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myonic

Standard Catalogue

TABLE OF CONTENTS

Company

4-5 Ultra Precision Made in Germany

6-7 Applications

8 Research and Development

Technology

10-11 myonic Designation System for Ball Bearings

12 Cleanliness and Quality Assurance

13 Material for Ball Bearing Races

14 Closures

15 Preloading and Duplex Mounting

16-17 Ball Cages

18-19 Dimensional and Running Accuracy of Radial Deep Groove Ball Bearings

20 Radial and Axial Bearing Clearance and Contact Angle

21 Friction

22 Starting Torque

23 Code for Grading by Dimensional Groups

24-25 Lubrication

26 Mounting Advice

27 Tolerances for Shafts and Housing Fits

28 Design Information

29 Calculation of Loads

30-37 Calculation of the Theoretical Life Expectancy of Ball Bearings

38 Packaging

Products

40-66 Product Tables

Accessories

68-73 Product Accessories

74-75 Addresses / Contacts

myonic

Ultra Precision Made in Germany

myonic GmbH

Headquarter and
Production Site
Steinbeisstraße, Leutkirch

myonic s.r.o.

Production Site
Roznov,
Czech Republic

myonic GmbH

Production Site
Nadlerstraße, Leutkirch

From a modest beginning, myonic has developed into a market leader

History:

2013 Acquisition APB Service GmbH, Ebensee (AT)

2012 Completion of new production hall Steinbeisstraße (GER)

2009 Acquired by Minebea Co., Ltd. (JP)

2006 Management Buy-Out with Süd Private Equity + DZ Equity Partner

2001 RMB becomes myonic

1994 Foundation of MPC (CZ)

1971 Acquisition of MKL (DE) by RMB SA (CH)

1968 Foundation of MKL GmbH (DE)

1936 Foundation of RMB SA (CH)

Size comparison of a myonic UL 103X bearing with a 1 Euro cent coin

This is myonic

Bernhard Böck
Managing Director

"Since the foundation of the company in 1936 as RMB SA, we have searched every day for the most efficient solutions for our customers.

Our capacity for innovation and our know-how is valued worldwide by all our customers. Originally focussing on the challenges of the dental industry – high speeds, maximum precision and compact dimensions – we have continually expanded our product range based on our core competencies.

Today, myonic is distinguished by the latest production technologies combined with high quality requirements and well thought-out logistics concepts. Our products can be found wherever intelligent solutions are required under the harshest environmental conditions.

Whether in space, in the medical sector, the automotive sector or in high-tech industrial products, myonic always has a suitable solution."

Part of the Minebea Group

Minebea is the world's leading vertically integrated manufacturer of miniature ball bearings and high-precision components for the telecommunications, aerospace, automotive, and electrical appliance industries.

The Minebea Group consists of 52 subsidiaries in 18 countries and employs more than 55,000 employees. In addition to its global manufacturing capabilities, Minebea's vision is to lead the competition through extensive research and development in new methods and technologies.

Dental Technology

Originally, our company mainly developed solutions for the dental industry. Today, a large proportion of our turnover comes from this sector. myonic solutions can be found in turbines, contra angle handpieces and dental motors. These dental products reach speeds of up to 500,000 r.p.m. and withstand thousands of sterilisation processes.

They are designed for maximum durability and minimum noise emission. Due to comprehensive detailed expertise, such as specially adapted tribology systems and material combinations, we have been the world market leaders for many years. Our customers also benefit from the lubrications and materials available only from myonic.

Medical Technology

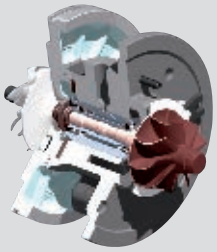
myonic solutions are essentially designed for a wide range of medical engineering applications such as X-ray diagnostics, computer tomography, minimally invasive surgery and prosthetics. Our bearing design for X-ray tubes with rotating anodes consists of high quality coatings from space technology, which ensure the functions in a temperature range of up to 530°C in a high vacuum at 10^{-8} mbar. Many manufacturers of surgical instruments and prosthetics also rely on our system solutions.

Aviation and Aerospace / Defence

myonic is a supplier of bearings for fuel control systems, mechanical systems for satellites and gyroscopic instruments. Our products withstand extreme temperature conditions, vacuums and vibrations and also provide full output after long standby periods.

The extreme requirements of the aviation and aerospace industry, also in terms of documentation requirements and traceability of all components and production steps, are implemented in full at myonic.

myonic

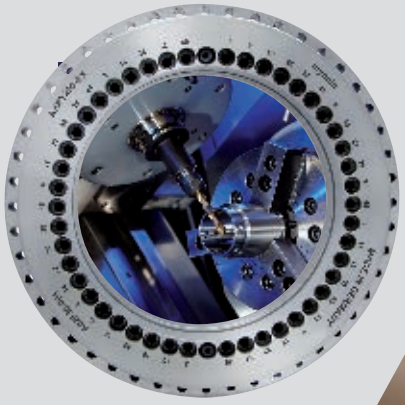


Automotive Industry

myonic and Minebea are jointly successful in the development and production of ball bearings for exhaust gas turbochargers.
The increasingly stricter emission directives force the automobile manufacturers to find further possibilities to reduce fuel consumption.

Our rolling bearings increase the degree of efficiency of the motor by approx. 2–4 % and are therefore of interest to all renowned turbocharger manufacturers. Special materials and production processes enable the high speeds of up to 250,000 r.p.m. in a temperature range from -40 to +320°C. Areas of application are car and truck engines of all sizes.

Machine Tool Industry



The machine tool industry requires system partners to further increase the efficiency of high power machines and increase its own competitiveness.

myonic products are used in rotary table systems and rotary axes as well as in in linear drive units.
In close co-operation with the customers, both high-speed solutions and highly rigid or friction-optimised applications are implemented.

The requirements for precision are met with state-of-the-art production technologies. These processes enable optimised geometries and are therefore ideal solutions for our customers.

Transmission and Crane Manufacture, Mechanical Engineering and Steelworks

APB myonic implements solutions, in particular for customers from the sectors of transmission and crane manufacture, mechanical engineering and for steelworks.

The main focus is on niche and series products such as rolling mill bearings, pulley bearings or planetary gear bearings.

In addition to the production of rolling bearings, we offer developments of optimised lubrication solutions such as DUROLUB polymer-matrix lubrication systems, special coatings and individual modifications.

Markets are becoming increasingly tight – we are constantly developing

myonic supports its customers right from an early development stage with a highly qualified engineering team and state-of-the-art equipment – from laboratory to production to installation.

First-class, highly flexible prototype production enables short development times. The components responsible for consistent top quality are manufactured in house by myonic. A stock of bearing components offers maximum flexibility and very short delivery periods.

Production is carried out in an air-conditioned environment and assembly in clean rooms of class ISO 7, under laminar flow boxes ISO 5. We also offer our expertise in assembly technology as a service to a diverse range of customers.

myonic continuously develops through strategic partnerships with leading companies and is thus the innovation partner, also for system solutions at the limits of what is technologically possible – based on the motto:

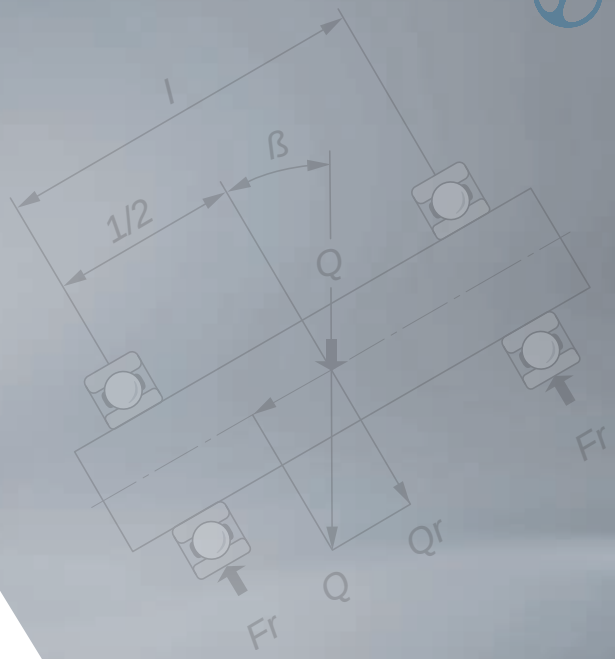
myonic – more than a bearing

High Precision Component Manufacture

Clean Room Installation

Inspection and Measuring Equipment

myonic



Technology

myonic Designation System for Ball Bearings

Basic Designation	Material	One-Sided Closure	Duplex Bearing	Cage	Tolerance Class	Radial Clearance
UL 3006	■			-48	-A5P	-6/10
ULKZ 4008	■	.1c			-A7P	–
RKF 310	■	.1v			-P5P	-11/20
R 6190	■			-237HG	-P4P	-2/5
ULKU 8012	■			-48	-A9P	-2/10
RA 4012	■			-257HP	-A7P	
R 5160	■		.9d/1000			-16/20
Design types Example: UL = Design type 3006 = Nominal dimension of bearing bore and outer diameter in 1/32 inch or, with metric series, in millimetres	X = 1.4125 (AISI 440 C) stainless steel > Page 13	.1 = one-sided closure .1c = one-sided closure on the flange side .1v = one-sided closure on the side opposite the flange > Page 14	Installation type / pre-load .9f = X arrangement .9d = O arrangement .9t = Tandem arrangement 1000 = Pre-load of 10 N > Page 15	Cage design and number of balls and material > Pages 16, 17	Dimensional and running accuracy as per ISO or ABEC > Pages 18, 19	Lower / upper limit in µm. The standard radial clearance is 6/15. > Page 20

