in. mm	lbf N				in. mm	in. mm	in. mm	oz. g		
0.0937 2.380	0.2750 6.985	0.0625 1.588	A280	C	1	8	0.025 0.64	20 89	4 18	9 40	0.115 2.92	0.120 3.05	0.157 3.99	0.217 5.51	0.005 0.13	0.013 0.37
0.1250 3.175	0.3750 9.525	0.0937 2.380	A834	R	2	8	0.039 1.00	46 205	10 44	26 116	0.153 3.89	0.165 4.19	0.230 5.84	0.301 7.65	0.005 0.13	0.036 1.02
0.1250 3.175	0.3750 9.525	0.1094 2.779	A281	C	2	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.230 5.84	0.304 7.72	0.003 0.08	0.042 1.19
0.1250 3.175	0.4100 10.414	0.0937 2.380	A521	C	1	11	0.039 1.00	53 236	15 67	39 173	0.177 4.50	0.226 5.74	0.286 7.26	0.349 8.86	0.005 0.13	0.042 1.19
0.1250 3.175	0.4100 10.414	0.0937 2.380	B70	R	2	8	0.039 1.00	46 205	10 44	26 116	0.153 3.89	0.165 4.19	0.230 5.84	0.323 8.20	0.005 0.13	0.045 1.28
0.1250 3.175	0.5000 12.700	0.1094 2.779	A430	C	1	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.220 5.59	0.376 9.55	0.005 0.13	0.083 2.35
0.1250 3.175	0.5000 12.700	0.1094 2.779	A431	C	2	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.230 5.84	0.376 9.55	0.005 0.13	0.084 2.38
0.1875 4.763	0.5000 12.700	0.1094 2.779	B44	R	1	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.402 10.21	0.005 0.13	0.072 2.04
0.1875 4.763	0.5000 12.700	0.1562 3.967	D893	C	2	8	¹ / ₁₆ 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.343 8.71	0.410 10.41	0.012 0.30	0.095 2.69
0.1875 4.763	0.5000 12.700	0.1562 3.967	A872	R	2	8	¹ / ₁₆ 1.59	103 458	28 125	59 262	0.218 5.54	0.235 5.97	0.343 8.71	0.410 10.41	0.012 0.30	0.094 2.66
0.2500 6.350	1.0480 26.619	0.1960 4.978	B285	R	2	8	³ / ₃₂ 2.38	209 930	63 280	114 507	0.317 8.05	0.366 9.30	0.535 13.59	0.812 20.62	0.012 0.30	0.648 18.37
0.3750 9.525	0.8750 22.225	0.2188 5.558	F469	ST	2	17	¹ / ₁₆ 1.59	147 654	65 289	127 565	0.453 11.51	0.507 12.88	0.787 19.99	0.796 20.22	0.016 0.41	0.365 10.35

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL OPEN FULL-COMPLEMENT BEARINGS STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

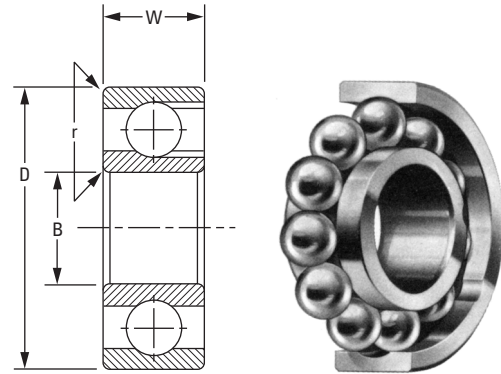
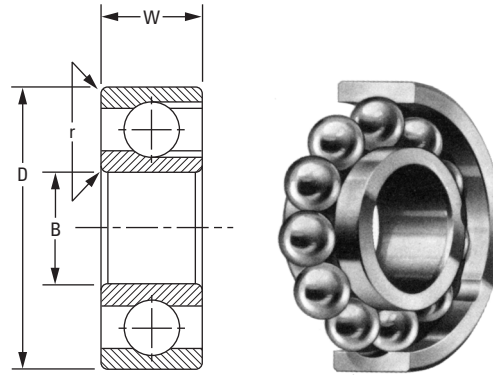


TABLE 33. RADIAL OPEN FULL-COMPLEMENT BEARINGS

Bore B	O.D. D	Width W	Chassis	Ball Complement		Load Ratings		Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight oz. g
				Number n	Dia. d	Dynamic C	Static Radial R _s	Shaft		Housing			
in. mm	in. mm	in. mm			in. mm	lbf N		in. mm	in. mm	in. mm	in. mm	in. mm	
0.0400 1.016	0.1250 3.175	0.0469 1.191	2	10	0.025 0.64	22 98	4 18	0.057 1.45	0.064 1.63	0.101 2.57	0.108 2.74	0.003 0.08	0.001 0.03
0.0469 1.191	0.1562 3.967	0.0625 1.588	25	10	1/32 0.79	33 147	7 31	0.072 1.83	0.081 2.06	0.128 3.25	0.134 3.40	0.003 0.08	0.003 0.09
0.0550 1.397	0.1875 4.763	0.0781 1.984	3	8	3/64 1.19	53 236	11 49	0.081 2.06	0.092 2.34	0.159 4.04	0.165 4.19	0.003 0.08	0.005 0.14
0.0781 1.984	0.2500 6.350	0.0937 2.380	4	8	1/16 1.59	90 400	20 89	0.108 2.74	0.124 3.15	0.215 5.46	0.225 5.72	0.003 0.08	0.011 0.31
0.0937 2.380	0.1875 4.763	0.0625 1.588	3332	14	1/32 0.79	42 187	11 49	0.115 2.92	0.120 3.05	0.164 4.17	0.167 4.24	0.003 0.08	0.004 0.11
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	11	1/16 1.59	124 552	34 151	0.136 3.45	0.173 4.39	0.271 6.88	0.285 7.24	0.005 0.13	0.022 0.62
0.1250 3.175	0.2500 6.350	0.0937 2.380	418	15	0.039 1.00	69 307	19 85	0.152 3.86	0.165 4.19	0.220 5.59	0.227 5.77	0.003 0.08	0.010 0.28
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	11	1/16 1.59	124 552	32 142	0.155 3.94	0.173 4.39	0.271 6.88	0.285 7.24	0.003 0.08	0.020 0.57
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	12	1/16 1.59	135 601	38 169	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.035 0.99
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	12	1/16 1.59	135 601	38 169	0.177 4.50	0.201 5.11	0.298 7.57	0.322 8.18	0.012 0.30	0.048 1.36
0.1562 3.967	0.3125 7.938	0.1094 2.779	5532	16	3/64 1.19	98 436	32 142	0.195 4.95	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.018 0.51
0.1875 4.763	0.3125 7.938	0.1094 2.779	5632	16	3/64 1.19	98 436	32 142	0.214 5.44	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.014 0.40
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	13	1/16 1.59	143 636	45 200	0.218 5.54	0.235 5.97	0.329 8.36	0.345 8.76	0.003 0.08	0.028 0.79
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	11	3/32 2.38	256 1139	78 347	0.243 6.17	0.272 6.91	0.415 10.54	0.444 11.28	0.012 0.30	0.081 2.30
0.2187 5.555	0.3125 7.938	0.1094 2.779	5732	26	1/32 0.79	59 262	24 107	0.241 6.12	0.246 6.25	0.285 7.24	0.290 7.37	0.003 0.08	0.012 0.34

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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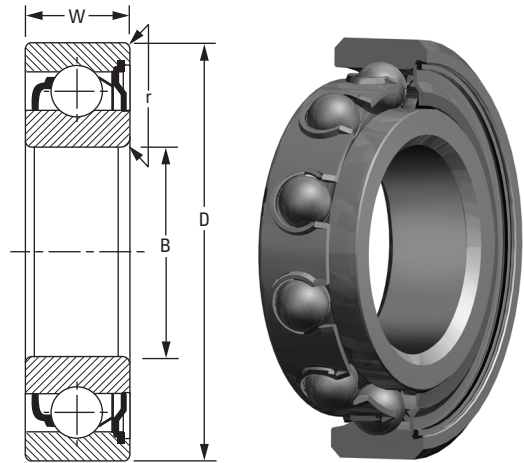
Bore B	O.D. D	Width W	Chassis	Ball Complement		Load Ratings		Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
				Number n	Dia. d	Dynamic C	Static Radial R _s	Shaft		Housing			
in. mm	in. mm	in. mm			in. mm	lbf N		in. mm	in. mm	in. mm	in. mm	in. mm	oz. g
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	25	0.039 1.00	92 409	36 160	0.277 7.04	0.289 7.34	0.342 8.69	0.351 8.92	0.003 0.08	0.022 0.62
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	19	¹ / ₁₆ 1.59	179 796	74 329	0.302 7.67	0.336 8.53	0.429 10.90	0.453 11.51	0.010 0.25	0.060 1.70
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	14	³ / ₃₂ 2.38	304 1352	111 494	0.318 8.08	0.366 9.30	0.509 12.93	0.557 14.15	0.012 0.30	0.161 4.56
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	20	¹ / ₁₆ 1.59	183 814	79 351	0.350 8.89	0.362 9.19	0.450 11.43	0.462 11.73	0.005 0.13	0.098 2.78

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

SINGLE-SHIELDED NARROW-WIDTH RADIAL-RETAINER BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.



NOTE: Not all bearings in this table are cross-representative of flange shown. Contact your Timken engineer for more information.

TABLE 34. SINGLE-SHIELDED NARROW-WIDTH RADIAL-RETAINER BEARINGS

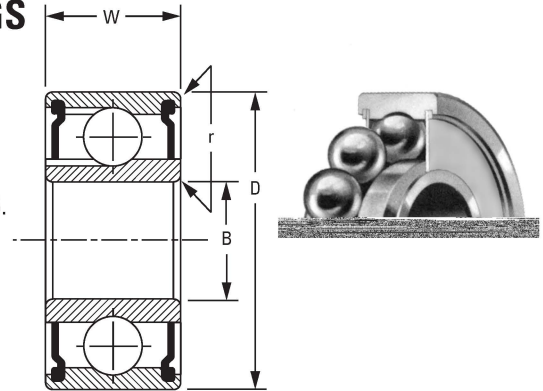
Bore B	O.D. D	Width W	Chassis	Std. Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight
					No. n	Diameter d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm				in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
0.0550 1.397	0.1875 4.763	0.0937 2.380	3	C	5	³ / ₆₄ 1.19	40 178	8 36	17 76	0.082 2.08	0.092 2.34	0.159 4.04	0.165 4.19	0.003 0.08	0.006 0.17
0.0781 1.984	0.2500 6.350	0.1094 2.779	4	C	5	¹ / ₁₆ 1.59	65 289	13 58	27 120	0.108 2.74	0.124 3.15	0.215 5.46	0.224 5.69	0.003 0.08	0.012 0.34
0.0937 2.380	0.3125 7.938	0.1094 2.779	5 ⁽²⁾	C,R	6	¹ / ₁₆ 1.590	81 360	19 85	40 178	0.137 3.48	0.173 4.39	0.271 6.88	0.284 7.21	0.005 0.13	0.021 0.60
0.1250 3.175	0.2500 6.350	0.0937 2.380	418 ⁽²⁾	C,R	7	0.039 1.00	42 187	9 40	23 102	0.153 3.89	0.165 4.19	0.220 5.59	0.226 5.74	0.003 0.08	0.009 0.26
0.1250 3.175	0.3125 7.938	0.1094 2.779	518 ⁽²⁾	C,R	6	¹ / ₁₆ 1.59	81 360	19 85	40 178	0.156 3.96	0.173 4.39	0.271 6.88	0.284 7.21	0.003 0.08	0.018 0.51
0.1250 3.175	0.3750 9.525	0.1094 2.779	618 ⁽²⁾	C	7	¹ / ₁₆ 1.59	94 418	23 102	49 218	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.033 0.94
0.1562 3.967	0.3125 7.938	0.1094 2.779	5532 ⁽²⁾	C,R	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.195 4.95	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.017 0.48
0.1875 4.763	0.3125 7.938	0.1094 2.779	5632 ⁽²⁾	C,R	7	³ / ₆₄ 1.19	56 249	14 62	35 156	0.214 5.44	0.225 5.72	0.285 7.24	0.290 7.37	0.003 0.08	0.013 0.37
0.2500 6.350	0.5000 12.700	0.1250 3.175	814 ⁽²⁾	C,R	10	¹ / ₁₆ 1.59	120 534	39 173	81 360	0.302 7.67	0.335 8.51	0.430 10.92	0.454 11.53	0.010 0.25	0.055 1.56

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Equal outer dimensions to open bearing (see pages 50-51).

RADIAL SHIELDED FULL-COMPLEMENT BEARINGS
STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.



0.0937 2.380	0.3125 7.938	0.1406 3.571	5	11	$\frac{1}{16}$ 1.59	124 552	34 151	0.136 3.45	0.173 4.39	0.271 6.88	0.285 7.24	0.005 0.13	0.029 0.82
0.1250 3.175	0.2500 6.350	0.1094 2.779	418	15	0.039 1.00	69 307	19 85	0.152 3.86	0.165 4.19	0.220 5.59	0.227 5.77	0.003 0.08	0.012 0.34
0.1250 3.175	0.3125 7.938	0.1406 3.571	518	11	$\frac{1}{16}$ 1.59	124 552	32 142	0.155 3.94	0.173 4.39	0.271 6.88	0.285 7.24	0.003 0.08	0.025 0.71
0.1250 3.175	0.3750 9.525	0.1406 3.571	618	12	$\frac{1}{16}$ 1.59	135 601	38 169	0.167 4.24	0.201 5.11	0.298 7.57	0.333 8.46	0.005 0.13	0.045 1.28
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	12	$\frac{1}{16}$ 1.59	135 601	38 169	0.177 4.50	0.201 5.11	0.298 7.57	0.322 8.18	0.012 0.30	0.050 1.42
0.1562 3.967	0.3125 7.938	0.1250 3.175	5532	16	$\frac{3}{64}$ 1.19	98 436	32 142	0.195 4.95	0.225 5.72	0.285 7.24	0.29 7.37	0.003 0.08	0.022 0.62
0.1875 4.763	0.3125 7.938	0.1250 3.175	5632	16	$\frac{3}{64}$ 1.19	98 436	32 142	0.214 5.44	0.225 5.72	0.285 7.24	0.29 7.37	0.003 0.08	0.017 0.48
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	13	$\frac{1}{16}$ 1.59	143 636	45 200	0.218 5.54	0.235 5.97	0.329 8.36	0.345 8.76	0.003 0.08	0.030 0.85
0.1875 4.763	0.5000 12.700	0.1960 4.978	R3	11	$\frac{3}{32}$ 2.38	256 1139	78 347	0.243 6.17	0.272 6.91	0.415 10.54	0.444 11.28	0.012 0.30	0.103 2.92
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	25	0.039 1.00	92 409	36 160	0.277 7.04	0.289 7.34	0.342 8.69	0.351 8.92	0.003 0.08	0.023 0.65
0.2500 6.350	0.5000 12.700	0.1875 4.763	814	19	$\frac{1}{16}$ 1.59	179 796	74 329	0.302 7.67	0.336 8.53	0.429 10.90	0.453 11.51	0.010 0.25	0.088 2.49
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	14	$\frac{3}{32}$ 2.38	304 1352	111 494	0.318 8.08	0.366 9.30	0.509 12.93	0.557 14.15	0.012 0.30	0.169 4.79
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	20	$\frac{1}{16}$ 1.59	183 814	79 351	0.350 8.89	0.362 9.19	0.450 11.43	0.462 11.73	0.005 0.13	0.101 2.86

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL OPEN-FLANGED FULL-COMPLEMENT BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

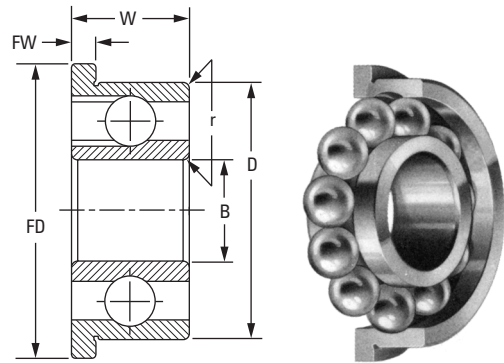


TABLE 36. RADIAL OPEN-FLANGED FULL-COMPLEMENT BEARINGS

Bore B	O.D. D	Width W	Chassis	Flange		Ball Complement		Load Ratings		Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
				Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Shaft			
in. mm	in. mm	in. mm		in. mm	in. mm	in. mm	in. mm	lbf N		in. mm	in. mm	oz. g	
0.0400 1.016	0.1250 3.175	0.0469 1.191	2	0.1710 4.340	0.0130 0.330	10	0.025 0.64	22 98	4 18	0.057 1.45	0.064 1.63	0.003 0.08	0.002 0.06
0.0469 1.191	0.1562 3.967	0.0625 1.588	25	0.2030 5.160	0.0130 0.330	10	1/32 0.79	33 147	7 31	0.072 1.83	0.081 2.06	0.003 0.08	0.004 0.11
0.0550 1.397	0.1875 4.763	0.0781 1.984	3	0.2340 5.940	0.0230 0.580	8	3/64 1.19	53 236	11 49	0.081 2.06	0.092 2.34	0.003 0.08	0.007 0.20
0.0781 1.984	0.2500 6.350	0.0937 2.380	4	0.2960 7.520	0.0230 0.580	8	1/16 1.59	90 400	20 89	0.108 2.74	0.124 3.15	0.003 0.08	0.014 0.40
0.0937 2.380	0.1875 4.763	0.0625 1.588	3332	0.2340 5.940	0.0180 0.460	14	1/32 0.79	42 187	11 49	0.115 2.92	0.120 3.05	0.003 0.08	0.005 0.14
0.0937 2.380	0.3125 7.938	0.1094 2.779	5	0.3590 9.120	0.0230 0.580	11	1/16 1.59	124 552	34 151	0.136 3.45	0.173 4.39	0.005 0.13	0.025 0.71
0.1250 3.175	0.2500 6.350	0.0937 2.380	418	0.2960 7.520	0.0230 0.580	15	0.039 1.00	69 307	19 85	0.152 3.86	0.165 4.19	0.003 0.08	0.012 0.34
0.1250 3.175	0.3125 7.938	0.1094 2.779	518	0.3590 9.120	0.0230 0.580	11	1/16 1.59	124 552	32 142	0.155 3.94	0.173 4.39	0.003 0.08	0.022 0.62
0.1250 3.175	0.3750 9.525	0.1094 2.779	618	0.4220 10.720	0.0230 0.580	12	1/16 1.59	135 601	38 169	0.167 4.24	0.201 5.11	0.005 0.13	0.038 1.08
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	0.4400 11.180	0.0300 0.760	12	1/16 1.59	135 601	38 169	0.177 4.50	0.201 5.11	0.012 0.30	0.035 0.99
0.1562 3.967	0.3125 7.938	0.1094 2.779	5532	0.3590 9.120	0.0230 0.580	16	3/64 1.19	98 436	32 142	0.195 4.95	0.225 5.72	0.003 0.08	0.021 0.60
0.1875 4.763	0.3125 7.938	0.1094 2.779	5632	0.3590 9.120	0.0230 0.580	16	3/64 1.19	98 436	32 142	0.214 5.44	0.225 5.72	0.003 0.08	0.017 0.48
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	0.4220 10.720	0.0230 0.580	13	1/16 1.59	143 636	45 200	0.218 5.54	0.235 5.97	0.003 0.08	0.031 0.88
0.1875 4.763	0.5000 12.700	0.1562 3.967	R3	0.5650 14.350	0.0420 1.070	11	3/32 2.38	256 1139	78 347	0.243 6.17	0.272 6.91	0.012 0.30	0.091 2.58
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	0.4220 10.720	0.0230 0.580	25	0.039 1.00	92 409	36 160	0.277 7.04	0.289 7.34	0.003 0.08	0.025 0.71
0.2500 6.350	0.5000 12.700	0.1250 3.175	814	0.5470 13.890	0.0230 0.580	19	1/16 1.59	183 814	74 329	0.302 7.67	0.336 8.53	0.010 0.25	0.064 1.81
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	0.6900 17.530	0.0420 1.070	14	3/32 2.38	304 1352	111 494	0.318 8.08	0.366 9.30	0.012 0.30	0.174 4.93
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	0.5470 13.890	0.0310 0.790	20	1/16 1.59	183 814	79 351	0.350 8.89	0.362 9.19	0.005 0.13	0.056 1.59

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL SHIELDED-FLANGED FULL-COMPLEMENT BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

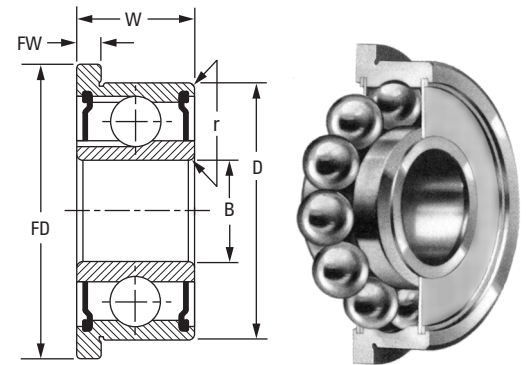


TABLE 37. RADIAL SHIELDED-FLANGED FULL-COMPLEMENT BEARINGS

Bore B	O.D. D	Width W	Chassis	Flange		Ball Complement		Load Ratings		Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
				Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Shaft			
in. mm	in. mm	in. mm		in. mm	in. mm	in. mm	in. mm	lbf N	lbf N	in. mm	in. mm	in. mm	oz. g
0.0550 1.397	0.1875 4.763	0.1094 2.779	3	0.2340 5.940	0.0310 0.790	8	3/64 1.19	53 236	11 49	0.081 2.06	0.092 2.34	0.003 0.08	0.010 0.28
0.0781 1.984	0.2500 6.350	0.1406 3.571	4	0.2960 7.520	0.0310 0.790	8	1/16 1.59	90 400	20 89	0.108 2.74	0.124 3.15	0.003 0.08	0.020 0.57
0.0937 2.380	0.1875 4.763	0.0937 2.380	3332	0.2340 5.940	0.0310 0.790	14	1/32 0.79	42 187	11 49	0.115 2.92	0.120 3.05	0.003 0.08	0.008 0.23
0.0937 2.380	0.3125 7.938	0.1406 3.571	5	0.3590 9.120	0.0310 0.790	11	1/16 1.59	124 552	34 151	0.136 3.45	0.173 4.39	0.005 0.13	0.032 0.91
0.1250 3.175	0.2500 6.350	0.1094 2.779	418	0.2960 7.520	0.0310 0.790	15	0.039 1.00	69 307	19 85	0.152 3.86	0.165 4.19	0.003 0.08	0.015 0.43
0.1250 3.175	0.3125 7.938	0.1406 3.571	518	0.3590 9.120	0.0310 0.790	11	1/16 1.59	124 552	32 142	0.155 3.94	0.173 4.39	0.003 0.08	0.029 0.82
0.1250 3.175	0.3750 9.525	0.1406 3.571	618	0.4220 10.720	0.0310 0.790	12	1/16 1.59	135 601	38 169	0.167 4.24	0.201 5.11	0.005 0.13	0.049 1.39
0.1250 3.175	0.3750 9.525	0.1562 3.967	R2	0.4400 11.180	0.0300 0.760	12	1/16 1.59	135 601	38 169	0.177 4.50	0.201 5.11	0.012 0.30	0.037 1.05
0.1562 3.967	0.3125 7.938	0.1250 3.175	5532	0.3590 9.120	0.0360 0.910	16	3/64 1.19	98 436	32 142	0.195 4.95	0.225 5.72	0.003 0.08	0.026 0.74
0.1875 4.763	0.3125 7.938	0.1250 3.175	5632	0.3590 9.120	0.0360 0.910	16	3/64 1.19	98 436	32 142	0.214 5.44	0.225 5.72	0.003 0.08	0.021 0.60
0.1875 4.763	0.3750 9.525	0.1250 3.175	6316	0.4220 10.720	0.0310 0.790	13	1/16 1.59	143 636	45 200	0.218 5.54	0.235 5.97	0.003 0.08	0.034 0.96
0.1875 4.763	0.5000 12.700	0.1960 4.978	R3	0.5650 14.350	0.0420 1.070	11	3/32 2.38	256 1139	78 347	0.243 6.17	0.272 6.91	0.012 0.30	0.113 3.20
0.2500 6.350	0.3750 9.525	0.1250 3.175	614	0.4220 10.720	0.0360 0.910	25	0.039 1.00	92 409	36 160	0.277 7.04	0.289 7.34	0.003 0.08	0.028 0.79
0.2500 6.350	0.5000 12.700	0.1875 4.763	814	0.5470 13.890	0.0450 1.140	19	1/16 1.59	183 814	74 329	0.302 7.67	0.336 8.53	0.010 0.25	0.096 2.72
0.2500 6.350	0.6250 15.875	0.1960 4.978	R4	0.6900 17.530	0.0420 1.070	14	3/32 2.38	304 1352	111 494	0.318 8.08	0.366 9.30	0.012 0.30	0.181 5.13
0.3125 7.938	0.5000 12.700	0.1562 3.967	8516	0.5470 13.890	0.0310 0.790	20	1/16 1.59	183 814	79 351	0.350 8.89	0.362 9.19	0.005 0.13	0.059 1.67

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER OPEN BEARINGS – METRIC

STANDARD SPECIFICATIONS

Tolerances All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.

Radial Play Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).

Lubrication Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).

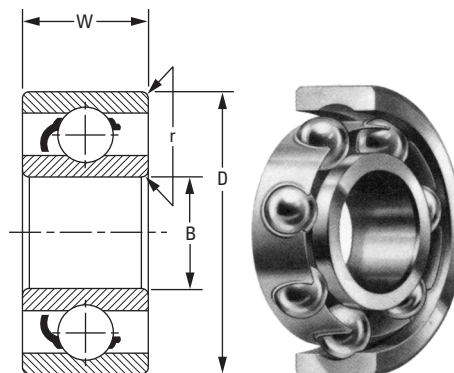
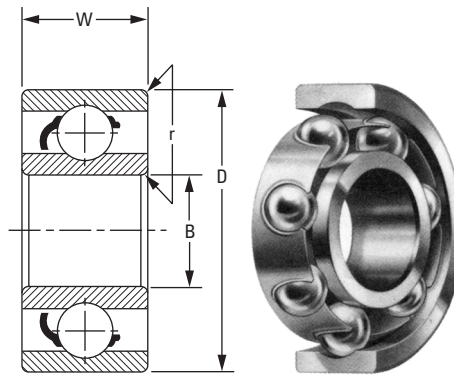


TABLE 38. RADIAL RETAINER OPEN BEARINGS – METRIC

Bore	O.D.	Width	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾	Approx. Weight
					Number	Dia.	Dynamic	Static Radial	Static Thrust	Shaft		Housing			
B	D	W			n	d	C	R _s	T _s	Min.	Max.	Min.	Max.	r	
mm in.	mm in.	mm in.				mm in.		N lbf.		mm in.		mm in.		mm in.	g oz.
1.000 0.0394	4.000 0.1575	1.600 0.0630	EL1	C	6	0.79 1/32	98 22	18 4	49 11	1.68 0.066	1.93 0.076	3.12 0.123	3.35 0.132	0.13 0.005	0.09 0.003
1.500 0.0591	5.000 0.1969	2.000 0.0787	EL15	C	7	0.79 1/32	116 26	22 5	67 15	2.41 0.095	3.05 0.120	4.19 0.165	4.37 0.172	0.13 0.005	0.20 0.007
				R	8	0.79 1/32	129 29	27 6	71 16	2.39 0.094	2.95 0.116	4.09 0.161	4.34 0.171	0.08 0.003	0.17 0.006
2.000 0.0787	5.000 0.1969	1.500 0.0591	UL20	C	7	0.79 1/32	116 26	22 5	67 15	2.72 0.107	3.05 0.120	4.19 0.165	4.37 0.172	0.13 0.005	0.11 0.004
2.000 0.0787	6.000 0.2362	2.300 0.0906	EL2	C	7	0.79 1/32	116 26	22 5	67 15	2.72 0.107	3.05 0.120	4.19 0.165	4.98 0.196	0.13 0.005	0.34 0.012
3.000 0.1181	7.000 0.2756	2.000 0.0787	UL30	C	9	1.00 0.039	218 49	49 11	129 29	3.76 0.148	4.14 0.163	5.66 0.223	6.17 0.243	0.13 0.005	0.34 0.012
3.000 0.1181	10.000 0.3937	4.000 0.1575	EL3	C, R	7	1.59 1/16	418 94	102 23	218 49	4.37 0.172	5.11 0.201	7.59 0.299	8.51 0.335	0.30 0.012	1.53 0.054
4.000 0.1575	9.000 0.3543	2.500 0.0984	UL40	C	7	1.59 1/16	418 94	102 23	218 49	4.77 0.188	5.11 0.201	7.57 0.298	8.13 0.320	0.13 0.005	0.62 0.022
4.000 0.1575	13.000 0.5118	5.000 0.1969	EL4	R	6	2.38 3/32	725 163	191 43	343 77	5.72 0.225	6.99 0.275	10.46 0.412	11.46 0.451	0.30 0.012	1.73 0.061
4.000 0.1575	16.000 0.6299	5.000 0.1969	34	R	6	3.18 1/8	1192 268	302 68	480 108	5.94 0.234	7.47 0.294	12.52 0.493	14.05 0.553	0.30 0.012	4.82 0.170
5.000 0.1969	11.000 0.4331	3.000 0.1181	UL50	C	8	1.59 1/16	458 103	125 28	169 38	6.05 0.238	6.68 0.263	9.32 0.367	9.96 0.392	0.15 0.006	1.13 0.040
5.000 0.1969	16.000 0.6299	5.000 0.1969	EL5	R	6	3.18 1/8	1192 268	302 68	480 108	6.53 0.257	7.47 0.294	12.52 0.493	14.07 0.554	0.30 0.012	4.82 0.170
5.000 0.1969	16.000 0.6299	5.000 0.1969	345	R	6	3.18 1/8	1192 268	302 68	480 108	6.55 0.258	7.47 0.294	12.52 0.493	14.05 0.553	0.30 0.012	4.82 0.170

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight g oz.
					Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
										Min.	Max.	Min.	Max.		
5.000 0.1969	19.000 0.7480	6.000 0.2362	35	R	6	3.57 9/64	1477 332	423 95	618 139	7.47 0.294	9.78 0.385	15.14 0.596	16.89 0.665	0.30 0.012	8.50 0.300
6.000 0.2362	13.000 0.5118	3.500 0.1378	UL60	C	8	1.98 5/64	689 155	178 40	316 71	7.24 0.285	7.92 0.312	10.77 0.424	11.63 0.458	0.25 0.010	1.84 0.065
6.000 0.2362	19.000 0.7480	6.000 0.2362	EL6	R	6	3.57 9/64	1477 332	423 95	618 139	8.15 0.321	9.78 0.385	15.14 0.596	16.81 0.662	0.30 0.012	8.16 0.288
6.000 0.2362	19.000 0.7480	6.000 0.2362	36	R, MC	6	3.57 9/64	1477 332	423 95	618 139	8.08 0.318	9.78 0.385	15.14 0.596	16.89 0.665	0.30 0.012	8.08 0.285
7.000 0.2756	14.000 0.5512	3.500 0.1378	UL70	C	10	1.59 1/16	534 120	173 39	360 81	8.08 0.318	8.53 0.336	10.92 0.430	12.29 0.484	0.25 0.010	2.24 0.079
7.000 0.2756	19.000 0.7480	6.000 0.2362	EL7	R	6	3.57 9/64	1477 332	423 95	618 139	8.76 0.345	9.78 0.385	15.14 0.596	16.81 0.662	0.30 0.012	7.65 0.270
7.000 0.2756	22.000 0.8661	7.000 0.2756	37	R	7	3.97 5/32	1988 447	618 139	947 213	9.45 0.372	11.73 0.462	17.58 0.692	19.69 0.775	0.30 0.012	12.93 0.456
8.000 0.3150	22.000 0.8661	7.000 0.2756	EL8	R	7	3.97 5/32	1988 447	618 139	947 213	9.88 0.389	11.73 0.462	17.58 0.692	19.86 0.782	0.30 0.012	12.33 0.435
8.000 0.3150	22.000 0.8661	7.000 0.2756	38	R, MC	7	3.97 5/32	1988 447	618 139	947 213	10.06 0.396	11.73 0.462	17.58 0.692	19.69 0.775	0.30 0.012	12.25 0.432
9.000 0.3543	26.000 1.0236	8.000 0.3150	EL9	R	7	4.76 3/16	4252 956	1864 419	2949 663	13.11 0.516	15.39 0.606	21.26 0.837	23.34 0.919	0.41 0.016	20.78 0.733

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER SHIELDED BEARINGS – METRIC

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).

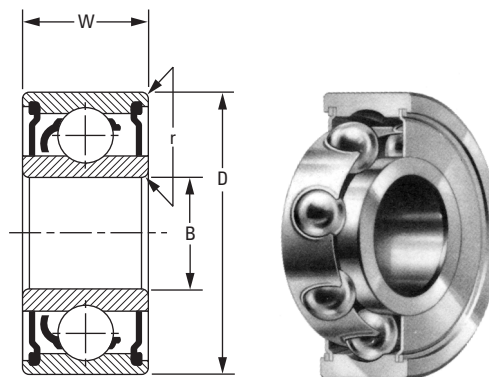


TABLE 39. RADIAL RETAINER SHIELDED BEARINGS – METRIC

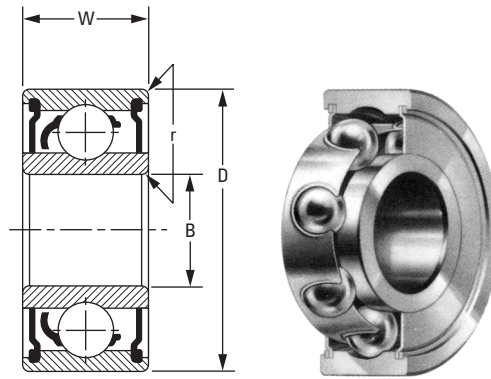
Bore	O.D.	Width	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾	Approx. Weight
					Number	Dia.	Dynamic	Static Radial	Static Thrust	Shaft		Housing			
										Min.	Max.	Min.	Max.		
1.500 0.0591	5.000 0.1969	2.600 0.1024	EL15	C	7	0.79 1/32	116 26	22 5	67 15	2.41 0.095	3.05 0.120	4.19 0.165	4.37 0.172	0.13 0.005	0.26 0.009
1.500 0.0591	5.000 0.1969	2.000 0.0787	EL15 ⁽²⁾	R	8	0.79 1/32	129 29	27 6	71 16	2.39 0.094	2.95 0.116	4.09 0.161	4.34 0.171	0.08 0.003	0.20 0.007
2.000 0.0787	5.000 0.1969	2.300 0.0906	UL20	C	7	0.79 1/32	116 26	22 5	67 15	2.51 0.099	2.59 0.102	4.19 0.165	4.37 0.172	0.13 0.005	0.20 0.007
2.000 0.0787	6.000 0.2362	3.000 0.1181	EL2	C	8	0.64 0.025	80 18	18 4	27 6	2.69 0.106	3.05 0.120	3.99 0.157	4.90 0.193	0.13 0.005	0.48 0.017
2.000 0.0787	6.000 0.2362	2.300 0.0906	EL2C ⁽²⁾	C	8	0.64 0.025	80 18	18 4	27 6	2.69 0.106	3.05 0.120	3.99 0.157	4.90 0.193	0.13 0.005	0.37 0.013
3.000 0.1181	7.000 0.2756	3.000 0.1181	UL30	C	9	1.00 0.039	218 49	49 11	129 29	3.60 0.142	3.68 0.145	5.66 0.223	6.17 0.243	0.13 0.005	0.51 0.018
3.000 0.1181	10.000 0.3937	4.000 0.1575	EL3	C, R	7	1.59 1/16	418 94	102 23	218 49	4.37 0.172	5.11 0.201	7.59 0.299	8.51 0.335	0.30 0.012	1.59 0.056
4.000 0.1575	9.000 0.3543	4.000 0.1575	UL40	C	7	1.59 1/16	418 94	102 23	218 49	4.70 0.185	4.80 0.189	7.57 0.298	8.13 0.320	0.13 0.005	0.99 0.035
4.000 0.1575	13.000 0.5118	5.000 0.1969	EL4	R	6	2.38 3/32	725 163	191 43	343 77	5.46 0.215	6.31 0.249	10.46 0.412	11.46 0.451	0.30 0.012	1.87 0.066
4.000 0.1575	16.000 0.6299	5.000 0.1969	34	R	6	3.18 1/8	1192 268	302 68	480 108	5.54 0.218	6.40 0.252	12.52 0.493	14.05 0.553	0.30 0.012	5.33 0.188
5.000 0.1969	11.000 0.4331	5.000 0.1969	UL50	C	8	1.59 1/16	458 103	125 28	169 38	6.05 0.238	6.68 0.263	9.32 0.367	9.96 0.392	0.15 0.006	1.87 0.066
5.000 0.1969	16.000 0.6299	5.000 0.1969	EL5	R	6	3.18 1/8	1192 268	302 68	480 108	6.30 0.248	6.40 0.252	12.52 0.493	14.07 0.554	0.30 0.012	5.02 0.177
5.000 0.1969	16.000 0.6299	5.000 0.1969	345	R	6	3.18 1/8	1192 268	302 68	480 108	6.30 0.248	6.40 0.252	12.52 0.493	14.05 0.553	0.30 0.012	5.05 0.178

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Narrow width N design.