Contact-angle	Quietness	Friction torque	Coding of bores and outer diameter	Special instruction	Lubrication
		10/75D	-S2	-J...	-L23-L23
					-G48
	-10/174				-G48/20
			-SB4/0C		-G21/…mg
				-J...	-L25
-20/25°					-L23
			-S4/BB	-J...	-L23-L23
Lower / upper limit in degrees. The standard angle of contact is 17/22°. > Page 20	10 ≧ limit value 174 ≧ gauge	10 ≧ limit value µNm 75 ≧ axial force cN D^≧ initial friction moment > Pages 21, 22	Classification by dimensional groups > Page 23	The letter J followed by an ordinal number refers to internal company regulations and denotes requirements which cannot be expressed with the previous suffixes.	Code letter L = oil G = grease Example: G5/20 = grease G5, Dispersion 20% G18/... mg = grease type G18 and dosage in mg > Pages 24, 25

Cleanliness is essential for correct functioning of miniature ball bearings

myonic meets this requirement through:

- complete temperature and humidity control as well as air filtering in all production areas
- Ultrasonic cleaning of all components between the individual production stages
- Cleaning of components with special processes developed by myonic immediately before assembly
- Assembly of ball bearings in clean rooms (ISO 7) under laminar flow boxes (ISO 5).
- strict observance of clean room processes by all personnel working there
- cleaning of the assembled product with processes specially developed and optimised by myonic for miniature ball bearings
- use of specially filtered lubricants
- packaging of the ball bearings in clean, hermetically sealed bags or tubes

myonic is thus able to supply the customers with ball bearings with the highest possible degree of cleanliness. To ensure this state up to installation of the ball bearing, our customers should also exercise this high degree of care. We therefore recommend that the following information be observed:

- All adjacent components must be produced with the correct tolerances recommended in this catalogue.
- The surface quality of these parts must meet the requirements for the individual area of application and the components must not have any burrs, loose particles, swarf, rust etc.
- Cleaning before final assembly should be carried out away from the area of installation, during which it must be ensured that the cleaned parts are not contaminated again when transported to the area of installation.
- The ball bearings should be installed in an area especially prepared for this purpose, which is separated from other rooms.

  Where possible, this area should meet clean room requirements and have a dust-free atmosphere as well as temperature and humidity control. Mechanical pro cessing steps should not take place in the same room.
- The assembly personnel must observe special cleanliness regulations. Normally, gloves and work suits such as gowns and hoods made of special, lint-free material are used for this. In the clean room, smoking, eating, wearing make-up etc. must be strictly prohibited.
- The miniature ball bearings should only be removed from their packaging immediately before installation. If a package contains more than one ball bearing, only the number of ball bearings immediately required should be removed.
- Ball bearings should be handled with tweezers or other special tools.

  High-precision miniature ball bearings must never be touched directly with fingers.
  Wearing of lint-free and abrasion-free finger cots or gloves is recommended.

  The higher the requirements of the bearings are, the more important it is to strictly observe these recommendations.

DIN EN ISO 14001:2004
DIN EN ISO 9001:2008

Certificates: http://www.myonic.com/isozertifikat

myonic miniature ball bearings have ring materials per list below

In the case of miniature ball bearings, selection of the correct material is decisive for perfect functioning in the end use.

At myonic, the materials are procured, tested and released for use in products in accordance with defined processes. The materials therefore meet the necessary requirements for safe functioning of the end product.

myonic uses various grades of steel which meet specific customers' requirements. Please contact the engineers in our Sales and Engineering Departments.

They will be pleased to help you to select the right material for your specific area of application.

Standard material suffix “X”

X105CrMo17– DIN 1.4125 – AISI 440C

This is the standard material which is mainly used in areas in which corrosion-resistance is important.

The steel has a high degree of corrosion resistance and due to the heat treatment, this material has good hardness of 61 HRC.

Material on request suffix “V”

100Cr6 – DIN 1.3505 – AISI 52100

This material is most frequently used to produce ball bearings of all sizes. Its composition complies with the standard AISI 52100 and ensures a good, uniform microstructure with a hardness after heat treatment of 62 HRC.

Material on request suffix “XG”

X65Cr13 – DIN 1.4037

myonic introduced this grade of steel at the request of customers and to round off the range of stainless rolling bearing steels.

Due to the low carbon content, the degree of hardness is lower than with AISI 440C, but still sufficient for use in rolling bearings. Due to the relatively low chromium content of 13 % (limit value for stainless steels), the requirement for corrosion resistance is easily met.

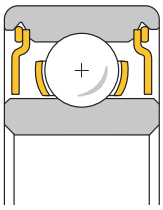
Material on request suffix “XA”

X30CrMoN15-1 – DIN 1.4108

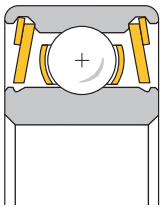
This stainless steel has a large proportion of nitrogen, which together with the available carbon produces a grain structure in which carbon nitrides are contained in the form of homogeneously distributed microspheres. Corrosion-resistance is ensured by the chrome content.

This special microstructure results in improved macro-mechanical properties, in particular in terms of hot hardness, elasticity, flexural strength and elongation at break. The achievable hardness is less than steel AISI 440C.

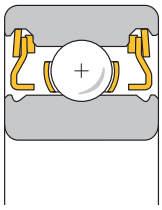
Please contact our application engineers for a recommendation of the most suitable steel grade for your application.
Our engineers will offer the right solution for areas of application with maximum requirements for ball bearings.
Steel grades from the above list and / or special materials are used.



Standard closure
Types «V» and «Z»



Standard closure
Type «X»



Filmoseal
Type «F»

Closures

Closures in the form of shields or seals are used for the following:

- to prevent contamination during handling or assembly of the ball bearing
- to protect the inside of the ball bearing during operation
- to keep lubricant back and reduce its loss to a minimum

myonic standard closures, types «V, Z, X»

myonic produces high-precision closures punched from stainless steel material. These closures do not come into contact with the bearing part and provide basic protection against dirt from the outside.

This ensures that neither the friction moment nor noise development nor the operating temperature of the ball bearing increases.

It should be noted that this type of closure does not ensure complete protection against external contamination due to dust nor against the ingress of liquids.

Our standard closures are identified with one of the following letters: «V», «Z», «X».
Depending on the requirements of the area of application, we can supply permanently mounted or removable closures.

Filmoseal from myonic, a non-contact seal, type «F»

This is a capillary seal known as «Filmoseal», an exclusive myonic design identified with an «F» after the bearing type and before the size.

myonic developed this cover named «Filmoseal» to combine the advantage of a contactless cover with the practical effect of a seal via the capillary effect of an oil film.

This is achieved with the advanced design of the shields and the special groove in the inner ring of the ball bearing.

Due to this design, circulation of the lubricant in the ball bearing is increased and loss of lubricant and dirt from the outside is considerably reduced.

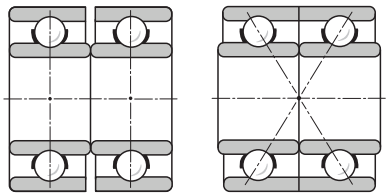
The use of a PTFE seal which is impermeable to oil in the outer ball cage also contributes to preventing loss of lubricant. This non-contact seal is recommended in cases in which high speeds or protection against dirt is required or if the ball bearing is subjected to high centrifugal forces.

«Filmoseal» from myonic is particularly effective with a rotating outer ball cage, as the hermetic seal between the shield and the outer ball cage prevents all loss of lubricant without an increase in noise development or temperature.

Special seals from myonic

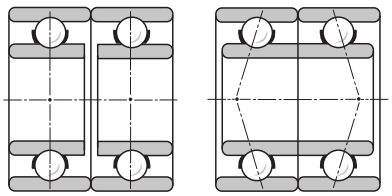
myonic develops special seals and shields which meet maximum customer requirements. Further information is available from our sales engineers or technicians.

X - configuration (suffix .9f) face to face



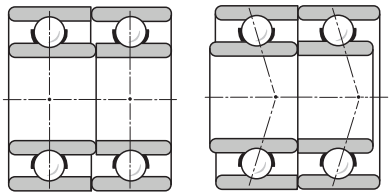
before mounting after mounting

O - configuration (suffix .9d) back to back



before mounting after mounting

Tandem mounting (suffix .9t)



before mounting after mounting

Preloading and Duplex Mounting

The preloading of radial or angular contact ball bearings serves the purpose of increasing rigidity and running accuracy and minimising sliding of the balls at very high speeds or in the case of rapid acceleration / deceleration. In general, pre-loading of a ball bearing is achieved by exerting an axial force on the face of the ball race. This axial force is applied either by springs or by a pre-set axial offset of the outer ring to the inner ring.

Preloading by Spring

Spring preloading is achieved with the aid of one or more spring elements which act against the front face of the outer ring or inner ring of the ball bearing with a pre-set axial force.

With inner ring rotation, the spring disk is pressed against the outer ring (sliding fit). With outer ring rotation, the spring disk is pressed against the inner ring (sliding fit). myonic produces ultra precision, stainless steel spring disks for all standard bearings in our catalogue.

Here it is essential that the two front faces of the spring disks are as parallel as possible to each other, so that correct preloading is ensured and misalignments of the ball bearings are avoided.

Preloading of the duplex bearings

To define preloading for two or more ball bearings with high precision, the races must be produced as shown in the diagrams. The axial offset of the inner ring front face to the outer ring front face defines the required preloading. On installation, the axial offset is cancelled and thus the pre-loading is produced.

Preloading of the “X - configuration” (suffix .9f)

With the X - arrangement, the distance between the outer rings is smaller than the distance between the inner rings. The difference between the races is produced on installation by cancellation of a defined axial offset of the front faces. The axial offset of the front face of the inner ring to the front face of the outer ring is produced by grinding the front faces of the outer rings on one side of the ball bearing. With the X – arrangement, the effective distance between the bearing centres is reduced.

The contact lines converge. The distance between the virtual pressure points (intersection of the angle of contact lines with the symmetry axis) is less than the race clearance. This arrangement is more error tolerant in terms of alignment of the bearing system during installation and has good rigidity.

Preloading of the “O - configuration” (suffix .9d)

With the O - arrangement, the distance between the outer races is greater than that of the inner rings. The difference between the races is produced on installation by cancellation of a defined axial offset of the front faces.

The axial offset between the inner and outer ring front faces is produced by grinding the front faces of the inner rings on one side of the ball bearing.