⁽³⁾Single shield only available for MC retainer.

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Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽¹⁾ r	Approx. Weight g oz.
					Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
										Min.	Max.	Min.	Max.		
5.000 0.1969	19.000 0.7480	6.000 0.2362	35	R	6	3.57 9/64	1477 332	423 95	618 139	6.99 0.275	8.56 0.337	15.14 0.596	16.89 0.665	0.30 0.012	8.90 0.314
6.000 0.2362	13.000 0.5118	5.000 0.1969	UL60	C	8	1.98 5/64	689 155	178 40	316 71	7.11 0.280	7.62 0.300	10.77 0.424	11.63 0.458	0.25 0.010	2.69 0.095
6.000 0.2362	19.000 0.7480	6.000 0.2362	EL6	R	6	3.57 9/64	1477 332	423 95	618 139	7.57 0.298	8.56 0.337	15.14 0.596	16.81 0.662	0.30 0.012	8.53 0.301
6.000 0.2362	19.000 0.7480	6.000 0.2362	36	R, MC ⁽³⁾	6	3.57 9/64	1477 332	423 95	618 139	7.57 0.298	8.56 0.337	15.14 0.596	16.89 0.665	0.30 0.012	8.42 0.297
7.000 0.2756	14.000 0.5512	5.000 0.1969	UL70	C	10	1.59 1/16	534 120	173 39	360 81	8.08 0.318	8.53 0.336	10.92 0.430	12.29 0.484	0.25 0.010	3.23 0.114
7.000 0.2756	19.000 0.7480	6.000 0.2362	EL7	R	6	3.57 9/64	1477 332	423 95	618 139	8.76 0.345	9.78 0.385	15.14 0.596	16.81 0.662	0.30 0.012	8.05 0.284
7.000 0.2756	22.000 0.8661	7.000 0.2756	37	R	7	3.97 5/32	1988 447	618 139	947 213	8.92 0.351	10.44 0.411	17.58 0.692	19.69 0.775	0.30 0.012	13.61 0.480
8.000 0.3150	22.000 0.8661	7.000 0.2756	EL8	R	7	3.97 5/32	1988 447	618 139	947 213	9.88 0.389	11.73 0.462	17.58 0.692	19.86 0.782	0.30 0.012	13.01 0.459
8.000 0.3150	22.000 0.8661	7.000 0.2756	38	R, MC ⁽³⁾	7	3.97 5/32	1988 447	618 139	947 213	9.65 0.380	10.44 0.411	17.58 0.692	19.69 0.775	0.30 0.012	12.96 0.457
9.000 0.3543	26.000 1.0236	8.000 0.3150	EL9	R	7	4.76 3/16	4252 956	1864 419	2949 663	13.11 0.516	13.84 0.545	21.26 0.837	23.34 0.919	0.41 0.016	21.60 0.762

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

⁽²⁾Narrow width N design.

⁽³⁾Single shield only available for MC retainer.

RADIAL RETAINER FLANGED OPEN BEARINGS – METRIC

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).

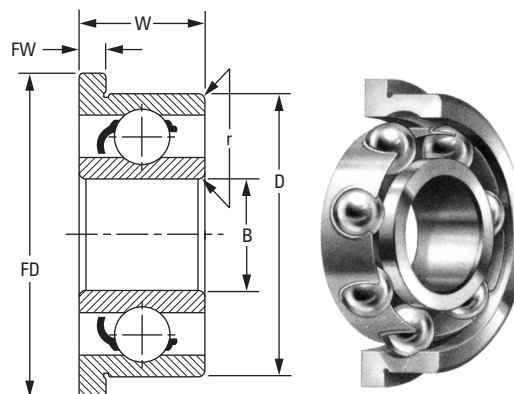


TABLE 40. RADIAL RETAINER FLANGED OPEN BEARINGS – METRIC

Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
					Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Min.	Max.		
mm in.	mm in.	mm in.			mm in.	mm in.	mm in.	mm in.	N lbf.			mm in.	mm in.	g oz.	
1.000 0.0394	4.000 0.1575	1.600 0.0630	EL1	C	5.00 0.197	0.50 0.020	6	0.79 1/32	98 22	18 4	49 11	1.68 0.066	1.93 0.076	0.13 0.005	0.11 0.004
1.500 0.0591	5.000 0.1969	2.000 0.0787	EL15	C	6.50 0.256	0.60 0.024	7	0.79 1/32	116 26	22 5	67 15	2.41 0.095	3.05 0.120	0.13 0.005	0.26 0.009
1.500 0.0591	5.000 0.1969	2.000 0.0787		R	6.50 0.256	0.60 0.024	8	0.79 1/32	129 29	27 6	71 16	2.39 0.094	2.95 0.116	0.13 0.005	0.26 0.009
2.000 0.0787	5.000 0.1969	1.500 0.0591	UL20	C	6.10 0.240	0.50 0.020	7	0.79 1/32	116 26	22 5	67 15	2.72 0.107	3.05 0.120	0.13 0.005	0.17 0.006
2.000 0.0787	6.000 0.2362	2.300 0.0906	EL2	C	7.50 0.295	0.60 0.024	7	0.79 1/32	116 26	22 5	67 15	2.72 0.107	3.05 0.120	0.13 0.005	0.34 0.012
3.000 0.1181	7.000 0.2756	2.000 0.0787	UL30	C	8.10 0.319	0.50 0.020	9	1.00 0.039	218 49	49 11	129 29	3.76 0.148	4.14 0.163	0.13 0.005	0.34 0.012
3.000 0.1181	10.000 0.3937	4.000 0.1575	EL3	C,R	11.50 0.453	1.00 0.039	7	1.59 1/16	418 94	102 23	218 49	4.37 0.172	5.11 0.201	0.30 0.012	1.53 0.054
4.000 0.1575	9.000 0.3543	2.500 0.0984	UL40	C	10.30 0.406	0.60 0.024	7	1.59 1/16	418 94	102 23	218 49	4.77 0.188	5.11 0.201	0.13 0.005	0.62 0.022
5.000 0.1969	11.000 0.4331	3.000 0.1181	UL50	C	12.50 0.492	0.80 0.031	8	1.59 1/16	458 103	125 28	169 38	6.05 0.238	6.68 0.263	0.15 0.006	1.30 0.046
6.000 0.2362	13.000 0.5118	3.500 0.1378	UL60	C	15.00 0.591	1.00 0.039	8	1.98 5/64	689 155	178 40	316 71	7.24 0.285	7.92 0.312	0.25 0.010	2.18 0.077
7.000 0.2756	14.000 0.5512	3.500 0.1378	UL70	C	16.00 0.630	1.00 0.039	10	1.59 1/16	534 120	173 39	360 81	8.08 0.318	8.53 0.336	0.25 0.010	2.61 0.092

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

RADIAL RETAINER FLANGED SHIELDED BEARINGS – METRIC

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) or ABEC 7P (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 20, 21 and 25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).

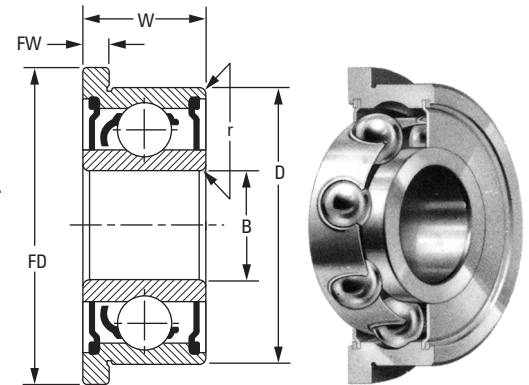


TABLE 41. RADIAL RETAINER FLANGED SHIELDED BEARINGS – METRIC

Bore B	O.D. D	Width W	Chassis	Standard Retainer Options	Flange		Ball Complement		Load Ratings			Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight
					Dia. FD	Width FW	Number n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft Min. Max.			
mm in.	mm in.	mm in.			mm in.	mm in.	mm in.	mm in.	N lbf.			mm in.	mm in.	g oz.	
1.500 0.0591	5.000 0.1969	2.600 0.1024	EL15	C	6.50 0.256	0.80 0.031	7	0.79 1/32	116 26	22 5	67 15	2.41 0.095	3.05 0.120	0.13 0.005	0.34 0.012
1.500 0.0591	5.000 0.1969	2.000 0.0787	EL15 ⁽²⁾	R	6.50 0.256	0.80 0.031	8	0.79 1/32	129 29	27 6	71 16	2.39 0.094	2.95 0.116	0.13 0.005	0.28 0.010
2.000 0.0787	5.000 0.1969	2.300 0.0906	UL20	C	6.10 0.240	0.60 0.024	7	0.79 1/32	116 26	22 5	67 15	2.51 0.099	2.59 0.102	0.13 0.005	0.26 0.009
2.000 0.0787	6.000 0.2362	3.000 0.1181	EL2	C	7.50 0.295	0.80 0.031	8	0.64 0.025	80 18	18 4	27 6	2.72 0.107	3.05 0.120	0.13 0.005	0.57 0.020
3.000 0.1181	7.000 0.2756	3.000 0.1181	UL30	C	8.10 0.319	0.80 0.031	9	1.00 0.039	218 49	49 11	129 29	3.60 0.142	3.68 0.145	0.13 0.005	0.60 0.021
3.000 0.1181	10.000 0.3937	4.000 0.1575	EL3	C, R	11.50 0.453	1.00 0.039	7	1.59 1/16	418 94	102 23	218 49	4.37 0.172	5.11 0.201	0.30 0.012	1.76 0.062
4.000 0.1575	9.000 0.3543	4.000 0.1575	UL40	C	10.30 0.406	1.00 0.039	7	1.59 1/16	418 94	102 23	218 49	4.70 0.185	4.80 0.189	0.13 0.005	1.93 0.068
5.000 0.1969	11.000 0.4331	5.000 0.1969	UL50	C	12.50 0.492	1.00 0.039	8	1.59 1/16	458 103	125 28	169 38	6.05 0.238	6.68 0.263	0.15 0.006	2.07 0.073
6.000 0.2362	13.000 0.5118	5.000 0.1969	UL60	C	15.00 0.591	1.10 0.043	8	1.98 5/64	689 155	178 40	316 71	7.11 0.280	7.62 0.300	0.25 0.010	3.06 0.108
7.000 0.2756	14.000 0.5512	5.000 0.1969	UL70	C	16.00 0.630	1.10 0.043	10	1.59 1/16	534 120	173 39	360 81	8.08 0.318	8.53 0.336	0.25 0.010	3.66 0.129

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

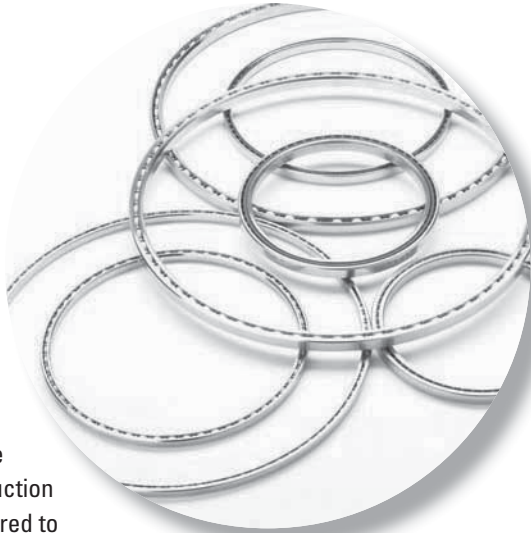
⁽²⁾Narrow width N design.

**THIN-SECTION
BALL BEARINGS**

Thin-section ball bearings, with their large complements of small-diameter balls, provide greater stiffness and lower torque while permitting a significant reduction in weight and space when compared to standard-section bearings. These advantages have found wide acceptance in many critical applications where thin bearing cross sections are important.

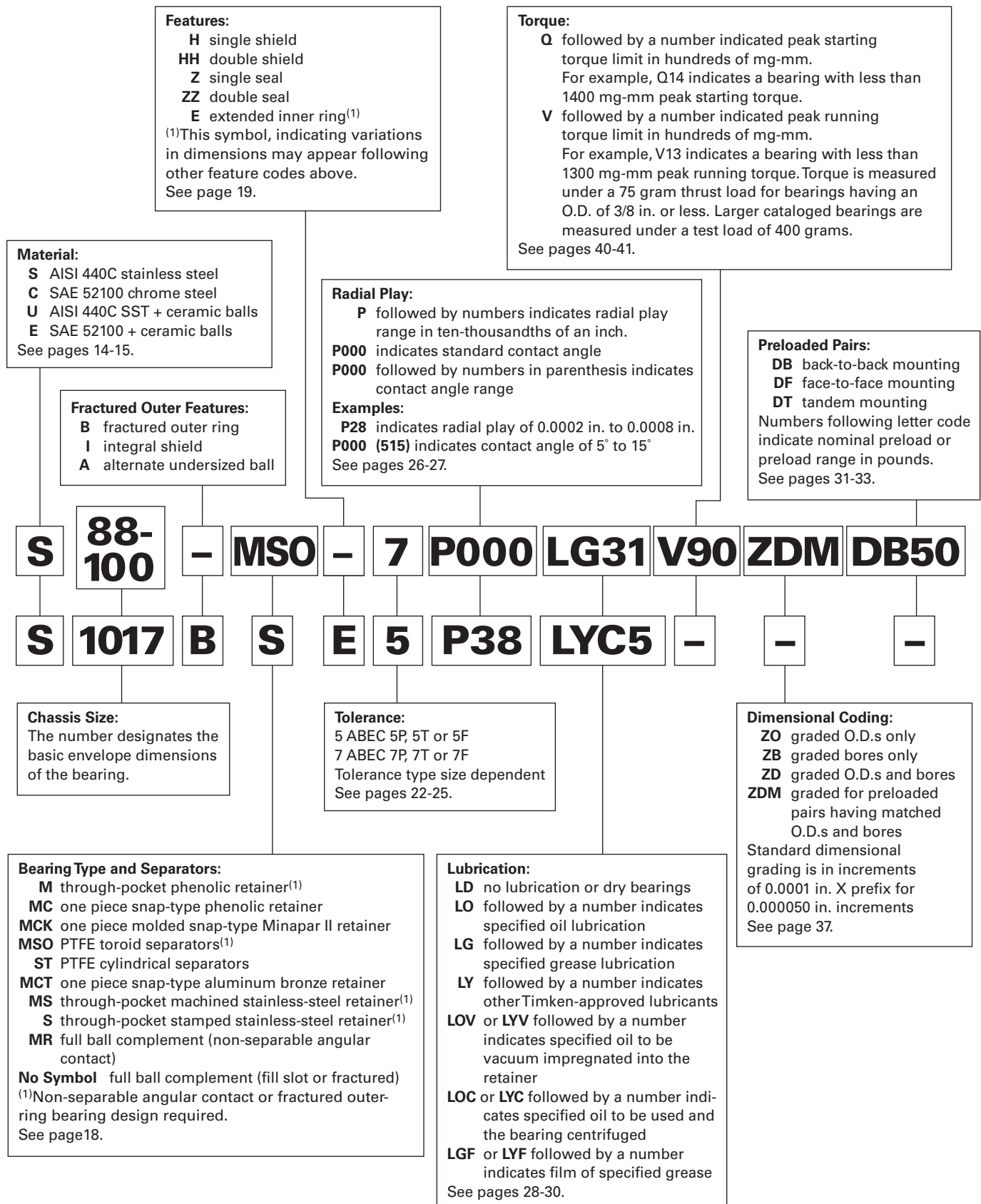
This section of the catalog represents a portion of products offered by Timken. Timken also produces many specialized bearings, assemblies and bearing-related products for particular applications where a standard bearing will not do.

Contact your Timken engineer for assistance in choosing the most appropriate standard or custom Timken product for your specific application.



- Nomenclature 95
- Conrad Bearings 96
- Angular-Contact Bearings 103
- Fractured-Race Bearings 110
- Commercial Series Fractured-Race – Single Row 112
- Commercial Series Fractured-Race – Double Row 113

THIN-SECTION BALL BEARING PART-NUMBERING NOMENCLATURE



CONRAD BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard thin-section ball bearings are available in ABEC 5T (add suffix 5 to bearing number) or ABEC 7T (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 22-25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28-30).
- Dimensions** All bearings are manufactured to inch standards.

NOTE: All bearing sizes available with equal W_o inner- and outer-ring width. Extended inner-ring bearing designs also available for sizes that have W_i width values in the table below.

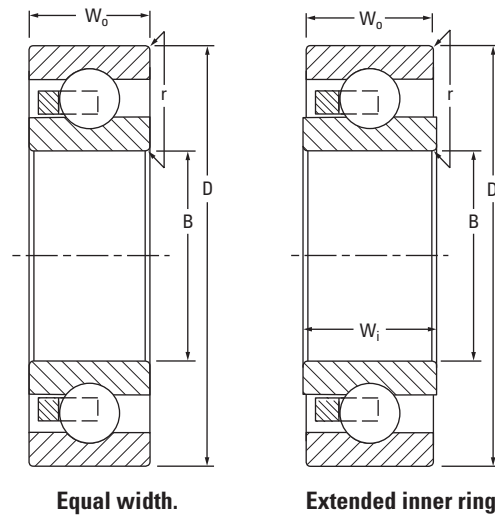


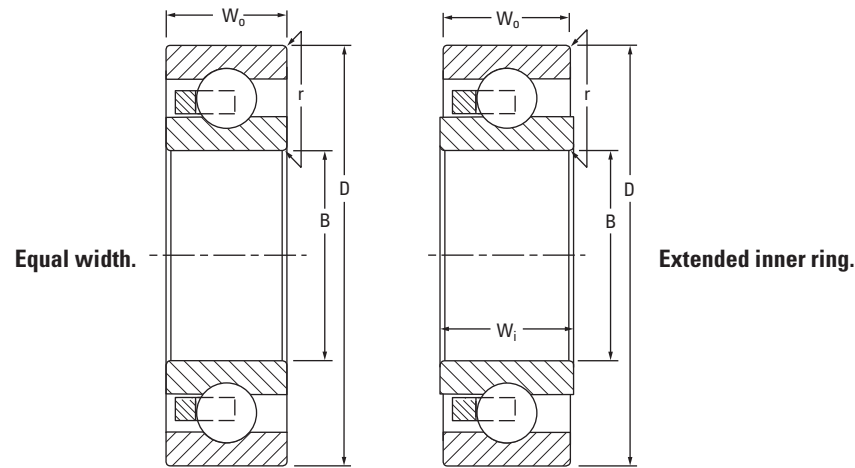
TABLE 42. CONRAD BEARINGS

Bore B	O.D. D	Width ⁽¹⁾ W_o	Width W_i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R_s	Static Thrust T_s	Shaft		Housing			
										Min.	Max.	Min.	Max.		
in. mm	in. mm	in. mm	in. mm		in. mm	in. mm	lbf N	in. mm	in. mm	in. mm	in. mm	in. mm	oz. g		
0.3750 9.525	0.6250 15.875	0.1560 3.962	—	610	14	1/16 1.59	170 756	79 351	112 498	0.437 11.10	0.457 11.61	0.543 13.79	0.563 14.30	0.010 0.25	0.096 2.72
0.5000 12.700	0.7500 19.050	0.1560 3.962	—	812	17	1/16 1.59	178 792	94 418	129 574	0.567 14.40	0.587 14.91	0.673 17.09	0.693 17.60	0.010 0.25	0.119 3.37
0.6250 15.875	0.8750 22.225	0.1560 3.962	—	1014	20	1/16 1.59	198 881	121 538	161 716	0.692 17.58	0.712 18.08	0.798 20.27	0.818 20.78	0.010 0.25	0.142 4.03
0.6250 15.875	1.0625 26.988	0.2500 6.350	0.2812 7.142	1017	12	1/8 3.18	642 2856	351 1561	494 2197	0.759 19.28	0.779 19.79	0.919 23.34	0.939 23.85	0.015 0.38	0.453 12.84
0.7500 19.050	1.0000 25.400	0.1560 3.962	—	1216	23	1/16 1.59	209 930	136 605	201 894	0.817 20.75	0.837 21.26	0.923 23.44	0.943 23.95	0.010 0.25	0.166 4.71
0.7500 19.050	1.1875 30.163	0.2500 6.350	0.2812 7.142	1219	12	1/8 3.18	628 2793	362 1610	386 1717	0.872 22.15	0.892 22.66	1.044 26.52	1.064 27.03	0.015 0.38	0.503 14.26
0.8750 22.225	1.1250 28.575	0.1560 3.962	—	1418	26	1/16 1.59	220 979	162 721	211 939	0.937 23.80	0.957 24.31	1.043 26.49	1.063 27.00	0.010 0.25	0.190 5.39
0.8750 22.225	1.3125 33.338	0.2500 6.350	0.2812 7.142	1421	14	1/8 3.18	679 3020	433 1926	481 2140	0.999 25.37	1.019 25.88	1.169 29.69	1.189 30.20	0.015 0.38	0.572 16.22
1.0000 25.400	1.3750 34.925	0.1875 4.763	—	1622	21	3/32 2.38	481 2140	378 1681	727 3234	1.119 28.42	1.139 28.93	1.236 31.39	1.256 31.90	0.015 0.38	0.434 12.30
1.0625 26.988	1.3125 33.338	0.1560 3.962	—	1721	32	1/16 1.59	242 1076	203 903	244 1085	1.124 28.55	1.144 29.06	1.231 31.27	1.251 31.78	0.010 0.25	0.226 6.41
1.0625 26.988	1.5000 38.100	0.2500 6.350	0.2812 7.142	1724	18	1/8 3.18	775 3447	572 2544	582 2589	1.189 30.20	1.209 30.71	1.361 34.57	1.381 35.08	0.015 0.38	0.673 19.08
1.2500 31.750	1.5000 38.100	0.1560 3.962	—	2024	36	1/16 1.59	254 1130	231 1028	293 1303	1.312 33.32	1.332 33.83	1.418 36.02	1.438 36.53	0.010 0.25	0.262 7.43
1.3125 33.338	1.7500 44.450	0.2500 6.350	0.2812 7.142	2128	20	1/8 3.18	797 3545	651 2896	683 3038	1.437 36.50	1.457 37.01	1.607 40.82	1.627 41.33	0.015 0.38	0.803 22.76
1.3750 34.925	1.6250 41.275	0.1560 3.962	—	2226	40	1/16 1.59	267 1188	258 1148	326 1450	1.437 36.50	1.457 37.01	1.543 39.19	1.563 39.70	0.010 0.25	0.286 8.11

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm		in. mm		in. mm	oz. g
1.5000 38.100	1.7500 44.450	0.1560 3.962	—	2428	44	1/16 1.59	280 1246	285 1268	358 1592	1.562 39.67	1.582 40.18	1.668 42.37	1.688 42.88	0.010 0.25	0.310 8.79
1.5000 38.100	1.8750 47.625	0.1875 4.763	—	2430	29	3/32 2.38	549 2442	541 2406	1020 4537	1.619 41.12	1.639 41.63	1.736 44.09	1.756 44.60	0.015 0.38	0.616 17.46
1.5625 39.688	2.0000 50.800	0.2500 6.350	0.2812 7.142	2532	24	1/8 3.18	867 3857	795 3536	819 3643	1.686 42.82	1.706 43.33	1.857 47.17	1.877 47.68	0.015 0.38	0.935 26.51
1.6250 41.275	1.8750 47.625	0.1560 3.962	—	2630	48	1/16 1.59	293 1303	312 1388	392 1744	1.687 42.85	1.707 43.36	1.793 45.54	1.813 46.05	0.010 0.25	0.334 9.47
1.8125 46.038	2.2500 57.150	0.2500 6.350	0.2812 7.142	2936	28	1/8 3.18	932 4146	940 4181	911 4052	1.926 48.92	1.946 49.43	2.098 53.29	2.118 53.80	0.015 0.38	1.069 30.31
2.0000 50.800	2.5000 63.500	0.2500 6.350	—	3240	30	1/8 3.18	952 4235	1016 4519	1003 4462	2.154 54.71	2.174 55.22	2.326 59.08	2.346 59.59	0.025 0.64	1.404 39.80
2.0000 50.800	2.6250 66.675	0.3125 7.938	—	3242	25	5/32 3.97	1310 5827	1279 5689	1454 6468	2.188 55.58	2.218 56.34	2.407 61.14	2.437 61.90	0.040 1.02	2.216 62.82
2.0625 52.388	2.6250 66.675	0.2500 6.350	0.2812 7.142	3342	32	1/8 3.18	985 4381	1087 4835	1042 4635	2.241 56.92	2.261 57.43	2.413 61.29	2.433 61.80	0.015 0.38	1.749 49.58
2.3125 58.738	2.8750 73.025	0.2500 6.350	0.2812 7.142	3746	34	1/8 3.18	1002 4457	1164 5178	1156 5142	2.500 63.50	2.520 64.01	2.664 67.67	2.684 68.17	0.015 0.38	1.951 55.31
2.5000 63.500	3.0000 76.200	0.2500 6.350	—	4048	36	1/8 3.18	1027 4568	1237 5502	1205 5360	2.654 67.41	2.674 67.92	2.826 71.78	2.846 72.29	0.025 0.64	1.713 48.56
2.5000 63.500	3.1250 79.375	0.3125 7.938	—	4050	30	5/32 3.97	1412 6281	1563 6953	1702 7571	2.688 68.28	2.718 69.04	2.907 73.84	2.937 74.60	0.040 1.02	2.692 76.32
2.5625 65.088	3.2500 82.550	0.3120 7.925	0.3750 9.525	4152	26	3/16 4.76	1838 8176	1930 8585	2097 9328	2.733 69.42	2.783 70.69	3.011 76.48	3.061 77.75	0.015 0.38	3.087 87.51
2.8125 71.438	3.5000 88.900	0.3125 7.925	0.3750 9.525	4556	28	3/16 4.76	1894 8425	2066 9190	2373 10556	2.983 75.77	3.033 77.04	3.258 82.75	3.308 84.02	0.015 0.38	3.360 95.25
3.0000 76.200	3.5000 88.900	0.2500 6.350	—	4856	43	1/8 3.18	1117 4969	1493 6641	1441 6410	3.154 80.11	3.174 80.62	3.326 84.48	3.346 84.99	0.025 0.64	2.026 57.44
3.0000 76.200	3.6250 92.075	0.3125 7.938	—	4858	35	5/32 3.97	1508 6708	1846 8211	2043 9088	3.188 80.98	3.218 81.74	3.407 86.54	3.437 87.30	0.040 1.02	3.168 89.81
3.0625 77.788	3.8750 98.425	0.3120 7.925	0.3750 9.525	4962	32	3/16 4.76	2020 8985	2382 10596	2621 11659	3.326 84.48	3.376 85.75	3.601 91.47	3.651 92.74	0.015 0.38	4.648 131.77

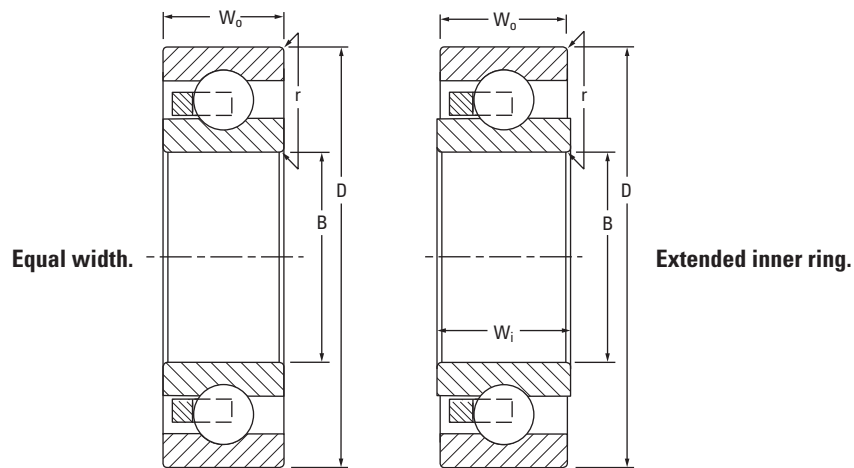
⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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THIN-SECTION BALL BEARINGS

CONRAD BEARINGS



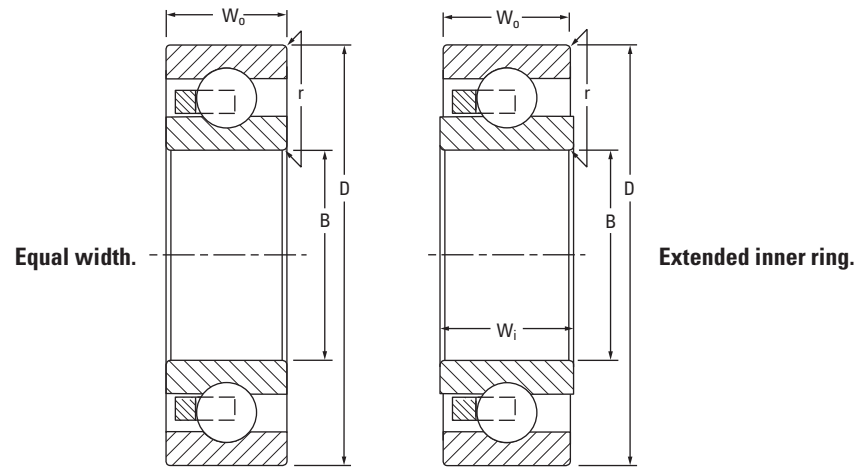
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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
3.5000 88.900	4.0000 101.600	0.2500 6.350	—	5664	49	1/8 3.18	1051 4675	1516 6744	1054 4688	3.654 92.81	3.674 93.32	3.826 97.18	3.846 97.69	0.025 0.64	2.337 66.25
3.5000 88.900	4.1250 104.775	0.3125 7.938	—	5666	40	5/32 3.97	1438 6397	1859 8269	1415 6294	3.688 93.68	3.718 94.44	3.907 99.24	3.937 100.00	0.040 1.02	3.645 103.33
4.0000 101.600	4.5000 114.300	0.2500 6.350	—	6472	55	1/8 3.18	1094 4866	1712 7615	1183 5262	4.154 105.51	4.174 106.02	4.326 109.88	4.346 110.39	0.025 0.64	2.646 75.01
4.0000 101.600	4.6250 117.475	0.3125 7.938	—	6474	45	5/32 3.97	1501 6677	2106 9368	1584 7046	4.188 106.38	4.218 107.14	4.407 111.94	4.437 112.70	0.040 1.02	4.114 116.63
4.0000 101.600	4.7500 120.650	0.3750 9.525	—	6476	38	3/16 4.76	1939 8625	2489 11072	1937 8616	4.222 107.24	4.262 108.25	4.489 114.02	4.529 115.04	0.040 1.02	6.093 172.73
4.0000 101.600	5.0000 127.000	0.5000 12.700	—	6480	30	1/4 6.35	3056 13594	3587 15956	2562 11396	4.299 109.19	4.349 110.46	4.651 118.14	4.701 119.41	0.060 1.52	11.055 313.40
4.2500 107.950	4.7500 120.650	0.2500 6.350	—	6876	58	1/8 3.18	1114 4955	1810 8051	1244 5534	4.404 111.86	4.424 112.37	4.576 116.23	4.596 116.74	0.025 0.64	2.798 79.32
4.2500 107.950	4.8750 123.825	0.3125 7.938	—	6878	48	5/32 3.97	1541 6855	2254 10026	1691 7522	4.438 112.73	4.468 113.49	4.657 118.29	4.687 119.05	0.040 1.02	4.347 123.24
4.2500 107.950	5.0000 127.000	0.3750 9.525	—	6880	40	3/16 4.76	1974 8781	2630 11699	2038 9065	4.472 113.59	4.512 114.60	4.739 120.37	4.779 121.39	0.040 1.02	6.439 182.54
4.2500 107.950	5.2500 133.350	0.5000 12.700	—	6884	31	1/4 6.35	3077 13687	3724 16565	2649 11783	4.549 115.54	4.599 116.81	4.901 124.49	4.951 125.76	0.060 1.52	11.648 330.22
4.5000 114.300	5.0000 127.000	0.2500 6.350	—	7280	62	1/8 3.18	1146 5098	1939 8625	1330 5916	4.654 118.21	4.674 118.72	4.826 122.58	4.846 123.09	0.025 0.64	2.952 83.69
4.5000 114.300	5.1250 130.175	0.3125 7.938	—	7282	50	5/32 3.97	1559 6935	2354 10471	1761 7833	4.688 119.08	4.718 119.84	4.907 124.64	4.937 125.40	0.040 1.02	4.589 130.10
4.5000 114.300	5.2500 133.350	0.3750 9.525	—	7284	43	3/16 4.76	2040 9074	2836 12615	2190 9742	4.722 119.94	4.762 120.95	4.989 126.72	5.029 127.74	0.040 1.02	6.785 192.35
4.5000 114.300	5.5000 139.700	0.5000 12.700	—	7288	33	1/4 6.35	3161 14061	3980 17704	2821 12548	4.799 121.89	4.849 123.16	5.151 130.84	5.201 132.11	0.060 1.52	12.273 347.93
4.7500 120.650	5.2500 133.350	0.2500 6.350	—	7684	65	1/8 3.18	1165 5182	2037 9061	1395 6205	4.904 124.56	4.924 125.07	5.076 128.93	5.096 129.44	0.025 0.64	3.107 88.08
4.7500 120.650	5.3750 136.525	0.3125 7.938	—	7686	53	5/32 3.97	1597 7104	2501 11125	1868 8309	4.938 125.43	4.968 126.19	5.157 130.99	5.187 131.75	0.040 1.02	4.823 136.73