With the O - arrangement, the effective distance between the centre points increases. The contact lines diverge. The distance between the virtual pressure points (intersection of the angle of contact lines with the symmetry axis) is greater than the race clearance. This arrangement is used at high speeds and to increase the tilting torque.

“Tandem mounting” (suffix .9t)

The ball bearings can also be arranged in tandem form. In this case, the contact lines run parallel and the externally applied radial and axial forces are evenly distributed. This arrangement offers the advantage of a higher axial load-bearing capacity in one direction.

Normally, another bearing or another tandem bearing group is installed at the other end of the shaft to absorb any axial forces working in the opposite direction.

myonic cage “480” Two piece steel ribbon cage tightly crimped

This is a two-piece pressed cage. It is sufficient for most areas of application in which no extreme requirements are made. It can be used if no start-up or bearing friction moment is required, in applications with medium or high speeds or when sufficient lubrication is ensured.

This cage type is supplied as standard with most miniature radial ball bearings, when contaminating misalignment and fast acceleration / deceleration are not of importance. If the cage is used with a speed co-efficient of n x Dm above 400,000 (n = speed in r.p.m.; Dm = pitch circle in mm), please consult our Engineering Department.

myonic cage “48” Two piece steel ribbon cage loosely crimped for low torque

This cage is produced by pressing, is very light and prevents sticking. myonic developed the model “48” especially for areas of application with a requirement for a low friction moment or relatively low speeds. At speeds above 5,000 r.p.m., please contact our Engineering Department.

Two piece steel ribbon cage with coating

For cases where conventional lubricants are not suitable, both the two-piece standard cage model “480“ and model “48” can be coated with a fine layer of PTFE, silver, gold or other materials which are self-lubricating. PTFE-coated cages are used for very long storage times, in instruments which work in a vacuum and in optical systems.

Before selecting coated ball cages, it is strongly recommended that you contact our Engineering Department and / or carry out practical tests with the end application.

Ball Cages

The purpose of the ball cage is to keep the balls separate from each other around the pitch diameter of the bearing.

In order to find the ideal solution for every ball bearing, myonic has developed many different designs of ball cages.

They differ both in design and in material.

There is no single ball cage which meets all conceivable requirements.

When selecting the most suitable ball cage, the following requirements are to be considered:

- start-up and bearing friction moment
- speeds
- acceleration and deceleration
- operating temperature
- type and quantity of lubricant
- environmental conditions when using (vacuum, chemicals etc.)
- requirements for noise development
- external vibrations
- self-lubrication

myonic cage “23” for highspeed applications

This ball cage in the form of a crown or comb is machined with different synthetic materials or injection moulded.

With selection of the right material, this model can either be oil-impregnated for a longer service life or delivered completely dry if the environmental conditions do not allow lubrication with conventional lubricants.

The ball cage “23” is used in myonic ball bearings for areas of application in which speed co-efficients n x Dm of up to 1.3 million occur (n = speed in r.p.m; Dm = pitch circle in mm).

With even higher speed co-efficients, we recommend consulting our Engineering Department.

myonic cage “25” highspeed application for angular contact ball bearing type

This is a solid one-piece race which is machined or injection moulded. The myonic cage “25” is specially designed for the angular contact ball bearings of the series RA and RKA. This ball cage can be supplied in oil-impregnated form to increase the service life in the event of inadequate lubrication.

The ball pockets are designed in such a way that the inner ring of the ball bearing can be disassembled without the balls falling out.

The two rings can therefore be installed separately if required. The ball cage model “25” is used in myonic ball bearings for areas of application where speed co-efficients n x Dm of up to 1.5 million occur (n = speed in r.p.m; Dm = pitch circle in mm).

myonic cage “27” highspeed application for angular contact ball bearing type

This ball cage is very similar to the model “25”, except that the ball pockets are drilled through.

When the inner ring is disassembled, the balls are not held with this design. The advantage is the lower friction moment compared with the model “25”.

The model “27” is used in ball bearings from myonic for areas of application where speed co-efficients n x Dm of up to 2.4 million occur (n = speed in r.p.m.; Dm = pitch circle in mm).

With even higher speed co-efficients, we recommend that you contact our Engineering Department.

Materials for ball cages

In addition to metallic materials, myonic can supply many synthetic materials for ball cages. For example:

- Laminated fabric
- PAI
- PI
- PEEK
- PA
- PTFE
- POM
- Sterilisable laminated fabric (myonic patent)
- Laminated paper

Each of these materials has its advantages, depending on the area of application, lubrication and operating environment. We strongly recommend that you contact your nearest myonic sales centre or our engineers in order to select the ideal cage material.

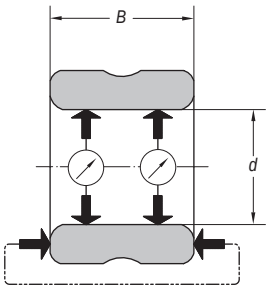
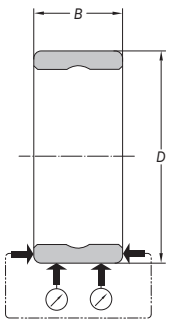
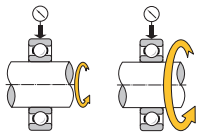
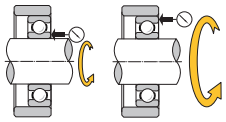
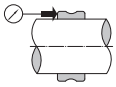
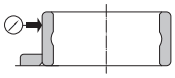
Customised cage designs

If none of the listed standard cages is suitable for customer requirements, myonic can also produce special designs completely in accordance with customer specifications. Our Research and Development Department continually tests new, innovative materials and construction types for ball cages which offer first class performance. Please contact our sales engineers or technicians, who will be pleased to help you find the best solution for your application.

Dimensional and Running Accuracy of Radial Deep Groove Ball Bearings

Tolerance class

All myonic miniature ball bearings are produced in tolerance classes pursuant to ISO and / or ABEC.
The International Organization for Standardization (ISO) defines standards which apply to the tolerances of ball bearings in metric dimensions, whereas the standards of the Annular Bearings Engineers Conference (ABEC) are applied for ball bearings in inch dimensions. myonic produces according to both tolerance standards.

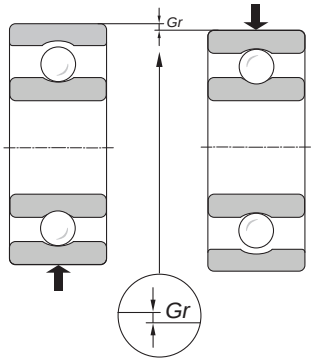
	Grades **ISO 492**			**2**		**4**	
	ABEC				**9P**		**7P**
	myonic suffix			**P2**	**A9P**	**P4P**	**A7P**
Inner ring 	$\frac{d\ max+d\ min}{2}=dmp$	Δ dmp	max	0	0	0	0
			min	-2.5	-2.5	-5*	-5
	Absolute limit values, bore diameter	Δ ds	max	0	0	0	0
			min	-2.5	-2.5	-5*	-5
	Irregularity	Δ dsp	Bore hole max	0.8*	–	–	–
			Race max.	0.5	–	–	–
	Width **B**	ΔB_s	max	0	0	0	0
			min	-25	-25	-25	-25
	Parallelism deviation	V B_s	max	1.5	1.25	2.5	2.5
Outer ring 	$\frac{D\ max+D\ min}{2}=Dm$	ΔD_{mp}	max	0	0	0	0
			min	-2.5	-2.5	-5*	-5
	Absolute limit values, outer diameter	ΔD_s	max	0	0	0	0
			min	-2.5	-2.5	-5*	-5
	Irregularity		from d or D max	0.5	–	–	–
			Race max	0.8*	–	–	–
	Width **B**	ΔC_s	max	0	0	0	0
			min	-25	-25	-25	-25
	Parallelism error	V C_s	max	1.5	1.25	2.5	2.5
Radial run-out 	Inner ring	Kia	max	1.5	1.25	2.5	2.5
	Outer ring	Kea	max	2*	1.25	5*	3.75
Axial run-out 	Inner ring	S_{ia}	max	2*	1.25	2.5*	2.5
	Outer ring	S_{ea}	max	4*	1.25	5	5
Face run-out 	Inner ring	S_d	max	2*	1.25	2.5*	2.5
Perpendicularity 	Outer ring	S_D	max	2*	1.25	3.75	3.75

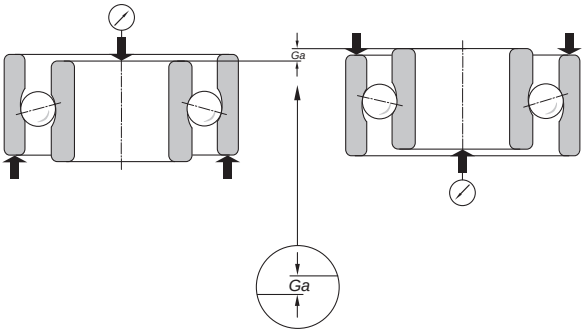
* divergent from the standard

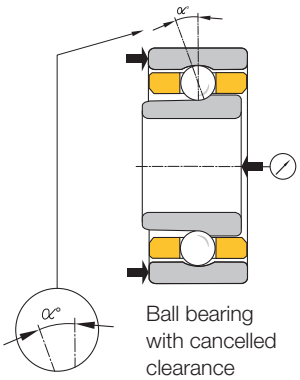
Tolerance Class

The high-precision production and assembly processes at myonic make it possible to produce ball bearings from ISO 5P and / or ABEC 5P to ISO 2 and / or ABEC 9P. For areas of application which have to meet maximum requirements, myonic produces ball bearings with even lower tolerances than required by the standards. Our sales engineers and technicians will present you with the ideal solution.