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⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm		in. mm		lbf N			in. mm	in. mm	in. mm	oz. g		
4.7500 120.650	5.5000 139.700	0.3750 9.525	—	7688	45	3/16 4.76	2072 9217	2976 13238	2291 10191	4.972 126.29	5.012 127.30	5.239 133.07	5.279 134.09	0.040 1.02	7.130 202.13
4.7500 120.650	5.7500 146.050	0.5000 12.700	—	7692	35	1/4 6.35	3243 14426	4237 18847	2993 13314	5.049 128.24	5.099 129.51	5.401 137.19	5.451 138.46	0.060 1.52	12.898 365.65
4.7500 120.650	6.2500 158.750	0.7500 19.050	—	76100	25	3/8 9.53	5817 25875	6293 27993	5118 22766	5.214 132.44	5.274 133.96	5.726 145.44	5.786 146.96	0.080 2.03	30.689 870.02
5.0000 127.000	5.5000 139.700	0.2500 6.350	—	8088	68	1/8 3.18	1183 5262	2135 9497	1460 6494	5.154 130.91	5.174 131.42	5.326 135.28	5.346 135.79	0.025 0.64	3.265 92.56
5.0000 127.000	5.6250 142.875	0.3125 7.938	—	8090	55	5/32 3.97	1613 7175	2601 11570	1939 8625	5.188 131.78	5.218 132.54	5.407 137.34	5.437 138.10	0.040 1.02	5.064 143.56
5.0000 127.000	5.7500 146.050	0.3750 9.525	—	8092	47	3/16 4.76	2104 9359	3117 13865	2392 10640	5.222 132.64	5.262 133.65	5.489 139.42	5.529 140.44	0.040 1.02	7.490 212.34
5.0000 127.000	6.0000 152.400	0.5000 12.700	—	8096	36	1/4 6.35	3260 14501	4373 19452	3080 13701	5.299 134.59	5.349 135.86	5.651 143.54	5.701 144.81	0.060 1.52	13.491 382.46
5.0000 127.000	6.5000 165.100	0.7500 19.050	—	80104	26	3/8 9.53	5899 26240	6576 29251	5326 23691	5.464 138.79	5.524 140.31	5.976 151.79	6.036 153.31	0.080 2.03	32.070 909.17
5.5000 139.700	6.0000 152.400	0.2500 6.350	—	8896	74	1/8 3.18	1218 5418	2331 10369	1589 7068	5.654 143.61	5.674 144.12	5.826 147.98	5.846 148.49	0.025 0.64	3.574 101.32
5.5000 139.700	6.1250 155.575	0.3125 7.938	—	8898	60	5/32 3.97	1665 7406	2849 12673	2116 9412	5.688 144.48	5.718 145.24	5.907 150.04	5.937 150.80	0.040 1.02	5.540 157.06
5.5000 139.700	6.2500 158.750	0.3750 9.525	—	88100	51	3/16 4.76	2164 9626	3398 15115	2595 11543	5.722 145.34	5.762 146.35	5.989 152.12	6.029 153.14	0.040 1.02	8.182 231.96
5.5000 139.700	6.5000 165.100	0.5000 12.700	—	88104	39	1/4 6.35	3354 14919	4766 21200	3338 14848	5.799 147.29	5.849 148.59	6.151 156.24	6.201 157.51	0.060 1.52	14.708 416.96
5.5000 139.700	7.0000 177.800	0.7500 19.050	—	88112	28	3/8 9.53	6058 26947	7141 31765	5741 25537	5.964 151.49	6.024 153.01	6.476 164.49	6.536 166.01	0.080 2.03	34.831 987.44
6.0000 152.400	6.5000 165.100	0.2500 6.350	—	96104	80	1/8 3.18	1252 5569	2526 11236	1718 7642	6.154 156.31	6.174 156.82	6.326 160.68	6.346 161.19	0.025 0.64	3.883 110.08
6.0000 152.400	6.6250 168.275	0.3125 7.938	—	96106	65	5/32 3.97	1713 7620	3096 13772	2293 10200	6.188 157.18	6.218 157.94	6.407 162.74	6.437 163.50	0.040 1.02	6.015 170.52
6.0000 152.400	6.7500 171.450	0.3750 9.525	—	96108	55	3/16 4.76	2221 9879	3678 16361	2797 12442	6.222 158.04	6.262 159.05	6.489 164.82	6.529 165.84	0.040 1.02	8.874 251.57

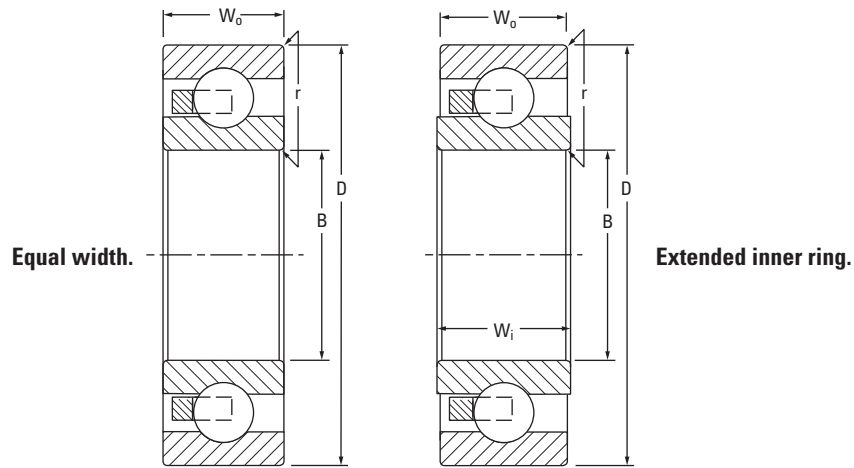
⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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THIN-SECTION BALL BEARINGS

CONRAD BEARINGS



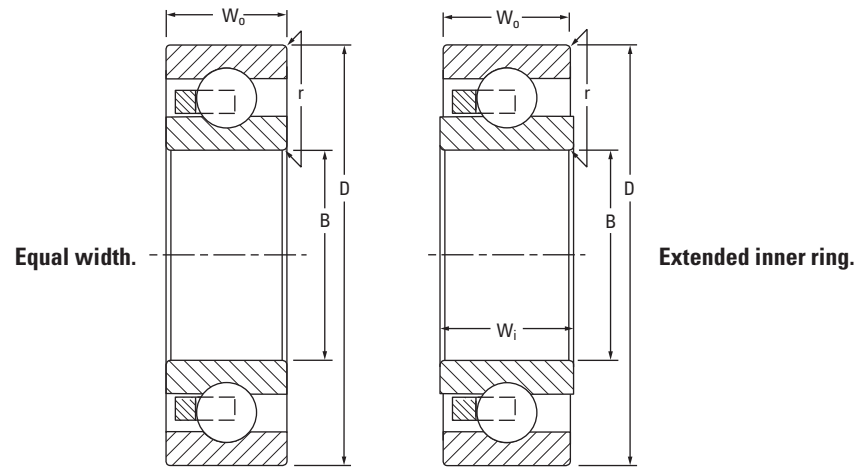
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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm			
6.0000 152.400	7.0000 177.800	0.5000 12.700	—	96112	43	1/4 6.35	3497 15555	5280 23487	3683 16383	6.299 159.99	6.349 161.26	6.651 168.94	6.701 170.21	0.060 1.52	15.926 451.49
6.0000 152.400	7.5000 190.500	0.7500 19.050	—	96120	30	3/8 9.53	6209 27619	7705 34274	6156 27383	6.464 164.19	6.524 165.71	6.976 177.19	7.036 178.71	0.080 2.03	37.592 1065.72
6.5000 165.100	7.0000 177.800	0.2500 6.350	—	104112	87	1/8 3.18	1294 5756	2754 12250	1869 8314	6.654 169.01	6.674 169.52	6.826 173.38	6.846 173.89	0.025 0.64	4.192 118.84
6.5000 165.100	7.1250 180.975	0.3125 7.938	—	104114	70	5/32 3.97	1760 7829	3344 14875	2470 10987	6.688 169.88	6.718 170.64	6.907 175.44	6.937 176.20	0.040 1.02	6.490 183.99
6.5000 165.100	7.2500 184.150	0.3750 9.525	—	104116	59	3/16 4.76	2276 10124	3959 17611	2999 13340	6.722 170.74	6.762 171.75	6.989 177.52	7.029 178.54	0.040 1.02	9.565 271.16
6.5000 165.100	7.5000 190.500	0.5000 12.700	—	104120	46	1/4 6.35	3579 15920	5673 25235	3941 17530	6.799 172.69	6.849 173.96	7.151 181.64	7.201 182.91	0.060 1.52	17.144 486.02
6.5000 165.100	8.0000 203.200	0.7500 19.050	—	104128	32	3/8 9.53	6353 28260	8269 36782	6570 29225	6.964 176.89	7.024 178.41	7.476 189.89	7.536 191.41	0.080 2.03	40.353 1143.99
7.0000 177.800	7.5000 190.500	0.2500 6.350	—	112120	93	1/8 3.18	1324 5889	2949 13118	1998 8888	7.154 181.71	7.174 182.22	7.326 186.08	7.346 186.59	0.025 0.64	4.505 127.71
7.0000 177.800	7.6250 193.675	0.3125 7.938	—	112122	75	5/32 3.97	1804 8025	3591 15974	2647 11774	7.188 182.58	7.218 183.34	7.407 188.14	7.437 188.90	0.040 1.02	6.965 197.45
7.0000 177.800	7.7500 196.850	0.3750 9.525	—	112124	64	3/16 4.76	2354 10471	4306 19154	3252 14466	7.222 183.44	7.262 184.45	7.489 190.22	7.509 190.73	0.040 1.02	10.257 290.78
7.0000 177.800	8.0000 203.200	0.5000 12.700	—	112128	19	1/4 6.35	3658 16272	6065 26978	4200 18683	7.299 185.39	7.349 186.66	7.651 194.34	7.701 195.61	0.060 1.52	18.394 521.46
7.0000 177.800	8.5000 215.900	0.7500 19.050	—	112136	34	3/8 9.53	6490 28869	8832 39287	6985 31071	7.464 189.59	7.524 191.11	7.976 202.59	8.036 204.11	0.080 2.03	43.113 1222.23
7.5000 190.500	8.0000 203.200	0.2500 6.350	—	120128	99	1/8 3.18	1353 6018	3145 13990	2128 9466	7.654 194.41	7.674 194.92	7.826 198.78	7.846 199.29	0.025 0.64	4.815 136.50
7.5000 190.500	8.1250 206.375	0.3125 7.938	—	120130	80	5/32 3.97	1847 8216	3839 17077	2824 12562	7.688 195.28	7.718 196.04	7.907 200.84	7.937 201.60	0.040 1.02	7.441 210.95
7.5000 190.500	8.2500 209.550	0.3750 9.525	—	120132	68	3/16 4.76	2404 10694	4587 20404	3455 15369	7.722 196.14	7.762 197.15	7.989 202.92	8.029 203.94	0.040 1.02	10.949 310.40
7.5000 190.500	8.5000 215.900	0.5000 12.700	—	120136	52	1/4 6.35	3735 16614	6457 28722	4459 19835	7.799 198.09	7.849 199.36	8.151 207.04	8.201 208.31	0.060 1.52	19.612 555.99

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⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm		in. mm	in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
7.5000 190.500	9.0000 228.600	0.7500 19.050	—	120144	36	3/8 9.53	6623 29461	9394 41787	7399 32912	7.964 202.29	8.024 203.81	8.476 215.29	8.536 216.81	0.080 2.03	45.874 1300.51
8.0000 203.200	8.5000 215.900	0.2500 6.350	—	128136	106	1/8 3.18	1390 6183	3372 14999	2278 10133	8.154 207.11	8.174 207.62	8.326 211.48	8.346 211.99	0.025 0.64	5.124 145.26
8.0000 203.200	8.6250 219.075	0.3125 7.938	—	128138	86	5/32 3.97	1902 8461	4134 18389	3037 13509	8.188 207.98	8.218 208.74	8.407 213.54	8.437 214.30	0.040 1.02	7.916 224.41
8.0000 203.200	8.7500 222.250	0.3750 9.525	—	128140	72	3/16 4.76	2452 10907	4867 21649	3657 16267	8.222 208.84	8.262 209.85	8.489 215.62	8.529 216.64	0.040 1.02	11.654 330.39
8.0000 203.200	9.0000 228.600	0.5000 12.700	—	128144	55	1/4 6.35	3808 16939	6849 30466	4718 20987	8.299 210.79	8.349 212.06	8.651 219.74	8.701 221.01	0.060 1.52	20.830 590.52
8.0000 203.200	9.5000 241.300	0.7500 19.050	—	128152	38	3/8 9.53	6750 30025	9956 44286	7814 34758	8.464 214.99	8.524 216.51	8.976 227.99	9.036 229.51	0.080 2.03	48.635 1378.78
9.0000 228.600	9.5000 241.300	0.2500 6.350	—	144152	118	1/8 3.18	1442 6414	3763 16739	2537 11285	9.154 232.51	9.174 233.02	9.326 236.88	9.346 237.39	0.025 0.64	5.746 162.90
9.0000 228.600	9.6250 244.475	0.3125 7.938	—	144154	96	5/32 3.97	1979 8803	4629 20591	3391 15084	9.188 233.38	9.218 234.14	9.407 238.94	9.437 239.70	0.040 1.02	8.867 251.38
9.0000 228.600	9.7500 247.650	0.3750 9.525	—	144156	80	3/16 4.76	2543 11312	5428 24145	4062 18069	9.222 234.24	9.262 235.25	9.489 241.02	9.529 242.04	0.040 1.02	13.038 369.62
9.0000 228.600	10.0000 254.000	0.5000 12.700	—	144160	62	1/4 6.35	3991 17753	7757 34505	5321 23669	9.299 236.19	9.349 237.46	9.651 245.14	9.701 246.41	0.060 1.52	23.265 659.55
9.0000 228.600	10.5000 266.700	0.7500 19.050	—	144168	43	3/8 9.53	7103 31596	11344 50461	8849 39362	9.464 240.39	9.524 241.91	9.976 253.39	10.036 254.91	0.080 2.03	54.157 1535.32
10.0000 254.000	10.5000 266.700	0.2500 6.350	—	160168	131	1/8 3.18	1500 6672	4186 18620	2817 12531	10.154 257.91	10.174 258.42	10.327 262.31	10.347 262.81	0.025 0.64	6.364 180.42
10.0000 254.000	10.6250 269.875	0.3125 7.938	—	160170	106	5/32 3.97	2050 9119	5124 22793	3745 16659	10.187 258.75	10.217 259.51	10.408 264.36	10.438 265.13	0.040 1.02	9.817 278.31
10.0000 254.000	10.7500 273.050	0.3750 9.525	—	160172	89	3/16 4.76	2649 11783	6056 26938	4518 20097	10.222 259.64	10.262 260.65	10.490 266.45	10.530 267.46	0.040 1.02	14.421 408.83
10.0000 254.000	11.0000 279.400	0.5000 12.700	—	160176	68	1/4 6.35	4120 18327	8540 37988	5838 25969	10.299 261.59	10.349 262.86	10.652 270.56	10.702 271.83	0.060 1.52	25.701 728.61
10.0000 254.000	11.5000 292.100	0.7500 19.050	—	160184	47	3/8 9.53	7325 32583	12468 55460	9678 43050	10.464 265.79	10.524 267.31	10.977 278.82	11.037 280.34	0.080 2.03	59.789 1694.99

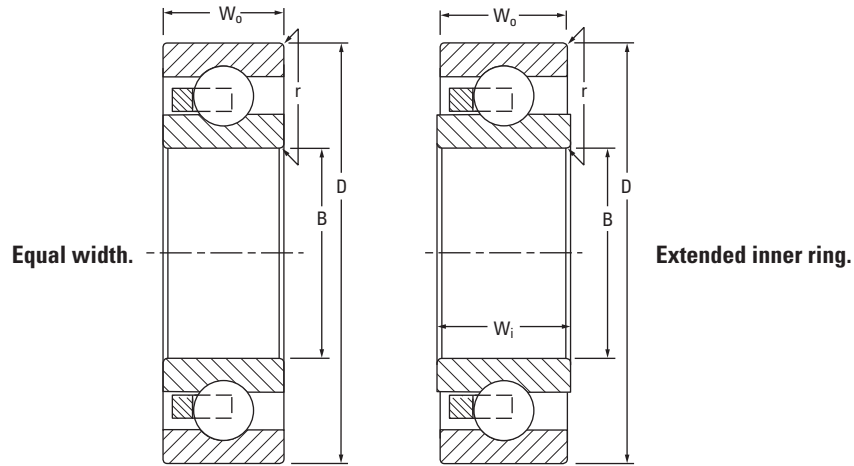
⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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THIN-SECTION BALL BEARINGS

CONRAD BEARINGS



Continued from previous page.

Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
										Min.	Max.	Min.	Max.		
in. mm	in. mm	in. mm	in. mm		in. mm		lbf N			in. mm		in. mm		in. mm	oz. g
11.0000 279.400	11.5000 292.100	0.2500 6.350	–	176184	144	1/8 3.18	1553 6908	4609 20502	3097 13776	11.154 283.31	11.174 283.82	11.327 287.71	11.347 288.21	0.025 0.64	6.986 198.05
11.0000 279.400	11.6250 295.275	0.3125 7.938	–	176186	116	5/32 3.97	2118 9421	5618 24990	4099 18233	11.188 284.18	11.218 284.94	11.408 289.76	11.438 290.53	0.040 1.02	10.768 305.27
11.0000 279.400	11.7500 298.450	0.3750 9.525	–	176188	97	3/16 4.76	2729 12139	6616 29429	4922 21894	11.222 285.04	11.262 286.05	11.490 291.85	11.530 292.86	0.040 1.02	15.819 448.46
11.0000 279.400	12.0000 304.800	0.5000 12.700	–	176192	74	1/4 6.35	4243 18874	9323 41471	6355 28268	11.299 286.99	11.349 288.26	11.652 295.96	11.702 297.23	0.060 1.52	28.169 798.58

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

ANGULAR-CONTACT BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard thin-section ball bearings are available in ABEC 5T (add suffix 5 to bearing number) or ABEC 7T (add suffix 7 to bearing number) tolerances. For information on ABEC tolerances see pages 22-25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28- 30).
- Dimensions** All bearings are manufactured to inch standards.

NOTE: All bearing sizes available with equal W_o inner- and outer-ring width. Extended inner-ring bearing designs also available for sizes that have W_i width values in the table below.

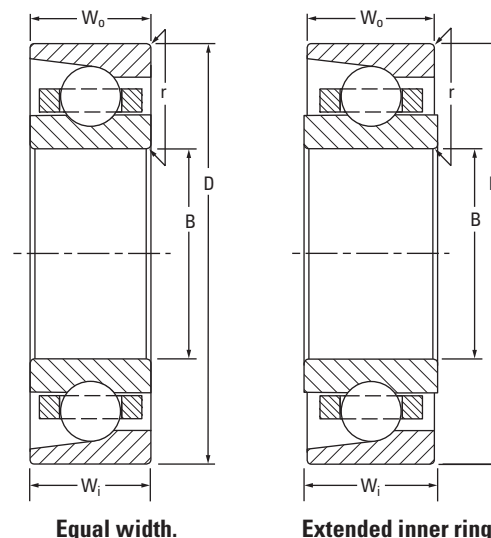


TABLE 43. ANGULAR-CONTACT BEARINGS

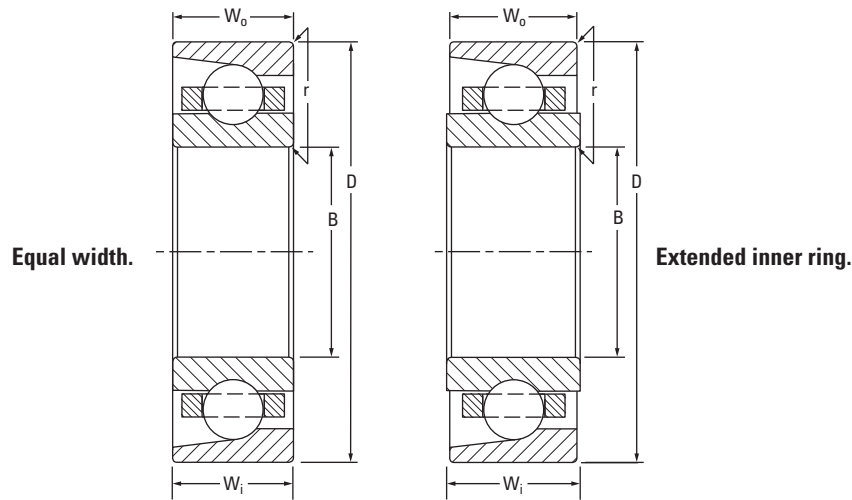
Bore B	O.D. D	Width ⁽¹⁾ W_o	Width W_i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R_s	Static Thrust T_s	Shaft		Housing			
					in. mm	in. mm	lbf N	in. mm	in. mm	Min.	Max.	Min.	Max.		
0.3750 9.525	0.6250 15.875	0.1560 3.962	—	610	16	1/16 1.59	186 827	90 400	128 569	0.437 11.10	0.457 11.61	0.543 13.79	0.563 14.30	0.010 0.25	0.093 2.64
0.5000 12.700	0.7500 19.050	0.1560 3.962	—	812	21	1/16 1.59	212 943	124 552	169 752	0.567 14.40	0.587 14.91	0.673 17.09	0.693 17.60	0.010 0.25	0.116 3.29
0.6250 15.875	0.8750 22.225	0.1560 3.962	—	1014	24	1/16 1.59	222 988	145 645	193 859	0.692 17.58	0.712 18.08	0.798 20.27	0.818 20.78	0.010 0.25	0.139 3.94
0.6250 15.875	1.0625 26.988	0.2500 6.350	0.2812 7.142	1017	16	1/8 3.18	768 3416	460 2046	613 2727	0.759 19.28	0.779 19.79	0.919 23.34	0.939 23.85	0.015 0.38	0.442 12.53
0.7500 19.050	1.0000 25.400	0.1560 3.962	—	1216	30	1/16 1.59	250 1112	185 823	249 1108	0.817 20.75	0.837 21.26	0.923 23.44	0.943 23.95	0.010 0.25	0.164 4.65
0.7500 19.050	1.1875 30.163	0.2500 6.350	0.2812 7.142	1219	18	1/8 3.18	813 3616	522 2322	575 2558	0.872 22.15	0.892 22.66	1.044 26.52	1.064 27.03	0.015 0.38	0.500 14.17
0.8750 22.225	1.1250 28.575	0.1560 3.962	—	1418	32	1/16 1.59	252 1121	200 890	260 1157	0.937 23.80	0.957 24.31	1.043 26.49	1.063 27.00	0.010 0.25	0.187 5.30
0.8750 22.225	1.3125 33.338	0.2500 6.350	0.2812 7.142	1421	20	1/8 3.18	850 3781	606 2696	634 2820	0.999 25.37	1.019 25.88	1.169 29.69	1.189 30.20	0.015 0.38	0.566 16.05
1.0000 25.400	1.3750 34.925	0.1875 4.763	—	1622	28	3/32 2.38	584 2598	504 2242	969 4310	1.119 28.42	1.139 28.93	1.236 31.39	1.256 31.90	0.015 0.38	0.423 11.99
1.0625 26.988	1.3125 33.338	0.1560 3.962	—	1721	38	1/16 1.59	272 1210	241 1072	289 1286	1.124 28.55	1.144 29.06	1.231 31.27	1.251 31.78	0.010 0.25	0.221 6.27
1.0625 26.988	1.5000 38.100	0.2500 6.350	0.2812 7.142	1724	24	1/8 3.18	926 4119	748 3327	714 3176	1.189 30.20	1.209 30.71	1.361 34.57	1.381 35.08	0.015 0.38	0.662 18.77
1.2500 31.750	1.5000 38.100	0.1560 3.962	—	2024	44	1/16 1.59	290 1290	282 1254	359 1597	1.312 33.32	1.332 33.83	1.418 36.02	1.438 36.53	0.010 0.25	0.257 7.29
1.3125 33.338	1.7500 44.450	0.2500 6.350	0.2812 7.142	2128	28	1/8 3.18	984 4377	895 3981	882 3923	1.437 36.50	1.457 37.01	1.607 40.82	1.627 41.33	0.015 0.38	0.794 22.51
1.3750 34.925	1.6250 41.275	0.1560 3.962	—	2226	48	1/16 1.59	302 1343	309 1374	391 1739	1.437 36.50	1.457 37.01	1.543 39.19	1.563 39.70	0.010 0.25	0.280 7.94

⁽¹⁾Equal width bearings have W_o width inner and outer rings.
⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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THIN-SECTION BALL BEARINGS

ANGULAR-CONTACT BEARINGS



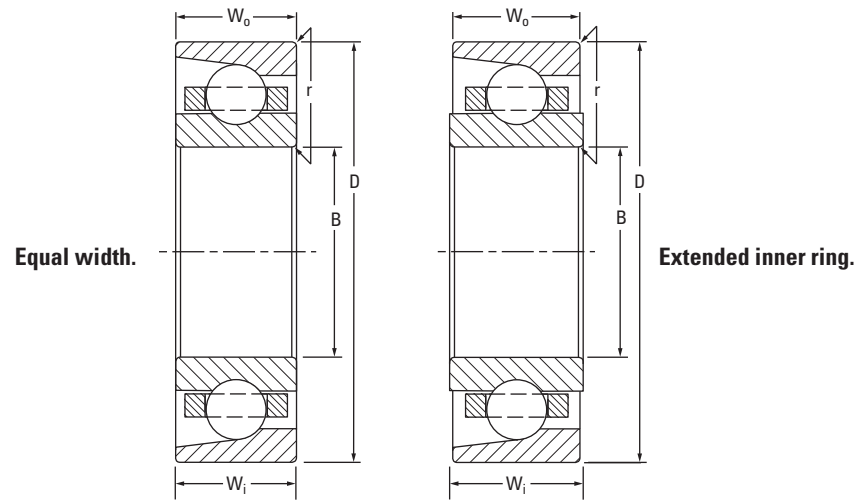
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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
1.5000 38.100	1.7500 44.450	0.1560 3.962	–	2428	52	1/16 1.59	313 1392	337 1499	424 1886	1.562 39.67	1.582 40.18	1.668 42.37	1.688 42.88	0.010 0.25	0.303 8.59
1.5000 38.100	1.8750 47.625	0.1875 4.763	–	2430	40	3/32 2.38	680 3025	747 3323	1389 6179	1.619 41.12	1.639 41.63	1.736 44.09	1.756 44.60	0.015 0.38	0.603 17.09
1.5625 39.688	2.0000 50.800	0.2500 6.350	0.2812 7.142	2532	34	1/8 3.18	1080 4804	1106 4920	1070 4760	1.686 42.82	1.706 43.33	1.857 47.17	1.877 47.68	0.015 0.38	0.928 26.31
1.6250 41.275	1.8750 47.625	0.1560 3.962	–	2630	56	1/16 1.59	324 1441	364 1619	457 2033	1.687 42.85	1.707 43.36	1.793 45.54	1.813 46.05	0.010 0.25	0.327 9.27
1.8125 46.038	2.2500 57.150	0.2500 6.350	0.2812 7.142	2936	38	1/8 3.18	1128 5018	1252 5569	1138 5062	1.926 48.92	1.946 49.43	2.098 53.29	2.118 53.80	0.015 0.38	1.057 29.97
2.0000 50.800	2.5000 63.500	0.2500 6.350	–	3240	42	1/8 3.18	1177 5236	1397 6214	1293 5752	2.154 54.71	2.174 55.22	2.326 59.08	2.346 59.59	0.025 0.64	1.393 39.49
2.0000 50.800	2.6250 66.675	0.3125 7.938	–	3242	34	5/32 3.97	1603 7130	1730 7695	1940 8630	2.188 55.58	2.218 56.34	2.407 61.14	2.437 61.90	0.040 1.02	2.190 62.09
2.0625 52.388	2.6250 66.675	0.2500 6.350	0.2812 7.142	3342	44	1/8 3.18	1203 5351	1468 6530	1320 5872	2.241 56.92	2.261 57.43	2.413 61.29	2.433 61.80	0.015 0.38	1.737 49.24
2.3125 58.738	2.8750 73.025	0.2500 6.350	0.2812 7.142	3746	48	1/8 3.18	1245 5538	1614 7179	1505 6695	2.500 63.50	2.520 64.01	2.664 67.67	2.684 68.17	0.015 0.38	1.944 55.11
2.5000 63.500	3.0000 76.200	0.2500 6.350	–	4048	52	1/8 3.18	1296 5765	1756 7811	1605 7139	2.654 67.41	2.674 67.92	2.826 71.78	2.846 72.29	0.025 0.64	1.707 48.39
2.5000 63.500	3.1250 79.375	0.3125 7.938	–	4050	42	5/32 3.97	1762 7838	2177 9684	2336 10391	2.688 68.28	2.718 69.04	2.907 73.84	2.937 74.60	0.040 1.02	2.671 75.72
2.5625 65.088	3.2500 82.550	0.3120 7.925	0.3750 9.525	4152	36	3/16 4.76	2302 10240	2670 11877	3047 13554	2.733 69.42	2.783 70.69	3.011 76.48	3.061 77.75	0.015 0.38	3.095 87.74
2.8125 71.438	3.5000 88.900	0.3120 7.925	0.3750 9.525	4556	39	3/16 4.76	2380 10587	2915 12967	3462 15400	2.983 75.77	3.033 77.04	3.258 82.75	3.308 84.02	0.015 0.38	3.363 95.34
3.0000 76.200	3.5000 88.900	0.2500 6.350	–	4856	62	1/8 3.18	1408 6263	2116 9412	1917 8527	3.326 84.48	3.376 85.75	3.601 91.47	3.651 92.74	0.025 0.64	2.020 57.27
3.0000 76.200	3.6250 92.075	0.3125 7.938	–	4858	50	5/32 3.97	1906 8478	2624 11672	2863 12735	3.154 80.11	3.174 80.62	3.326 84.48	3.346 84.99	0.040 1.02	3.151 89.33
3.0625 77.788	3.8750 98.425	0.3120 7.925	0.3750 9.525	4962	42	3/16 4.76	2400 10676	3166 14083	3610 16058	3.188 80.98	3.218 81.74	3.407 86.54	3.437 87.30	0.015 0.38	4.620 130.97

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm		in. mm	in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
3.5000 88.900	4.0000 101.600	0.2500 6.350	—	5664	70	1/8 3.18	1333 5929	2166 9635	1485 6606	3.654 92.81	3.674 93.32	3.826 97.18	3.846 97.69	0.025 0.64	2.325 65.91
3.5000 88.900	4.1250 104.775	0.3125 7.938	—	5666	58	5/32 3.97	1842 8194	2695 11988	2013 8954	3.688 93.68	3.718 94.44	3.907 99.24	3.937 100.00	0.040 1.02	3.634 103.02
4.0000 101.600	4.5000 114.300	0.2500 6.350	—	6472	80	1/8 3.18	1404 6245	2490 11076	1698 7553	4.154 105.51	4.174 106.02	4.326 109.88	4.346 110.39	0.025 0.64	2.639 74.81
4.0000 101.600	4.6250 117.475	0.3125 7.938	—	6474	66	5/32 3.97	1937 8616	3091 13749	2323 10333	4.188 106.38	4.218 107.14	4.407 111.94	4.437 112.70	0.040 1.02	6.748 191.30
4.0000 101.600	4.7500 120.650	0.3750 9.525	—	6476	54	3/16 4.76	2450 10898	3541 15751	2748 12224	4.222 107.24	4.262 108.25	4.489 114.02	4.529 115.04	0.040 1.02	9.926 281.40
4.0000 101.600	5.0000 127.000	0.5000 12.700	—	6480	42	1/4 6.35	3825 17014	5022 22339	3587 15956	4.299 109.19	4.349 110.46	4.651 118.14	4.701 119.41	0.060 1.52	15.942 451.95
4.2500 107.950	4.7500 120.650	0.2500 6.350	—	6876	86	1/8 3.18	1449 6445	2684 11939	1845 8207	4.404 111.86	4.424 112.37	4.576 116.23	4.596 116.74	0.025 0.64	4.977 141.10
4.2500 107.950	4.8750 123.825	0.3125 7.938	—	6878	68	5/32 3.97	1944 8647	3195 14212	2394 10649	4.438 112.73	4.468 113.49	4.657 118.29	4.687 119.05	0.040 1.02	7.569 214.58
4.2500 107.950	5.0000 127.000	0.3750 9.525	—	6880	58	3/16 4.76	2529 11250	3817 16979	2950 13122	4.472 113.59	4.512 114.60	4.739 120.37	4.779 121.39	0.040 1.02	10.653 302.01
4.2500 107.950	5.2500 133.350	0.5000 12.700	—	6884	44	1/4 6.35	3886 17286	5285 23509	3759 16721	4.549 115.54	4.599 116.81	4.901 124.49	4.951 125.76	0.060 1.52	17.039 483.05
4.5000 114.300	5.0000 127.000	0.2500 6.350	—	7280	90	1/8 3.18	1469 6534	2815 12522	1931 8590	4.654 118.21	4.674 118.72	4.826 122.58	4.846 123.09	0.025 0.64	5.573 157.99
4.5000 114.300	5.1250 130.175	0.3125 7.938	—	7282	72	5/32 3.97	1988 8843	3392 15088	2535 11276	4.688 119.08	4.718 119.84	4.907 124.64	4.937 125.40	0.040 1.02	8.211 232.78
4.5000 114.300	5.2500 133.350	0.3750 9.525	—	7284	62	3/16 4.76	2604 11583	4094 18211	3152 14021	4.722 119.94	4.762 120.95	4.989 126.72	5.029 127.74	0.040 1.02	11.090 314.40
4.5000 114.300	5.5000 139.700	0.5000 12.700	—	7288	46	1/4 6.35	3945 17548	5548 24679	3932 17490	4.799 121.89	4.849 123.16	5.151 130.84	5.201 132.11	0.060 1.52	18.741 531.30
4.7500 120.650	5.2500 133.350	0.2500 6.350	—	7684	94	1/8 3.18	1490 6628	2946 13104	2017 8972	4.904 124.56	4.924 125.07	5.076 128.93	5.096 129.44	0.025 0.64	13.684 387.93
4.7500 120.650	5.3750 136.525	0.3125 7.938	—	7686	76	5/32 3.97	2030 9030	3589 15965	2677 11908	4.938 125.43	4.968 126.19	5.157 130.99	5.187 131.75	0.040 1.02	8.876 251.63