5		**6**		**0**		
	5P		**3**		**1**	
P5P	**A5P**	**P6**	**A3**	**–**	**A1**	
0	0	0	0	0	0	Limit values of the arithmetic mean of all measurements in two planes (dm = mean inner diameter).
-5	-5	-7	-5	-8	-7.5	
0	0	+1	+2.5	+1	+2.5	Limits of the absolute value of the smallest and largest inner diameter measured in two planes.
-5	-5	-8	-7.5	-9	-10	
–	–	2	–	–	–	Maximum difference authorised by myonic between the radii of two concentric circles, the inscribed and the circumscribed circle, with reference to the form error diagram.
–	–	2	–	–	–	
0	0	0	0	0	0	Lower and upper absolute limit values of the width of the inner ring.
-25	-25	-40	-125	-40	-125	
5	5	12	–	12	–	Maximum deviation between the smallest and the largest measured width.
0	0	0	0	0	0	Limit values of the arithmetic mean of all measurements in two planes (Dm = mean outer diameter).
-5	-5	-7	-7.5	-8	-10	
0	0	+1	+2.5	+1	+2.5	Limits of the absolute value of the smallest and largest outer diameter measured in two planes (only for bearing without shields).
-5	-5	-8	-10	-9	-12.5	
–	–	2	–	–	–	Maximum difference authorised by myonic between the radii of two concentric circles, the inscribed and the circumscribed circle, with reference to the form error diagram.
–	–	3	–	–	–	
0	0	0	0	0	0	Lower and upper absolute limit values of the width of the outer ring.
-25	-25	-40	-125	-40	-125	
5	5	–	–	–	–	Maximum deviation between the smallest and the largest measured width.
5*	3.75	5	5	10	7.5	Total pointer deflection of the dial gauge during one revolution of the inner ring with stationary outer ring.
5	5	8	10	15	15	Total pointer deflection of the dial gauge during one revolution of the outer ring with stationary inner ring (only for bearings without shields).
7.5	7.5	–	–	–	–	Total pointer deflection during one revolution of the inner ring with stationary outer ring (Limit of the axial run-out of the race in relation to the fronts).
7.5	7.5	–	–	–	–	Total pointer deflection of the dial gauge during one revolution of the outer ring with stationary inner ring.
7.5	7.5	–	–	–	–	Total pointer deflection of the dial gauge during one revolution of the inner ring.
7.5	7.5	–	–	–	–	Total pointer deflection of the dial gauge during one revolution of the outer ring (only for bearings without shields).







Ball bearing with cancelled clearance (without axial load)

Radial and Axial Bearing Clearance and Angle of Contact

Radial bearing clearance (Gr)

The radial bearing clearance is one of the most important bearing specifications and not a reference to the quality of the ball bearing.

Without sufficient radial bearing clearance, press fits (interference fits) and the normal expansion of the components cannot be absorbed without affecting the bearing. In extreme cases, the bearing may therefore fail prematurely.

The radial bearing clearance of the installed ball bearing influences the angle of contact during operation and thus radial and axial load capacity, rigidity, service life and other basic performance characteristics. Information on installation conditions which influence the radial bearing clearance is given in the section on shaft and housing tolerances (page 27).

Greater radial bearing clearance is advantageous when more heat is produced due to high speeds and when shear loads occur. Lower radial bearing clearance is more suitable for mainly radial loads.

As standard, the radial bearing clearance of myonic radial bearings is between 6 and 15 µm (.0002" to .0006").
If required, the ball bearings can be supplied with a smaller or greater radial bearing clearance.

Please contact the engineers in our Sales and Engineering Departments. They will be pleased to help you to select the right radial bearing clearance for your specific area of application.

Axial bearing clearance (Ga)

The axial bearing clearance of a ball bearing corresponds to the total axial displacement of the inner ring compared with the outer ring under the influence of a low measurement load.

Angle of contact (α°)

The angle of contact of a radial ball bearing or angular contact ball bearing is the angle between the line perpendicular to the axis and the connecting line through the contact points of the balls on the races, after eliminating the complete radial bearing clearance.

The angle of contact is defined by the radial bearing clearance, the size of the balls and the radius of the races. It increases slightly if an external axial load is exerted on the ball bearing.

As standard, the angle of contact of the myonic radial ball bearings is between 17° and 22°.

The greater the angle of contact is, the greater also is the axial load capacity of the ball bearings, i.e. the capacity to absorb axial loads increases.

Please contact our application engineers, who will be pleased to help you select the right contact angle for your area of application.

	Steps			
Radial bearing clearance in (µm)	2 to 5	6 to 10	11 to 15	16 to 20
Suffixes	2/5	6/10	11/15	16/20

	Steps				
Angle of contact α°	11° to 16°	14° to 19°	17° to 22°	20° to 25°	23° to 28°
Suffixes	11/16°	14/19°	17/22°	20/25°	23/28°

Friction

The criteria by which the bearing friction of ball bearings is determined are very complex and still the subject of detailed studies.

Some of the important factors on which bearing friction depends have been determined based on research and experience:

- Dimensional precision, design and surface quality of the races
- Dimensional precision of the balls
- Material of the balls and rings
- Design, material and guide of the ball cages
- Properties, quantity, quality and distribution of the lubricant
- Precision of housing and shaft in or on which the bearings are installed
- the fit tolerances with which the clearance is set on installation
- size and direction of the externally exerted loads
- position of the ball bearing axis

Various standardisation projects for these measurements are still at a preparatory stage. myonic has developed its own method from these, which is based on practical experience with actual applications and on tests in the company's own research and development laboratory.

The sensitivity of ball bearings is determined by the relative value of one or more of the following forces:

- Start-up moment
- Bearing friction moment
- Friction peak

In the majority of torque measuring instruments the bearing to be measured is subjected to a pure axial load (which basically has an even effect on all balls of the bearing).

The axial test load is:

- 0.75 N for ball bearings with an outer diameter of up to 10 mm incl. or up to .375" for bearings in inch dimensions
- 4 N for ball bearings with a diameter of more than 10 mm or an outer diameter of more than .375” for bearings in inch dimensions

Starting Torque for Instruments – Ball Bearings

The maximum value given in the table for the start-up friction moment was taken from the ABMA standard for instruments – ball bearings. They apply to ball bearings of quality ABEC 7P (with or without shields), both in stainless steel (e.g. AISI 440C) and in chromium steel (AISI 52100), with a two-piece ball cage and lubricated with instrument oil.

The definitions and test conditions are defined in this standard. These values are maximum values for myonic ball bearings of the relevant category.

Inner diameter d	**Outer diameter** D	**Test load**	**Maximum starting torque µN · m** radial clearance inner		
			Press fit	**Normal fit**	**Loose fit**
inches	inches	N	.0001"- .0003" 2–8 µm	.0002"- .0005" 5–12 µm	.0005"- .0008" 12–20 µm
.0400	.1250	.75	18	15	14
.0469	.1563	.75	18	15	14
.0550	.1875	.75	18	15	14
.0781	.2500	.75	18	15	14
.0938	.3125	.75	18	15	14
.1250	.2500	.75	18	15	14
.1250	.3125	.75	18	15	14
.1250	.3750	.75	20	16	15
.1250	.3750	4	50	45	42
.1250	.5000	4	50	45	42
.1563	.3125	.75	18	15	14
.1875	.3125	.75	18	15	14
.1875	.3750	.75	20	16	15
.1875	.5000	4	65	55	50
.2500	.3750	.75	18	15	14
.2500	.5000	4	60	52	48
.2500	.6250	4	70	60	55
.2500	.7500	4	80	70	65
.3750	.8750	4	110	95	90

Code for Grading by Dimensional Groups

In order to improve the fit conditions between bearings and shaft or housing fits, myonic uses the group classification of the inner and outer diameters of the bearings.

			Outer diameter D						
	Tolerance in µm		0 -2.5	-2.5 -5	0 -1.25	-1.25 -2.5	-2.5 -3.75	-3.75 -5	not classified
	µm	Code	**1**	**2**	**A**	**B**	**C**	**D**	**0**
Inner diameter d	0 -2.5	**1**	11	12	1A	1B	1C	1D	10
	-2.5 -5	**2**	21	22	2A	2B	2C	2D	20
	-0 -1.25	**A**	A1	A2	AA	AB	AC	AD	A0
	-1.25 -2.5	**B**	B1	B2	BA	BB	BC	BD	B0
	-2.5 -3.75	**C**	C1	C2	CA	CB	CC	CD	C0
	-3.75 -5	**D**	D1	D2	DA	DB	DC	DD	D0
	not classified	**0**	01	02	0A	0B	0C	0D	none Suffix

S2 (11, 12, 21, 22) · SN2-SB4 (1A, 1B, 1C, 2A, 2B, 2C) · SN2 (10, 20) · SN4-SB2 (A1, A2, B1, B2) · S4 (AA, AB, AC, BA, BB, BC) · SN4 (A0, B0) · SB2 (01, 02) · SB4 (0A, 0B, 0C)

Suffixes

If only one of the two diameters is to be classified, the symbol **«O» stands for the other diameter.**

S4
d= 0 / -1.25 — 1st symbol = A
D= -2.5 / -3.75 — 2nd symbol = C
} Group AC

SB2
d= not classified = A
D= 0 / -2.5 = 1
} Group 01

S2
d= 0 / -2.5 — 1st symbol = 1
D= -2.5 / -5 — 2nd symbol = 2
} Group 12

SN4
d= 0 / -1.25 = A
D= not classified = 0
} Group A0

Note: the classification may result in various dimensional groups. The measured groups are specified on the packaging. myonic cannot offer any assurance that bearings of one shipment are supplied in one single group.

Lubrication

One of the most important factors for the effective functioning of a miniature ball bearing is the lubricant and the lubrication method. Due to the size of the miniature ball bearings, there may be considerable differences between the performance characteristics of individual lubricants.

The selection of the lubricant, its quantity and distribution inside the bearing are decisive.
The following characteristics must therefore be taken into account:

- Speed of the inner and / or outer ring
- Operating conditions of the rotation (with interruptions, continual, oscillating, tilted etc.)
- Externally applied loads (axial, radial tilting movement)
- Operating temperature and environmental temperature of the ball bearings
- Permissible noise development
- Expected service life
- Storage before use
- Environmental conditions at the place of use of the ball bearings (vacuum, chemicals etc.)
- Required start-up and bearing friction moment

Our Research and Development Department develops tests in co-operation with our lubricant suppliers to ensure consistent quality of the product supplied to us.

Hundreds of oil and grease types and solid lubricants have been tested and are available for maximum requirements.

Please contact our Sales and Application Engineers.

Standard lubricants of myonic

The products in our range are normally available with the following standard lubricants:

Radial ball bearings with shields, outer diameter < 9 mm	L23
Radial ball bearings with shields, outer diameter ≥ 9 mm	G48
Angular contact ball bearing	G48
Axial ball bearing	G48

The adjacent tables contain information intended to help the designer with his selection of the suitable lubricant.

However, the specified values are not binding for myonic, as they were only taken from the publications of the respective manufacturers.
In critical cases, practical tests with the relevant lubricants are recommended; frequently, tests are even essential.

We do not claim that the tables are exhaustive. Provided that the relevant lubricant is available, myonic can lubricate ball bearings with any required product.

Characteristics of the Oils and Greases Most Frequently Used by myonic

Oils

Code	General	High speed	High speed and high temperature	High temperature (> 200°C)	Low temperature (< -50°C)	Low start-up friction moment	Low noise level
L2		■			■	■	■
L23	■		■		■		■
L25				■			

Code	Designation	Temperature range in °C	Temperature-peaks in °C	Viscosity in cSt at 20°C	Flash point in °C	Setting point in °C	Military specification USA
L 2	Isoflex® PDP 38	-65 to + 100	-	23	+200	-70	-
L23	Winsor L 245X	-57 to + 185	+204	24	+216	-60	MIL-L-6085D
L25	Krytox® 143 AB	-40 to + 232	-	230	+215	-40	-

Greases

Code	General	High speed	High speed and high temperature	High temperature (> 200°C)	Low temperature (< -50°C)	Low start-up friction moment	Low noise level	H1 approval
G21					■			
G48	■							
G58		■						
G79			■					
G86							■	
G90				■				
G100		■						
G144		■						
G163		■						■

Code	Designation	Temperature range in °C	Basic oil viscosity cSt	Penetration as per ASTM at 25°C	Drip point in °C	Basic	Military specification USA
G21	Nye Instrument 704C (Aeroshell grease 7)	-65 to +150	3 / 100°C	296	+260	Bentone Clay	MIL-PRF-23827C
G48	Turmogrease Li 802 EP plus	-35 to +140	85 / 40°C	257	> 250	Lithium	-
G58	Klüber Isoflex® LDS 18 Special A	-50 to +120	15 / 40°C	280	+185	Lithium	-
G79	Isoflex® Klüber Topas NB 52	-50 to +120	30 / 40°C	280	+240	Barium	-
G86	Asonic® GLY 32	-50 to +140	25 / 40°C	280	+190	Lithium	-
G90	Isoflex® Klüber Barrierta L55/2	-40 to +260	400 / 40°C	280			
G100	Nye Rheolube® 740 S	-30 to +120	116 / 40°C	295	+240	Polyurea	-
G144	myonic high speed lube	-40 to +200	46 / 40°C	340	> 200	Polyurea	-
G163	myonic H1 high speed lube	-40 to +200	46 / 40°C	325	> 200	Polyurea	-

Mounting Advice

Miniature ball bearings can only function perfectly as intended if installation is carried out correctly.
From experience it is known that functional defects and excessive wear are due in most cases to incorrect installation.
The following points should therefore be strictly observed:

Selection of the fit:

Perfect functioning of the ball bearings largely depends on the quality of the fit. The following aspects are to be taken into account when selecting the suitable fit:

- Surface quality and dimensional precision of the shaft and housing. These two factors not only influence the friction moment and running noise but also ensure perfect running of the ball bearing, especially at high speeds.
- Temperature fluctuations: at high temperatures the outer ring is loosened by the radial expansion of a light alloy housing, whereas the radial expansion of a light alloy shaft reduces the radial clearance.

  On the other hand, the difference between the axal expansion of a steel shaft and of a light alloy housing lead to an additional axial load.
- Size, type and direction of loads. The load of a ball bearing in rest position should not exceed its static load rating.
- Axial, radial, combined and loads applied in both directions, which lead to fast load changes.

  Such impact loads are very damaging to miniature ball bearings and should be prevented if possible.
- Relative movement of the inner and outer rings.
- The precision and radial rigidity required for the complete assembly.

  The two tables on the following pages show in the middle column – one for shafts and once for the housing – the most favourable production tolerances for optimum design of the fit, where
- the loads and speeds for the relevant application
- are taken as a basis on the left and the required precision and radial rigidity on the right.

The tolerances are given in µm and only apply if the material for the shafts and housing has the same expansion co-efficients as the steel used for the ball bearings*.

In all other cases, the different expansion values must be taken into account.

In general, the fits given in these tables are suitable for normal operating temperatures.

Great differences in temperature and the direction of the heat flow in the bearing must be taken into account.

Frequently, laboratory tests are required to find the best solutions. The installation and operating conditions are important here.

Such tests can be carried out in the myonic laboratory.
For easier installation, myonic ball bearings can be divided on delivery into dimensional groups of the bore hole and / or outer diameter.

* Expansion co-efficient of the steel for the ball bearing: 11 x 10^{-6} °C

Tolerances for Shafts

Shaft and ball bearing of the same material; otherwise, the different expansion co-efficients[1] are to be taken into account.

Shaft	Loads / Speeds	Fit	Tol. d of the ball bearing				Accuracy of the assembly	Typical Application areas	The Inner ring is laterally
			0/–8 µm	0/–5 µm	Sorting 0/-2.5	Sorting -2.5/-5			
			Tolerance shaft						
rotating or fixed (alternating)	Low loads Low to medium speeds No vibrations	Sliding fit	-5 -13	-5 -11	-5 -8	-8 -11	Normal precision without special requirements. Normal precision; of the inner ring must be movable sideways (expansion).	Guides (Films, audio tapes...) Brakes Couplings	fixed fixed
fixed	Medium loads Medium speeds Vibrations with high frequency	Press fit	0	0	0	-3	Precise radial Guide Radial rigidity	Gyroscope	fixed
rotating	Low loads Medium speeds Vibrations with low frequency		-8	-6	-3	-6	Normal precision	Small motors Potentiometer Servo motors	free
fixed	High loads High speeds Vibrations with high frequence	Press fit	+4	+4	+4	+1	The press fit must at high speeds be ensured. High radial rigidity	Gyroscope Fans Electric motors	free
rotating	Medium to high loads High speeds Vibrations with high frequency		-4	-2	+1	-2			

Tolerances for the Housing Fits

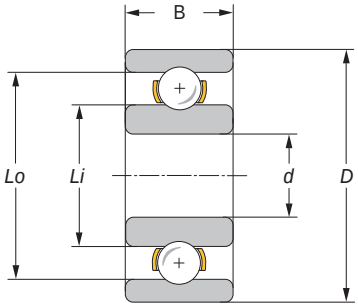
Housing and ball bearing of the same material; otherwise, the different expansion co-efficients[1] are to be taken into account.

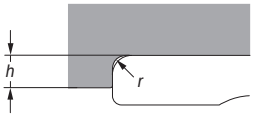
Outer ring	Loads / Speeds	Fit	Tol. d of the ball bearings				Accuracy of the assembly	Typical Areas of application
			0/–8 µm	0/–5 µm	Sorting 0/-2.5	Sorting -2.5/-5		
			Tolerance shaft					
rotating or fixed (alternating)	Low loads Low to medium speeds No vibrations	Sliding fit	+5 -3	+5 -1	+5 +2	+2 -1	Normal precision without special requirements. The outer ring must be movable sideways (expansion).	Electric motors Servo motors Fans Potentiometer
fixed	Medium loads Medium speeds Vibrations with high frequency	Press fit 0	0	0	0	-3	Precise radial guide Radial rigidity. The outer ring must fit firmly sideways.	Synchronous motors Rotor suspensions
rotating	Low loads Low to medium speeds Vibrations with low frequency		-8	-6	-3	-6	Normal precision	Guides Tensioner pulleys Pantographs
fixed	Large loads High speeds Vibrations with high frequency	Tight fit	-4	-3	-3	-6	The tight fit must at high speeds be ensured.	Rollers Deflecting rollers Planetary gear
rotating	Medium to large loads High speeds Vibrations with high frequency		-12	-9	-6	-9	It is not necessary for the outer ring to be held laterally. High rigidity	

[1] Temperature expansion co-efficient ball bearing steel: 11×10^{-6} °C

Design Information

The ball bearing tables contain the dimensions of the myonic miniature ball bearings d, D, B (Bf), Li, Lo, r max and h min.





d = Inner diameter

D = Outer diameter

B = Width of the ball bearing rings

Li = minimum permissible shoulder diameter of the housing seat

Lo = maximum permissible shoulder diameter of the shaft

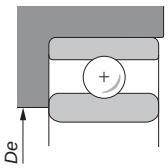
r max = maximum permissible rounding radius of the shaft or housing seat

h min = minimum permissible shoulder height of the shaft or housing seat

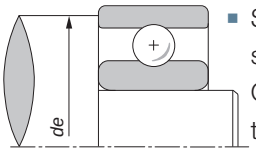
Please avoid:

- Larger radii than r max and lower shoulder heights of the locking ring than h min. Consequences: axial position undetermined, risk of deformation for the ring.

- Shoulder and locking ring lower than h min. Consequences: as above.

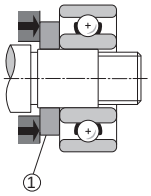


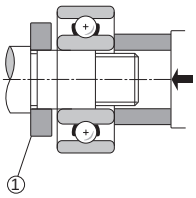
- Shoulder diameter De of the housing seat less than Li. Consequences: shoulder touches the inner ring.

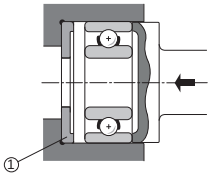


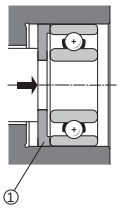
- Shoulder diameter De of the shaft greater than Lo. Consequences: shoulder touches the outer ring.