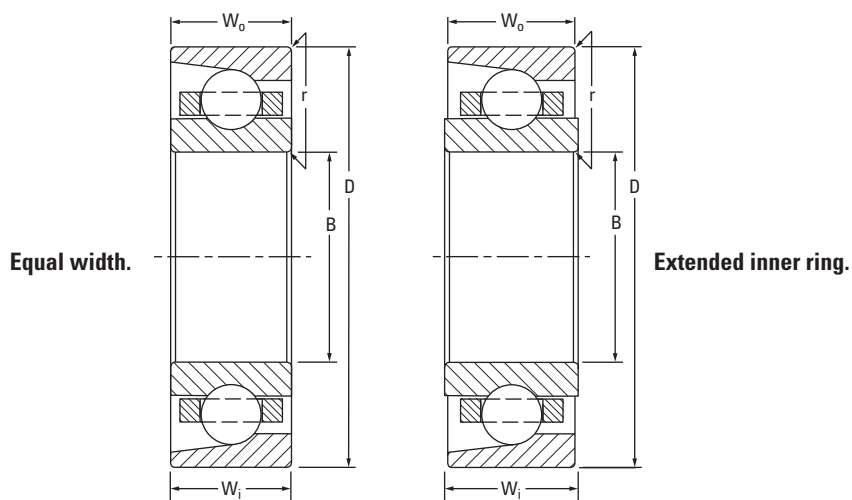
⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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THIN-SECTION BALL BEARINGS

ANGULAR-CONTACT BEARINGS



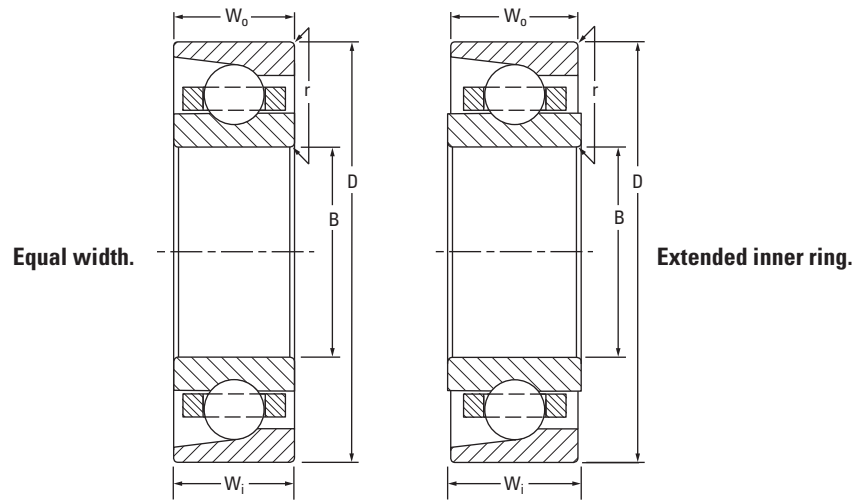
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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm	oz. g		
4.7500 120.650	5.5000 139.700	0.3750 9.525	—	7688	64	³ / ₁₆ 4.76	2621 11659	4238 18852	3253 14470	4.972 126.29	5.012 127.30	5.239 133.07	5.279 134.09	0.040 1.02	12.287 348.33
4.7500 120.650	5.7500 146.050	0.5000 12.700	—	7692	50	¹ / ₄ 6.35	4113 18296	6053 26925	4276 19021	5.049 128.24	5.099 129.51	5.401 137.19	5.451 138.46	0.060 1.52	19.238 545.39
4.7500 120.650	6.2500 158.750	0.7500 19.050	—	76100	34	³ / ₈ 9.53	7140 31760	8569 38117	6950 30915	5.214 132.44	5.274 133.96	5.726 145.44	5.786 146.96	0.080 2.03	42.049 1192.07
5.0000 127.000	5.5000 139.700	0.2500 6.350	—	8088	100	¹ / ₈ 3.18	1530 6806	3140 13967	2146 9546	5.154 130.91	5.174 131.42	5.326 135.28	5.346 135.79	0.025 0.64	6.514 184.67
5.0000 127.000	5.6250 142.875	0.3125 7.938	—	8090	80	⁵ / ₃₂ 3.97	2071 9212	3786 16841	2819 12540	5.188 131.78	5.218 132.54	5.407 137.34	5.437 138.10	0.040 1.02	9.564 271.13
5.0000 127.000	5.7500 146.050	0.3750 9.525	—	8092	68	³ / ₁₆ 4.76	2691 11970	4515 20084	3455 15369	5.222 132.64	5.262 133.65	5.489 139.42	5.529 140.44	0.040 1.02	13.068 370.47
5.0000 127.000	6.0000 152.400	0.5000 12.700	—	8096	52	¹ / ₄ 6.35	4166 18531	6317 28099	4448 19786	5.299 134.59	5.349 135.86	5.651 143.54	5.701 144.81	0.060 1.52	20.763 588.62
5.0000 127.000	6.5000 165.100	0.7500 19.050	—	80104	36	³ / ₈ 9.53	7329 32601	9116 40550	7363 32752	5.464 138.79	5.524 140.31	5.976 151.79	6.036 153.31	0.080 2.03	43.317 1228.02
5.5000 139.700	6.0000 152.400	0.2500 6.350	—	8896	110	¹ / ₈ 3.18	1587 7059	3465 15413	2362 10507	5.654 143.61	5.674 144.12	5.826 147.98	5.846 148.49	0.025 0.64	7.174 203.38
5.5000 139.700	6.1250 155.575	0.3125 7.938	—	8898	88	⁵ / ₃₂ 3.97	2149 9559	4181 18598	3102 13798	5.688 144.48	5.718 145.24	5.907 150.04	5.937 150.80	0.040 1.02	10.714 303.74
5.5000 139.700	6.2500 158.750	0.3750 9.525	—	88100	74	³ / ₁₆ 4.76	2774 12339	4936 21956	3759 16721	5.722 145.34	5.762 146.35	5.989 152.12	6.029 153.14	0.040 1.02	15.126 428.81
5.5000 139.700	6.5000 165.100	0.5000 12.700	—	88104	56	¹ / ₄ 6.35	4268 18985	6843 30439	4793 21320	5.799 147.29	5.849 148.59	6.151 156.24	6.201 157.51	0.060 1.52	23.620 669.62
5.5000 139.700	7.0000 177.800	0.7500 19.050	—	88112	38	³ / ₈ 9.53	7426 33032	9703 43161	7779 34603	5.964 151.49	6.024 153.01	6.476 164.49	6.536 166.01	0.080 2.03	49.138 1393.04
6.0000 152.400	6.5000 165.100	0.2500 6.350	—	96104	118	¹ / ₈ 3.18	1622 7215	3726 16574	2534 11272	6.154 156.31	6.174 156.82	6.326 160.68	6.346 161.19	0.025 0.64	8.428 238.93
6.0000 152.400	6.6250 168.275	0.3125 7.938	—	96106	96	⁵ / ₃₂ 3.97	2222 9884	4576 20355	3385 15057	6.188 157.18	6.218 157.94	6.407 162.74	6.437 163.50	0.040 1.02	12.197 345.78
6.0000 152.400	6.7500 171.450	0.3750 9.525	—	96108	80	³ / ₁₆ 4.76	2852 12686	5356 23825	4062 18069	6.222 158.04	6.262 159.05	6.489 164.82	6.529 165.84	0.040 1.02	17.012 482.28

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm		in. mm		lbf N			in. mm	in. mm	in. mm	oz. g		
6.0000 152.400	7.0000 177.800	0.5000 12.700	—	96112	62	1/4 6.35	4463 19852	7614 33869	5310 23620	6.299 159.99	6.349 161.26	6.651 168.94	6.701 170.21	0.060 1.52	25.858 733.06
6.0000 152.400	7.5000 190.500	0.7500 19.050	—	96120	42	3/8 9.53	7770 34563	10800 48041	8604 38272	6.464 164.19	6.524 165.71	6.976 177.19	7.036 178.71	0.080 2.03	54.229 1537.37
6.5000 165.100	7.0000 177.800	0.2500 6.350	—	104112	128	1/8 3.18	1674 7446	4051 18020	2750 12233	6.654 169.01	6.674 169.52	6.660 169.16	6.680 169.67	0.025 0.64	9.557 270.94
6.5000 165.100	7.1250 180.975	0.3125 7.938	—	104114	104	5/32 3.97	2291 10191	4971 22112	3668 16316	6.688 169.88	6.718 170.64	6.907 175.44	6.937 176.20	0.040 1.02	13.161 373.11
6.5000 165.100	7.2500 184.150	0.3750 9.525	—	104116	86	3/16 4.76	2927 13020	5777 25697	4365 19416	6.722 170.74	6.762 171.75	6.988 177.50	7.028 178.51	0.040 1.02	19.316 547.60
6.5000 165.100	7.5000 190.500	0.5000 12.700	—	104120	66	1/4 6.35	4553 20253	8139 36204	5655 25155	6.799 172.69	6.849 173.96	7.151 181.64	7.201 182.91	0.060 1.52	29.039 823.24
6.5000 165.100	8.0000 203.200	0.7500 19.050	—	104128	46	3/8 9.53	8091 35991	11900 52934	9430 41947	6.964 176.89	7.024 178.41	7.476 189.89	7.536 191.41	0.080 2.03	59.332 1682.03
7.0000 177.800	7.5000 190.500	0.2500 6.350	—	112120	138	1/8 3.18	1722 7660	4376 19465	2968 13202	7.154 181.71	7.174 182.22	7.326 186.08	7.346 186.59	0.025 0.64	10.751 304.79
7.0000 177.800	7.6250 193.675	0.3125 7.938	—	112122	112	5/32 3.97	2357 10484	5366 23869	3951 17575	7.188 182.58	7.218 183.34	7.407 188.14	7.437 188.90	0.040 1.02	15.105 428.22
7.0000 177.800	7.7500 196.850	0.3750 9.525	—	112124	94	3/16 4.76	3041 13527	6332 28166	4769 21214	7.222 183.44	7.262 184.45	7.489 190.22	7.509 190.73	0.040 1.02	20.335 576.49
7.0000 177.800	8.0000 203.200	0.5000 12.700	—	112128	72	1/4 6.35	4728 21031	8912 39643	6172 27454	7.299 185.39	7.349 186.66	7.651 194.34	7.701 195.61	0.060 1.52	31.755 900.24
7.0000 177.800	8.5000 215.900	0.7500 19.050	—	112136	48	3/8 9.53	8168 36333	12483 55527	9845 43793	7.464 189.59	7.524 191.11	7.976 202.59	8.036 204.11	0.080 2.03	66.639 1889.18
7.5000 190.500	8.0000 203.200	0.2500 6.350	—	120128	148	1/8 3.18	1769 7869	4701 20911	3181 14150	7.654 194.41	7.674 194.92	7.826 198.78	7.846 199.29	0.025 0.64	11.383 322.70
7.5000 190.500	8.1250 206.375	0.3125 7.938	—	120130	118	5/32 3.97	2393 10645	5666 25204	4164 18522	7.688 195.28	7.718 196.04	7.907 200.84	7.937 201.60	0.040 1.02	16.830 477.12
7.5000 190.500	8.2500 209.550	0.3750 9.525	—	120132	100	3/16 4.76	3108 13825	6753 30039	5073 22566	7.722 196.14	7.762 197.15	7.989 202.92	8.029 203.94	0.040 1.02	22.374 634.29
7.5000 190.500	8.5000 215.900	0.5000 12.700	—	120136	76	1/4 6.35	4810 21396	9437 41978	6517 28989	7.799 198.09	7.849 199.36	8.151 207.04	8.201 208.31	0.060 1.52	35.488 1006.07

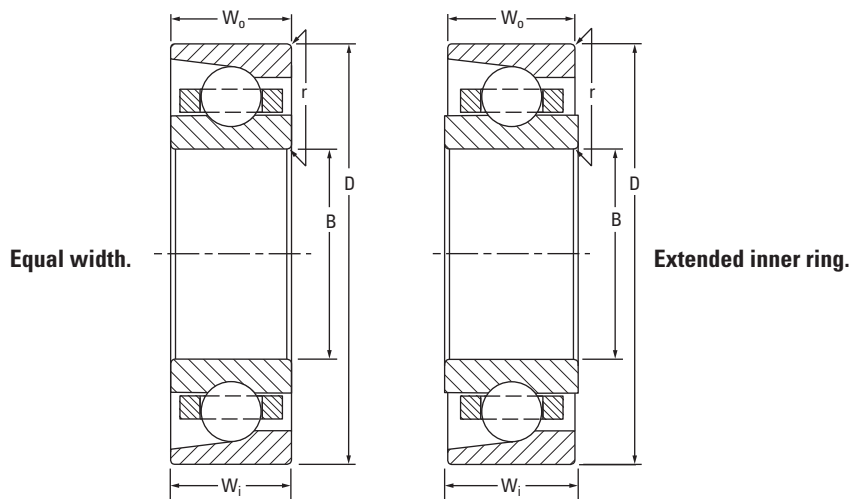
⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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THIN-SECTION BALL BEARINGS

ANGULAR-CONTACT BEARINGS



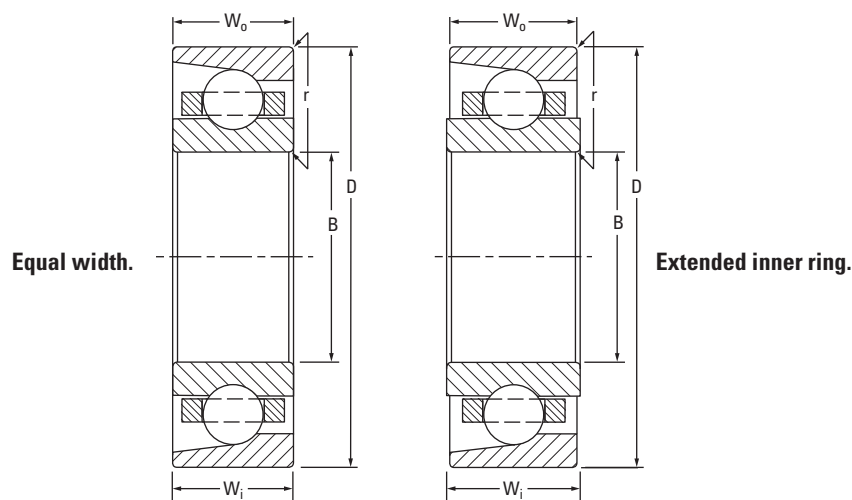
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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm			
7.5000 190.500	9.0000 228.600	0.7500 19.050	—	120144	52	3/8 9.53	8463 37645	13585 60429	10671 47467	7.964 202.29	8.024 203.81	8.476 215.29	8.536 216.81	0.080 2.03	70.326 1993.71
8.0000 203.200	8.5000 215.900	0.2500 6.350	—	128136	156	1/8 3.18	1798 7998	4962 22072	3353 14915	8.154 207.11	8.174 207.62	8.326 211.48	8.346 211.99	0.025 0.64	13.123 372.03
8.0000 203.200	8.6250 219.075	0.3125 7.938	—	128138	126	5/32 3.97	2454 10916	6061 26961	4447 19781	8.188 207.98	8.218 208.74	8.407 213.54	8.437 214.30	0.040 1.02	18.645 528.58
8.0000 203.200	8.7500 222.250	0.3750 9.525	—	128140	106	3/16 4.76	3173 14114	7174 31912	5376 23914	8.222 208.84	8.262 209.85	8.489 215.62	8.529 216.64	0.040 1.02	25.285 716.82
8.0000 203.200	9.0000 228.600	0.5000 12.700	—	128144	80	1/4 6.35	4889 21747	9962 44313	6862 30524	8.299 210.79	8.349 212.06	8.651 219.74	8.701 221.01	0.060 1.52	39.370 1116.12
8.0000 203.200	9.5000 241.300	0.7500 19.050	—	128152	56	3/8 9.53	8742 38886	14689 65340	11497 51141	8.464 214.99	8.524 216.51	8.976 227.99	9.036 229.51	0.080 2.03	76.687 2174.04
9.0000 228.600	9.5000 241.300	0.2500 6.350	—	144152	176	1/8 3.18	1883 8376	5612 24963	3784 16832	9.154 232.51	9.174 233.02	9.326 236.88	9.346 237.39	0.025 0.64	15.955 452.32
9.0000 228.600	9.6250 244.475	0.3125 7.938	—	144154	142	5/32 3.97	2569 11427	6851 30475	5013 22299	9.188 233.38	9.218 234.14	9.407 238.94	9.437 239.70	0.040 1.02	21.408 606.91
9.0000 228.600	9.7500 247.650	0.3750 9.525	—	144156	120	3/16 4.76	3332 14821	8151 36257	6083 27059	9.222 234.24	9.262 235.25	9.489 241.02	9.529 242.04	0.040 1.02	30.967 877.90
9.0000 228.600	10.0000 254.000	0.5000 12.700	—	144160	90	1/4 6.35	5117 22762	11260 50087	7724 34358	9.299 236.19	9.349 237.46	9.651 245.14	9.701 246.41	0.060 1.52	45.679 1294.98
9.0000 228.600	10.5000 266.700	0.7500 19.050	—	144168	62	3/8 9.53	9066 40328	16375 72840	12738 56661	9.464 240.39	9.524 241.91	9.976 253.39	10.036 254.91	0.080 2.03	87.951 2493.37
10.0000 254.000	10.5000 266.700	0.2500 6.350	—	160168	196	1/8 3.18	1962 8727	6263 27859	4213 18740	10.154 257.91	10.174 258.42	10.327 262.31	10.347 262.81	0.025 0.64	17.948 508.82
10.0000 254.000	10.6250 269.875	0.3125 7.938	—	160170	158	5/32 3.97	2675 11899	7642 33993	5580 24821	10.182 258.62	10.212 259.38	10.408 264.36	10.438 265.13	0.040 1.02	26.337 746.64
10.0000 254.000	10.7500 273.050	0.3750 9.525	—	160172	132	3/16 4.76	3445 15324	8992 39998	6690 29759	10.222 259.64	10.262 260.65	10.490 266.45	10.530 267.46	0.040 1.02	34.473 977.29
10.0000 254.000	11.0000 279.400	0.5000 12.700	—	160176	100	1/4 6.35	5328 23700	12559 55865	8585 38188	10.299 261.59	10.349 262.86	10.652 270.56	10.702 271.83	0.060 1.52	52.052 1475.65
10.0000 254.000	11.5000 292.100	0.7500 19.050	—	160184	68	3/8 9.53	9370 41680	18059 80330	13979 62182	10.464 265.79	10.524 267.31	10.977 278.82	11.037 280.34	0.080 2.03	102.242 2898.51