Please ensure:









- In particular, the values Li, Lo, r max and h min should be strictly observed.
- The following diagrams show how a ball bearing should normally be installed or disassembled.
- If for design reasons it cannot be avoided that the shoulder height is too small, a ground sliding ring should be inserted between the shoulder and the ball bearing.
- When installing and removing radial bearings, particular care is required to prevent all transmission of forces via the shaft to the bearing at the other end of the shaft. In addition, the ball bearing opposite the ball bearing which is being installed should be protected in such a way that the balls are not subjected to loads or impacts.
- The load must be directly applied to the ball bearing ring which is being installed or disassembled. A flux via the ball set is to be avoided. Therefore, to facilitate disassembly, intermediate rings ① should be inserted.

  If such intermediate rings cannot be used, grooves should be made in the shoulders of the housings or shafts so that special tools can be introduced for disassembly.

Calculation of Loads

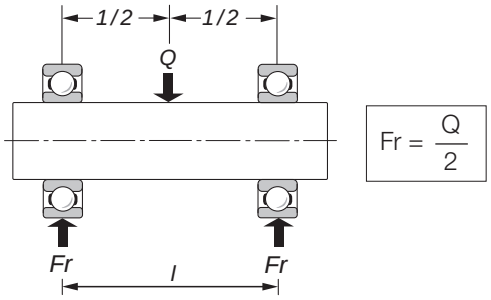
In most cases, miniature ball bearings are only subjected to relatively low loads, which can nevertheless affect their service life. For this reason, it is recommended to determine the direction and size of these loads as far as possible.

Loads which must be observed:

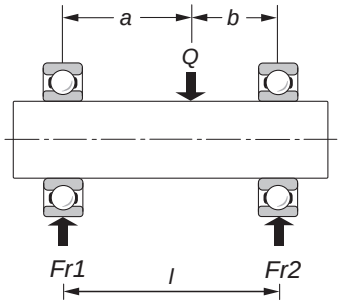
1. Weight of the moving part
2. Centrifugal force (imbalance)
3. Dynamic load (acceleration, deceleration)
4. Force as a result of energy transmission
   (Belt pulley, gears etc.)
5. Pre-tensioning of duplex bearings[1]

Direction and distribution of forces

Pure radial load Fr



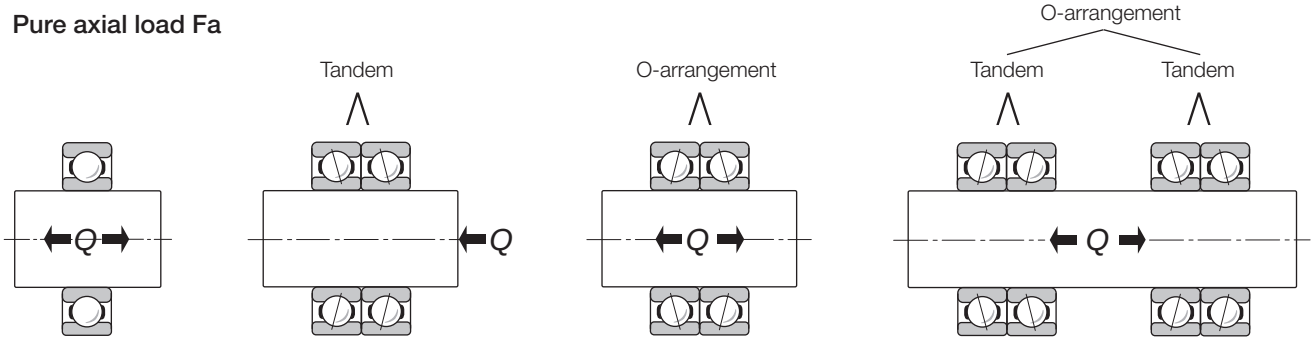
$$Fr = \frac{Q}{2}$$



$$Fr_1 = \frac{Q \cdot b}{l}$$

$$Fr_2 = \frac{Q \cdot a}{l}$$

Pure axial load Fa

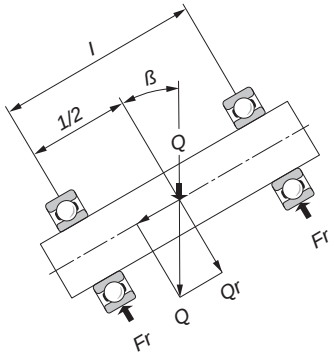


fa = Q (alternating load) fa = Q (one-sided) fa = Q (alternating load) fa = Q (alternating load)

Note: in order for an axial load to be absorbed by several ball bearings, they must be arranged in pairs[1], either ring against ring or with very precisely manufactured intermediate rings.

Combined loads

(radial and axial)



Qr = cos ß · Q
Qa = sin ß · Q

Normal installation

$Fr = \frac{Qr}{2}$

Fa = Qa (the axial load is absorbed by only one ball bearing)

Duplex installation in tandem design (Intermediate ring)

Fr = Qr
Fa = Qa

Pre-loading Fap

Ball bearings in duplex form[1] (O – arrangement or X – arrangement) have pre-loading (Fap), which is above or below the axial load Fa.

This pre-loading Fap must be adapted to the operating conditions and the required useful life.

[1]) see duplex installation on page 15

Calculation of the Theoretical Life Expectancy of Ball Bearings

The theoretical service life is only achieved in practice if the following conditions are met:

- precise determination of the size and direction of permanent loads;
- constant speeds;
- constant temperatures of max. 100°C;
- greatest possible cleanliness during installation and operation;
- careful selection and dispensing of the lubricant;
- installation under strict observance of the information on page 26.

In more complex applications or if in doubt, we recommend that you consult our Technical Support.

Calculation of the load rating and theoretical service life of ball bearings is based on the formulae and theories of the ISO and ABMA standards.

1. Service life of radial and axial ball bearings

$$L_{10} = \left(\frac{C}{P}\right)^3$$

The following applies:

L_{10} = Life cycle in millions of revolutions
C = dynamic load rating in N
P = dynamically equivalent load in N
C/P = Load safety

2. Service life in hours

$$L_{10h} = \frac{L \cdot 10^6}{60 \cdot n}$$

The following applies:

L_{10h} = Service life in millions of revolutions
n = Speed in r.p.m.

Conversion of units
1 N = 1 kg m/s2
1 kgf (= 1kp) = 9.81 N

3. Definitions

L_{10}, = Service life in millions of revolutions or in hours, which is achieved by 90% of a large number of similar ball bearings under similar conditions. 40% of these achieve a 5 times longer service life.

C = Dynamic load rating. In the case of radial bearings, this is a radial force and in the case of axial bearings an axial load, which has a constant effect and is stationary in relation to the outer ring.

The ball bearing can bear this load with a calculated service life of one million revolutions of the inner ring or 500 hrs. at $33^{1/3}$ r.p.m.

The dynamic load rating takes account of:

- repeated deformation of various components of the ball bearing (raceways and balls) depending on the mechanical resistance of their materials and geometric forms
- Frequency of loads
- an empirical probability factor

P = Dynamic equivalent load. This is a nominal load which records the axial and radial load components in such a way that with calculation of the theoretical service life the same values are determined as if only a pure radial load (for radial bearings) or a pure axial load (for axial bearings) is applied.

Co = Static load rating. With radial bearings this is a radial-oriented constant load and with axial bearings an axial-oriented constant load, where a residual deformation of max. .0001 of the rolling element diameter is achieved at the point of contact with the maximum load and the following operating conditions apply:

- standstill
- very slow swivel movements
- very low speeds

Po = equivalent static load.

4. Calculation of the dynamically equivalent load

4.1 **Radial deep groove ball bearing, single row:**

P = X · Fr + Y · Fa

The following applies:

P = dynamically equivalent load in N
Fr = radial component of the load in N
Fa = axial component of the load in N
X = radial factor of the bearing as per table on page 34
Y = axial factor of the bearing as per table on page 34

4.2 **Axial deep groove ball bearing:**

P = Fa

5. Calculation of the static load rating

Co = so · Po

The following applies:

Co = static load rating in N
Po = static equivalent load in N
so = static load safety factor

The value for the static load safety factor can be selected as follows depending on operating conditions and requirements of the bearings:

so = 0.5 to 0.7 for low requirements and vibration-free operation

so = 1.0 to 1.2 for normal requirements and vibration-free operation

so = 1.5 to 2.0 for high requirements and with impact loads

6. Calculation of the statically equivalent load

6.1 **Radial deep groove ball bearing:**

Po = Xo · Fr + Yo · Fa

The following applies:

Po = statically equivalent bearing load in N
Fr = Radial component of the highest static load in N
Fa = Axial component of the highest static load in N
Xo = Radial factor
Yo = Axial factor

If the statically equivalent bearing load calculated with this formula is Po <Fr, then Po = Fr is used for calculation.
Values for the factors Xo and Yo, Xo = 0.6 Yo = 0.5

6.2 **Axial deep groove ball bearing:**

Po = Fa

7. Duplex Bearings

If two single row radial deep groove ball bearings are used in duplex arrangement (X, O or tandem), the following ratios must be included in the calculation of the dynamic load rating and the dynamically equivalent load.

7.1 **Duplex arrangement X or O**

Dynamic load rating

Cd = (2 · cos α°) $^{0.7}$ · C

$$L_{10} = \left(\frac{Cd}{P}\right)^3$$

The following applies:

Cd = dynamic load rating for a ball bearing pair in N
α° = Contact angle
C = dynamic load rating for a single ball bearing in N
L_{10} = service life in millions of revolutions
P = dynamically equivalent load in N

Dynamically equivalent load

P = X · Fr + Y · Fa

The following applies:

P = dynamically equivalent load in N
Fr = radial component of the load in N
Fa = axial component of the load in N
X = radial factor for a ball bearing pair as per page 34
Y = axial factor for a ball bearing page as per page 34

Duplex arrangement X or O with pre-loading

Fa = 0.8 (Fap + Fa1)*

The following applies:

Fa = effective axial load in N
Fap = pre-loading of the ball bearing pair in N
Fa1 = external axial force acting on the pre-loaded ball bearing pair, axial force in N.

* The ratio pre-loading Fap and axial force Fa1 must be selected in such a way that no bearing is completely relieved. Within the radial clearances and angles of contact recommended by myonic, this condition is met if:

Fap ≥ 0.35 Fa1

Duplex arrangement X or O without pre-loading or with low axial clearance

For these cases, calculation must be carried out with the aid of the formulae listed under point 7.1. When determining the factors X and Y from the table on page 34, however, it is to be ensured that the number of balls of two bearings is taken into account.

$$\frac{Fa}{2 \cdot Z \cdot Dw^2}$$ (Total number of balls in two ball bearings)

7.2 Tandem arrangement

Dynamic load rating

$$Ct = C \cdot N^{0.7}$$

The following applies:
Ct = dynamic load rating of the tandem arrangement in N
C = dynamic load rating of a single ball bearing in N
N = number of ball bearings

Calculation of the dynamically equivalent load and of the service life is carried out taking Ct into account, as with single bearings with one row of balls. Accordingly, the factors X, Y and e as per page 34 apply.

8. Calculation example

Example 1

Calculation of the theoretical service life Lh of a radial deep groove ball bearing R 2570X for the following operating conditions:

Radial load	Fr = 5.7 N
Axial load	Fa = 2.8 N
Speed	n = 8000 r.p.m.
Radial clearance	2 / 5 µm

For the ball bearing R 2570X, the following applies:

C = 142N

$Z \cdot Dw^2 = 8$

$P = X \cdot Fr + Y \cdot Fa$

$$\frac{Fa}{Z \cdot Dw^2} = \frac{2.8}{8} = 0.35 \longrightarrow e=0.12$$

$$\frac{Fa}{Fr} = \frac{2.8}{5.7} = 0.5 \text{ therefore} > e$$

X = 0.56

Y = 2.77

$P = 0.56 \cdot 5.7 + 2.77 \cdot 2.8$

$= 3.2 + 7.8 = 11$ N

$$\frac{C}{P} = \frac{142}{11} = 12.9 \qquad L_{10} = \left(\frac{C}{P}\right)^3 = 12.9^3 = 2147$$

$$L_{10h} = \frac{L \cdot 10^6}{60 \cdot n} = \frac{2147 \cdot 10^6}{60 \cdot 8000}$$

$L_{10}h = 4473$ h

According to the table on page 33,
Lh = 4500 hrs. is also found by interpolation.

Example 2

A rotor is to be mounted with two pre-loaded angular contact ball bearings RA in duplex-O arrangement:

Radial load	Fr	= 4 N
Axial load	Fa1	= 12 N
Speed	n	= 24000 r.p.m.
Angle of contact	α^o	= 20°
required service life		= 5000 hrs.

The bearing size is to be determined

$$L_{10h} = \frac{L \cdot 10^6}{60 \cdot n} = 5000 \text{ hrs}$$

$$L_{10} = \left(\frac{Cd}{P}\right)^3 = 7200$$

$$\frac{Cd}{P} = \sqrt[3]{7200} = 19.3$$

or through linear interpolation from the table on page 33.

$$\frac{Cd}{P} = 19.3$$

According to information on page 31:
$Fap \geq 0.35 \cdot Fa1 = 0.35 \cdot 12 = 4.2$ N

Pre-loading Fap of 6 N is selected.

$Fa = 0.8 (Fap + Fa1) = 0.8 (6 + 12)$

$= 0.8 \cdot 18 = 14.4$ N

According to the table on page 34,

$\alpha^o = 20°$

e = 0.50

$$\frac{Fa}{Fr} = \frac{14.4}{4} = 3.6 \text{ therefore} > e,$$

X = 0.70

Y = 1.86

$P = X \cdot Fr + Y \cdot Fa = 0.70 \cdot 4 + 1.86 \cdot 14.4$

$= 2.8 + 26.7 = 29.5$ N

$$\frac{Cd}{P} = 19.3$$

$Cd = 19.3 \cdot P = 19.3 \cdot 29.5 = 569$

$Cd = (2 \cdot \cos \alpha^o)^{0.7} \cdot C$

$$C = \frac{Cd}{(2 \cdot \cos \alpha°)^{0.7}} = \frac{569}{(2 \cdot \cos 20°)^{0.7}} = \frac{569}{1.55} = 367 \text{ N}$$

The angular contact ball bearing RA 3100X-...
with a load rating of C = 332 N is a little too weak.
If sufficient space is available, angular contact ball bearing RA 4130X.9d/600-..... is selected.

Load safety C/P in relation to service life L_{10} (10^6 revolutions)

L_{10}	C/P	L_{10}	C/P	L_{10}	C/P
0.5	0.793	260	6.38	2400	13.4
0.75	0.909	280	6.54	2600	13.8
1.0	1.0	300	6.69	2800	14.1
1.5	1.14	320	6.84	3000	14.4
2	1.26	340	6.98	3200	14.7
3	1.44	360	7.11	3400	15.0
4	1.59	380	7.24	3600	15.3
5	1.71	400	7.37	3800	15.6
6	1.82	420	7.49	4000	15.9
8	2.0	440	7.61	4500	16.5
10	2.15	460	7.72	5000	17.1
12	2.29	480	7.83	5500	17.7
14	2.41	500	7.94	6000	18.2
16	2.52	550	8.19	6500	18.7
18	2.62	600	8.43	7000	19.1
20	2.71	650	8.66	7500	19.6
25	2.92	700	8.88	8000	20.0
30	3.11	750	9.09	8500	20.4
35	3.27	800	9.28	9000	20.8
40	3.42	850	9.47	9500	21.2
45	3.56	900	9.65	10000	21.5
50	3.68	950	9.83	12000	22.9
60	3.91	1000	10.0	14000	24.1
70	4.12	1100	10.3	16000	25.2
80	4.31	1200	10.6	18000	26.2
90	4.48	1300	10.9	20000	27.1
100	4.64	1400	11.2	25000	29.2
120	4.93	1500	11.4	30000	31.1
140	5.19	1600	11.7	35000	32.7
160	5.43	1700	11.9	40000	34.2
180	5.65	1800	12.2	45000	35.5
200	5.85	1900	12.4	50000	36.8
220	6.04	2000	12.6	55000	38.1
240	6.21	2200	13.0	60000	39.2

Radial factor X and axial factor Y for the calculation of the dynamically equivalent load of single row radial deep groove ball bearings.

Angle of contact	$\frac{Fa}{Z \cdot Dw^2}$	$\frac{Fa}{Fr} \geq e$ X	Y	e
≤5°	0.17	0.56	3.09	0.09
	0.35		2.77	0.12
approximate	0.70		2.43	0.14
radial clearance	1.05		2.23	0.15
2 – 5 µm	1.40		2.10	0.16
(Suffix 2/5)	2.10		1.92	0.18
	3.51		1.71	0.21
	5.27		1.56	0.23
	7.03		1.44	0.24
10°	0.17	0.46	2.20	0.25
	0.35		2.09	0.26
approximate	0.70		1.94	0.28
radial clearance	1.05		1.84	0.29
6 – 15 µm	1.40		1.77	0.31
(Standard	2.10		1.66	0.33
radial clearance,	3.51		1.53	0.35
no suffix)	5.27		1.44	0.38
	7.03		1.36	0.40
15°	0.17	0.44	1.55	0.35
	0.35		1.51	0.36
approximate	0.70		1.48	0.36
radial clearance	1.05		1.42	0.38
16 – 20 µm	1.40		1.39	0.39
(Suffix 16/20)	2.10		1.34	0.41
	3.51		1.26	0.43
	5.27		1.20	0.45
	7.03		1.16	0.47
20°	0.43		1.14	0.50
25°	0.41		0.95	0.62
30°	0.39		0.81	0.75
35°	0.37		0.69	0.91
40°	0.35		0.60	1.08

If $\frac{Fa}{Fr} \leq e$, X = 1, Y = 0 must be used for calculation.

Factors X and Y which refer to intermediate load and angle of contact values are to be determined through linear interpolation.

Fa = Axial load in N

Z = Number of balls

Dw = Diameter of the balls in mm

Radial factor X and axial factor Y for the calculation of the dynamically equivalent load with single row radial deep groove ball bearings in duplex arrangement. Angle of contact between 0° and 40°.

Angle of contact	$\frac{Fa}{Z \cdot Dw^2}$	$\frac{Fa}{Fr} \leq e$ X	Y	$\frac{Fa}{Fr} \geq e$ X	Y	e
0°	0.17	1	0	0.56	3.09	0.09
	0.35				2.77	0.12
for ball bearings	0.70				2.43	0.14
in duplex	1.05				2.23	0.15
arrangement	1.40				2.10	0.16
with low	2.10				1.92	0.18
axial clearance	3.51				1.71	0.21
	5.27				1.56	0.23
	7.03				1.44	0.24
5°	0.17	1	3.69	0.78	5.02	0.17
	0.35		3.30		4.49	0.19
approximate	0.70		2.89		3.94	0.22
radial clearance	1.05		2.66		3.63	0.24
2 – 5 µm	1.40		2.50		3.41	0.25
(Suffix 2/5)	2.10		2.29		3.12	0.27
	3.51		2.04		2.78	0.31
	5.27		1.86		2.53	0.34
	7.03		1.72		2.35	0.36
10°	0.17	1	2.25	0.75	3.58	0.25
	0.35		2.41		3.39	0.26
approximate	0.70		2.24		3.14	0.28
radial clearance	1.05		2.13		2.99	0.29
6 – 15 µm	1.40		2.04		2.87	0.31
(Standard	2.10		1.92		2.69	0.33
radial clearance,	3.51		1.77		2.49	0.35
no suffix)	5.27		1.66		2.33	0.38
	7.03		1.57		2.21	0.40
15°	0.17	1	1.74	0.72	2.52	0.35
	0.35		1.70		2.46	0.36
approximate	0.70		1.66		2.41	0.36
radial clearance	1.05		1.59		2.31	0.38
16 – 20 µm	1.40		1.56		2.25	0.39
(Suffix 16/20)	2.10		1.50		2.17	0.41
	3.51		1.42		2.05	0.43
	5.27		1.35		1.96	0.45
	7.03		1.30		1.88	0.47
20°		1	1.25	0.70	1.86	0.50
25°		1	1.00	0.67	1.55	0.62
30°		1	0.83	0.63	1.31	0.75
35°		1	0.69	0.60	1.12	0.91
40°		1	0.58	0.57	0.97	1.08