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings			Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					No. n	Dia. d	Dynamic C	Static Radial R _s	Static Thrust T _s	Shaft		Housing			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N			in. mm	in. mm	in. mm	in. mm	in. mm	oz. g
11.0000 279.400	11.5000 292.100	0.2500 6.350	—	176184	214	1/8 3.18	2023 8999	6849 30466	4603 20475	11.154 283.31	11.174 283.82	11.327 287.71	11.347 288.21	0.025 0.64	22.127 627.29
11.0000 279.400	11.6250 295.275	0.3125 7.938	—	176186	172	5/32 3.97	2754 12250	8336 37080	6076 27027	11.188 284.18	11.218 284.94	11.408 289.76	11.438 290.53	0.040 1.02	30.893 875.80
11.0000 279.400	11.7500 298.450	0.3750 9.525	—	176188	144	3/16 4.76	3551 15796	9833 43739	7296 32454	11.222 285.04	11.262 286.05	11.490 291.85	11.530 292.86	0.040 1.02	41.458 1175.31
11.0000 279.400	12.0000 304.800	0.5000 12.700	—	176192	110	1/4 6.35	5526 24581	13858 61643	9447 42022	11.299 286.99	11.349 288.26	11.652 295.96	11.702 297.23	0.060 1.52	62.288 1765.83

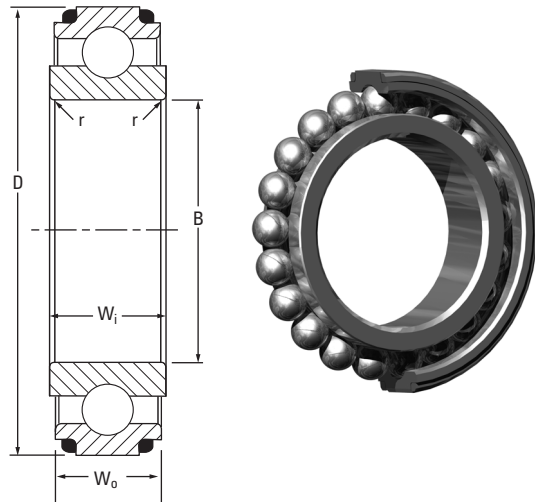
⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

FRACTURED-RACE BEARINGS

STANDARD SPECIFICATIONS

- Tolerances** All precision standard radial bearings are available in ABEC 5P (add suffix 5 to bearing number) For information on ABEC tolerances see pages 22-25.
- Radial Play** Standard tolerance is from 0.0002 to 0.0008 in., however, other ranges are available (see pages 26-27).
- Lubrication** Standard lubrication is dip and drain with Timken L01 lubricant. Other lubricants are available (see pages 28- 30).
- Dimensions** All bearings are manufactured to inch standards.



NOTE: All bearing sizes available with equal W_o inner- and outer-ring width. Extended inner-ring bearing designs also available for sizes that have W_i width values in the table below.

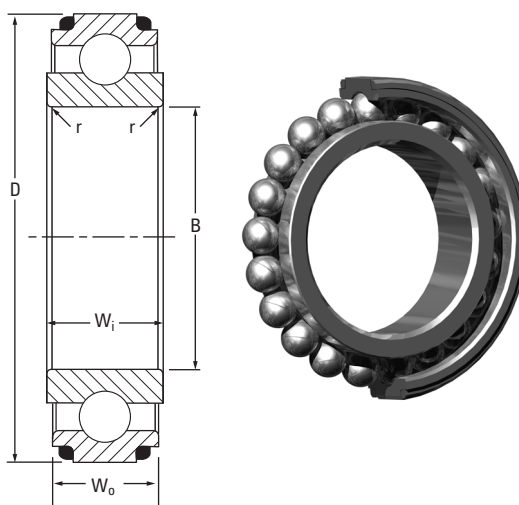
TABLE 44. FRACTURED-RACE BEARINGS

Bore B	O.D. D	Width ⁽¹⁾ W_o	Width W_i	Chassis	Ball Complement		Load Ratings		Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					Number n	Diameter d	Dynamic C	Static Radial R_s	Shaft		Housing			
									Min.	Max.	Min.	Max.		
in. mm	in. mm	in. mm	in. mm		in. mm	in. mm	lbf N		in. mm	in. mm	in. mm	oz. g		
0.3750 9.525	0.6250 15.875	0.1560 3.962	–	610	24	1/16 1.59	244 1085	136 605	0.437 11.10	0.457 11.61	0.543 13.79	0.568 14.43	0.010 .254	0.099 2.81
0.5000 12.700	0.7500 19.050	0.1560 3.962	–	812	31	1/16 1.59	276 1228	183 814	0.567 14.40	0.587 14.91	0.673 17.09	0.695 17.66	0.010 0.25	0.123 3.49
0.6250 15.875	0.8750 22.225	0.1560 3.962	–	1014	37	1/16 1.59	298 1326	224 996	0.692 17.58	0.712 18.08	0.798 20.27	0.820 20.83	0.010 0.25	0.148 4.20
0.6250 15.875	1.0625 26.988	0.2500 6.350	0.2812 7.142	1017	21	1/8 3.18	918 4083	600 2669	0.759 19.28	0.779 19.79	0.919 23.34	0.961 24.41	0.015 0.38	0.346 9.81
0.7500 19.050	1.0000 25.400	0.1560 3.962	–	1216	43	1/16 1.59	317 1410	265 1179	0.817 20.75	0.837 21.26	0.923 23.44	0.945 24.01	0.010 0.25	0.173 4.90
0.7500 19.050	1.1875 30.163	0.2500 6.350	0.2812 7.142	1219	24	1/8 3.18	980 4359	706 3140	0.872 22.15	0.892 22.66	1.044 26.52	1.086 27.58	0.015 0.38	0.408 11.57
0.8750 22.225	1.3125 33.338	0.2500 6.350	0.2812 7.142	1421	27	1/8 3.18	1035 4604	814 3621	0.999 25.37	1.019 25.88	1.169 29.69	1.206 30.62	0.015 0.38	0.480 13.61
1.0625 26.988	1.5000 38.100	0.2500 6.350	0.2812 7.142	1724	32	1/8 3.18	1117 4969	991 4408	1.189 30.20	1.209 30.71	1.361 34.57	1.397 35.48	0.015 0.38	0.583 16.53
1.3125 33.338	1.7500 44.450	0.2500 6.350	0.2812 7.142	2128	38	1/8 3.18	1201 5342	1207 5369	1.437 36.50	1.457 37.01	1.607 40.82	1.645 41.79	0.015 0.38	0.728 20.64

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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Bore B	O.D. D	Width ⁽¹⁾ W _o	Width W _i	Chassis	Ball Complement		Load Ratings		Shoulder Diameter				Radius ⁽²⁾ r	Approx. Weight oz. g
					Number n	Diameter d	Dynamic C	Static Radial R _s	Shaft		Housing			
									Min.	Max.	Min.	Max.		
in. mm	in. mm	in. mm	in. mm		in. mm	in. mm	lbf N	in. mm	in. mm	in. mm	in. mm	in. mm	oz. g	
1.5625 39.688	2.0000 50.800	0.2500 6.350	0.2812 7.142	2532	44	1/8 3.18	1277 5680	1422 6325	1.686 42.82	1.706 43.33	1.857 47.17	1.895 48.14	0.015 0.38	0.866 24.55
1.8125 46.038	2.2500 57.150	0.2500 6.350	0.2812 7.142	2936	50	1/8 3.18	1349 6001	1638 7286	1.926 48.92	1.946 49.43	2.098 53.29	2.150 54.60	0.015 0.38	1.007 28.55
2.0625 52.388	2.6250 66.675	0.2500 6.350	0.2812 7.142	3342	58	1/8 3.18	1440 6405	1924 8558	2.241 56.92	2.261 57.43	2.413 61.29	2.478 62.95	0.015 0.38	1.701 48.22
2.3125 58.738	2.8750 73.025	0.2500 6.350	0.2812 7.142	3746	64	1/8 3.18	1503 6686	2140 9519	2.500 63.50	2.520 64.01	2.664 67.67	2.731 69.36	0.015 0.38	1.916 54.32
2.5625 65.088	3.2500 82.550	0.3120 7.938	0.3750 9.525	4152	48	3/16 4.76	2781 12370	3545 15769	2.733 69.42	2.783 70.69	3.011 76.48	3.085 78.37	0.015 0.38	3.221 91.31
2.8125 71.438	3.5000 88.900	0.3120 7.938	0.3750 9.525	4556	52	3/16 4.76	2876 12793	3869 17210	2.983 75.77	3.033 77.04	3.258 82.75	3.328 84.54	0.015 0.38	3.518 99.73
3.0625 77.788	3.8750 98.425	0.3120 7.938	0.3750 9.525	4962	58	3/16 4.76	3019 13429	4354 19368	3.326 84.48	3.376 85.75	3.601 91.47	3.690 93.72	0.015 0.38	4.831 136.96

⁽¹⁾Equal width bearings have W_o width inner and outer rings.

⁽²⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

COMMERCIAL SERIES FRACTURED-RACE – SINGLE ROW

STANDARD SPECIFICATIONS

- Tolerances** Precision-ground races.
- Radial Play** 0.0005-0.0015 in.
- Lubrication** Rheolube lithium grease.
- Dimensions** All bearings are manufactured to inch standards.

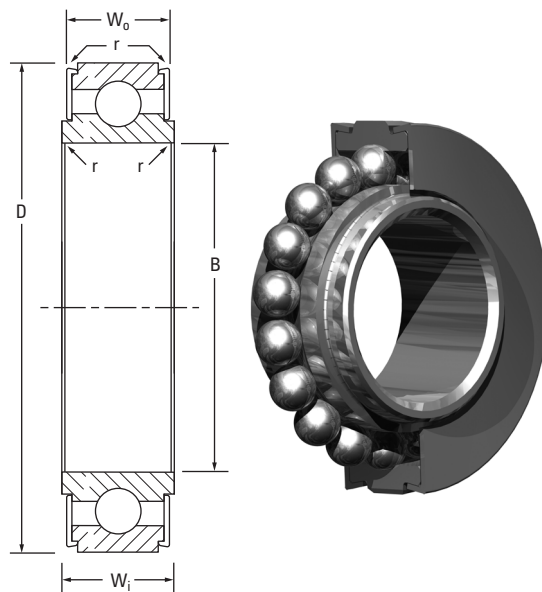


TABLE 45. COMMERCIAL SERIES FRACTURED-RACE – SINGLE ROW

Bore B	O.D. D	Width W _o	Width W _i	Chassis	Ball Complement		Load Ratings		Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight oz. g
					Number n	Dia. d	Dynamic C	Static Radial R _s	Shaft			
in. mm	in. mm	in. mm	in. mm			in. mm	lbf N		in. mm	in. mm		
0.4375 11.113	1.0000 25.400	0.3150 8.000	0.3750 9.525	SFSS-07	18	1/8 3.18	884 3932	638 2838	0.580 14.73	0.600 15.24	0.015 0.381	0.69 19.6
0.5000 12.700	1.0000 25.400	0.3150 8.000	0.3750 9.525	SFSS-08	18	1/8 3.18	884 3932	638 2838	0.580 14.73	0.600 15.24	0.015 0.381	0.61 17.3
0.6250 15.875	1.1250 28.575	0.3150 8.000	0.3750 9.525	SF55-10	21	1/8 3.18	961 4275	775 3447	0.705 17.91	0.725 18.42	0.015 0.381	0.66 18.7
0.7500 19.050	1.2500 31.750	0.3150 8.000	0.3750 9.525	SFSS-12	24	1/8 3.18	1027 4568	912 4057	0.830 21.08	0.850 21.59	0.015 0.381	0.77 21.8
0.8750 22.225	1.3750 34.925	0.3150 8.000	0.3750 9.525	SFSS-14	28	1/8 3.18	1112 4946	1089 4844	0.955 24.26	0.975 24.77	0.015 0.381	0.87 24.7
1.0000 25.400	1.5000 38.100	0.3150 8.000	0.3750 9.525	SFSS-16	31	1/8 3.18	1164 5178	1227 5458	1.080 27.43	1.100 27.94	0.015 0.381	0.97 27.5
1.1250 28.575	1.6250 41.275	0.3150 8.000	0.3750 9.525	SFSS-18	34	1/8 3.18	1211 5387	1365 6072	1.205 30.61	1.225 31.12	0.015 0.381	1.07 30.3
1.2500 31.750	1.7500 44.450	0.3150 8.000	0.3750 9.525	SFSS-20	37	1/8 3.18	1254 5578	1503 6686	1.330 33.78	1.350 34.29	0.015 0.381	1.16 32.9
1.3750 34.925	1.8750 47.625	0.3150 8.000	0.3750 9.525	SFSS-22	40	1/8 3.18	1294 5756	1642 7304	1.455 36.96	1.475 37.47	0.015 0.381	1.26 35.7
1.5000 38.100	2.0000 50.800	0.3150 8.000	0.3750 9.525	SFSS-24	43	1/8 3.18	1332 5925	1780 7918	1.580 40.13	1.600 40.64	0.015 0.381	1.36 38.6

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

COMMERCIAL SERIES FRACTURED-RACE – DOUBLE ROW

STANDARD SPECIFICATIONS

- Tolerances** Precision-ground races.
- Radial Play** DFSS-04 to DFSS-12 0.005-0.0015 in.
DFSS-12 to DFSS-24 0.0005-0.0020 in.
Ranges are available (see pages 26-27).
- Lubrication** Rheolube lithium grease.
- Dimensions** All bearings are manufactured to inch standards.

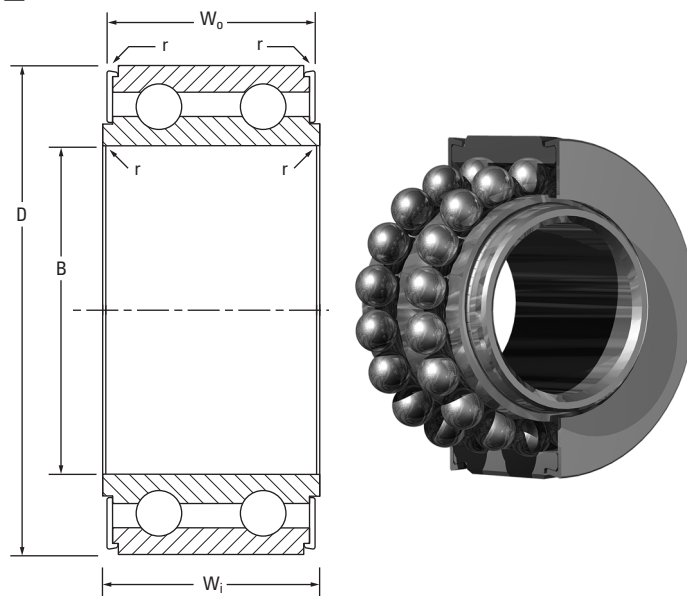


TABLE 46. COMMERCIAL SERIES FRACTURED-RACE – DOUBLE ROW

Bore B	O.D. D	Width W ₀	Width W ₁	Chassis	Ball Complement		Load Ratings		Shoulder Diameter		Radius ⁽¹⁾ r	Approx. Weight oz. g
					Number n	Dia. d	Dynamic C	Static Radial R _s	Shaft			
									Min.	Max.		
0.4375 11.113	1.0000 25.400	0.5650 14.351	0.6250 15.875	DFSS-07	36	1/8 3.18	1436 6388	1275 5671	0.580 14.73	0.600 15.24	0.015 0.381	1.19 33.7
0.5000 12.700	1.0000 25.400	0.5650 14.351	0.6250 15.875	DFSS-08	36	1/8 3.18	1436 6388	1275 5671	0.580 14.73	0.600 15.24	0.015 0.381	1.06 30.1
0.6250 15.875	1.1250 28.575	0.5650 14.351	0.6250 15.875	DFSS-10	42	1/8 3.18	1561 6944	1550 6895	0.705 17.91	0.725 18.42	0.015 0.381	1.28 36.3
0.7500 19.050	1.2500 31.750	0.5650 14.351	0.6250 15.875	DFSS-12	48	1/8 3.18	1669 7424	1824 8114	0.830 21.08	0.850 21.59	0.015 0.381	1.44 40.8
0.8750 22.225	1.3750 34.925	0.5650 14.351	0.6250 15.875	DFSS-14	56	1/8 3.18	1761 7833	2177 9684	0.955 24.26	0.975 24.77	0.015 0.381	1.60 45.4
1.0000 25.400	1.5000 38.100	0.5650 14.351	0.6250 15.875	DFSS-16	62	1/8 3.18	1842 8194	2454 10916	1.080 27.43	1.100 27.94	0.015 0.381	1.76 49.9
1.1250 28.575	1.6250 41.275	0.5650 14.351	0.6250 15.875	DFSS-18	68	1/8 3.18	1915 8518	2730 12144	1.205 30.61	1.225 31.12	0.015 0.381	2.08 59.0
1.2500 31.750	1.7500 44.450	0.5650 14.351	0.6250 15.875	DFSS-20	74	1/8 3.18	1983 8821	3007 13376	1.330 33.78	1.350 34.29	0.015 0.381	2.24 63.5
1.3750 34.925	1.8750 47.625	0.5650 14.351	0.6250 15.875	DFSS-22	80	1/8 3.18	2047 9106	3283 14604	1.455 36.96	1.475 37.47	0.015 0.381	2.40 68.0
1.5000 38.100	2.0000 50.800	0.5650 14.351	0.6250 15.875	DFSS-24	86	1/8 3.18	2107 9372	3560 15836	1.580 40.13	1.600 40.64	0.015 0.381	2.56 72.6

⁽¹⁾The maximum radius of shaft or housing fillet that bearing corner will clear.

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