Load safety C/P in relation to service life $L_{10}h$ in hrs. and speed n in r.p.m.

	n r.p.m.											
L_{10h}	10	40	100	160	200	250	320	400	500	630	800	1000
100	–	–	–	–	1.06	1.15	1.24	1.34	1.45	1.56	1.68	1.82
500	–	1.06	1.45	1.68	1.82	1.96	2.12	2.29	2.47	2.67	2.88	3.11
1000	–	1.34	1.82	2.12	2.29	2.47	2.67	2.88	3.11	3.36	3.63	3.91
1250	–	1.45	1.96	2.29	2.47	2.67	2.88	3.11	3.36	3.63	3.91	4.23
1600	–	1.56	2.12	2.47	2.67	2.88	3.11	3.36	3.63	3.91	4.23	4.56
2000	1.06	1.68	2.29	2.67	2.88	3.11	3.36	3.63	3.91	4.23	4.56	4.93
2500	1.15	1.82	2.47	2.88	3.11	3.36	3.63	3.91	4.23	4.56	4.93	5.32
3200	1.24	1.96	2.67	3.11	3.36	3.63	3.91	4.23	4.56	4.93	5.32	5.75
4000	1.34	2.12	2.88	3.36	3.63	3.91	4.23	4.56	4.93	5.32	5.75	6.20
5000	1.45	2.29	3.11	3.63	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70
6300	1.56	2.47	3.36	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23
8000	1.68	2.67	3.63	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81
10000	1.82	2.88	3.91	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43
12500	1.96	3.11	4.23	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11
16000	2.12	3.36	4.56	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83
20000	2.29	3.63	4.93	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.6
25000	2.47	3.91	5.32	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.6	11.5
32000	2.67	4.23	5.75	6.70	7.23	7.81	8.43	9.11	9.83	10.6	11.5	12.4
40000	2.88	4.56	6.20	7.23	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4
50000	3.11	4.93	6.70	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5
63000	3.36	5.32	7.23	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5	15.6
80000	3.63	5.75	7.81	9.11	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8
100000	3.91	6.20	8.43	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8	18.2
200000	4.93	7.81	10.6	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9

Load safety C/P in relation to service life L_{10h} in hrs. and speed n in r.p.m.

	n r.p.m.										
L_{10h}	1250	1600	2000	2500	3200	4000	5000	6300	8000	10000	12500
100	1.96	2.12	2.29	2.47	2.67	2.88	3.11	3.36	3.63	3.91	4.23
500	3.36	3.63	3.91	4.2	4.56	4.93	5.32	5.75	6.20	6.70	7.23
1000	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11
1250	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83
1600	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.6
2000	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.6	11.5
2500	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.6	11.5	12.4
3200	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4
4000	6.70	7.23	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5
5000	7.23	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5	15.6
6300	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8
8000	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8	18.2
10000	9.11	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8	18.2	19.6
12500	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2
16000	10.6	11.5	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9
20000	11.5	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9	24.7
25000	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9	24.7	26.7
32000	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9	24.7	26.7	28.8
40000	14.5	15.6	16.8	18.2	19.6	21.2	22.9	24.7	26.7	28.8	31.1
50000	15.6	16.8	18.2	19.6	21.2	22.9	24.7	26.7	28.8	31.1	33.6
63000	16.8	18.2	19.6	21.2	22.9	24.7	26.7	28.8	31.1	33.6	36.3
80000	18.2	19.6	21.2	22.9	24.7	26.7	28.8	31.1	33.6	36.3	39.2
100000	19.6	21.2	22.9	24.7	26.7	28.8	31.1	33.6	36.3	39.2	–
200000	24.7	26.7	28.8	31.1	33.6	36.3	39.2	–	–	–	–

Load safety C/P in relation to service life L_{10h} in hrs. and speed n in r.p.m.

	n r.p.m.								
L_{10h}	16000	20000	25000	32000	40000	50000	63000	80000	100000
100	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43
500	7.81	8.43	9.11	9.83	10.6	11.5	12.4	13.4	14.5
1000	9.83	10.6	11.5	12.4	13.4	14.5	15.6	16.8	18.2
1250	12.4	11.5	12.4	13.4	14.5	15.6	16.8	18.2	19.6
1600	11.5	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2
2000	12.4	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9
2500	13.4	14.5	15.6	16.8	18.2	19.6	21.2	22.9	24.7
3200	14.5	15.6	16.8	18.2	19.6	21.2	22.9	24.7	26.7
4000	15.6	16.8	18.2	19.6	21.2	22.9	24.7	26.7	28.8
5000	16.8	18.2	19.6	21.2	22.9	24.7	26.7	28.8	31.1
6300	18.2	19.6	21.2	22.9	24.7	26.7	28.8	31.1	33.6
8000	19.6	21.2	22.9	24.7	26.7	28.8	31.1	33.6	36.3
10000	21.2	22.9	24.7	26.7	28.8	31.1	33.6	36.3	39.2
12500	22.9	24.7	26.7	28.8	31.1	33.6	36.3	39.2	–
16000	24.7	26.7	28.8	31.1	33.6	36.3	39.2	–	–
20000	26.7	28.8	31.1	33.6	36.3	39.2	–	–	–
25000	28.8	31.1	33.6	36.3	39.2	–	–	–	–
32000	31.1	33.6	36.3	39.2	–	–	–	–	–
40000	33.6	36.3	39.2	–	–	–	–	–	–
50000	36.3	39.2	–	–	–	–	–	–	–
63000	39.2	–	–	–	–	–	–	–	–
80000	–	–	–	–	–	–	–	–	–
100000	–	–	–	–	–	–	–	–	–
200000	–	–	–	–	–	–	–	–	–

The Function of the Packaging is to protect the Ball Bearings during Transportation and Storage Periods before Use in final Application

The myonic packaging ist designed to protect against:

- dirt
- moisture
- influences due to transport

The packaging is adapted to the requirements.

Unless otherwise specified by the customer, myonic packs the ball bearings in plastic pouches which are hermetically heat sealed under vacuum.

The number of pouches depends on the type, characteristics and size of the ball bearings. Typically there are 40, 20, 10 or 5 ball bearings per pouch, depending on the size of the ball bearing.

The plastic pouches are delivered in cardboard boxes to protect them against mechanical influences during transport.

In addition to the standard packaging described, the following packaging types for the ball bearings are also available from myonic:

- Transparent plastic strip packaging, with individual pouches separated from each other by heat sealing
- Individual packaging in heat sealed strip packaging
- Individual packaging in metallic pouches

If a different type of packaging is required, please consult our Technical Department.

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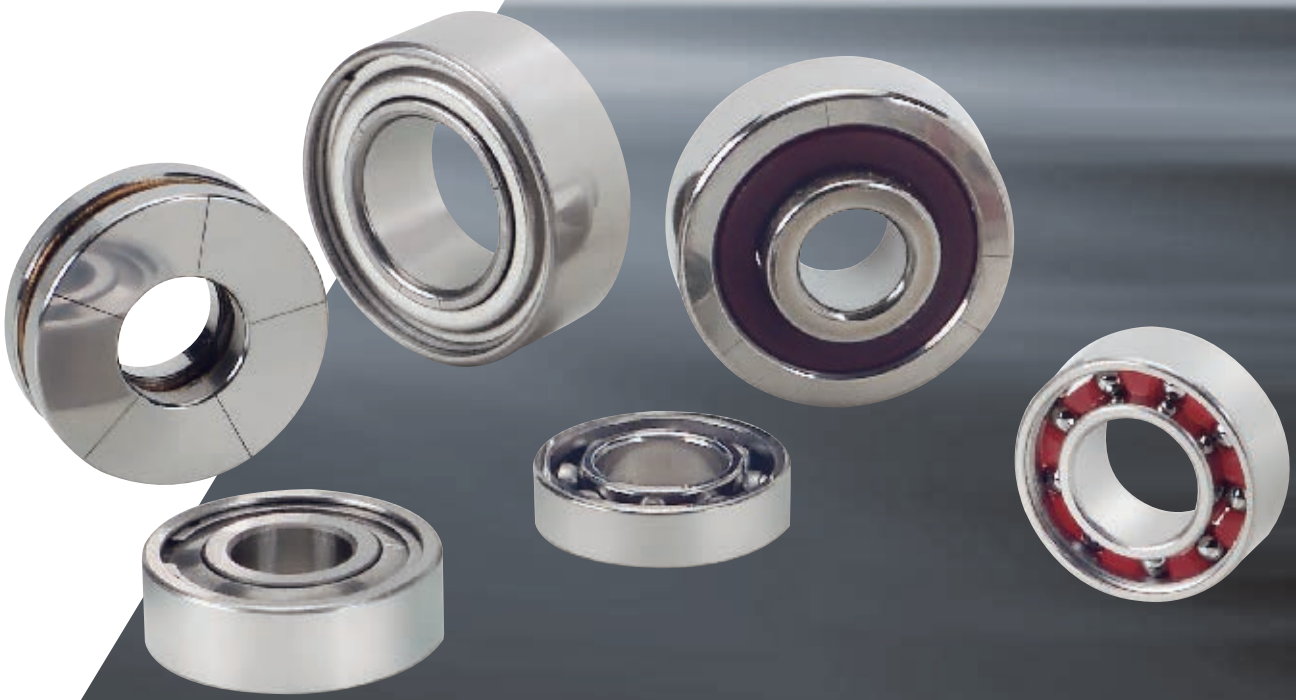
Product Tables



Product Tables

42–45 Single row radial deep groove ball bearings, metric dimensions:

open **R, UL**
closed **RV, ULV, ULZT, ULZ, RX, RF**

46–49 Single row radial deep groove ball bearings, inch dimensions:

open **R, UL**
closed **RV, ULV, ULZ, RX, RF**

50–51 Single row radial deep groove ball bearings with reinforced outer ring, inch dimensions:

closed **MV, MVT, MZ, MX, MF**

52–53 Single row radial deep groove ball bearings with wide inner ring, inch dimensions:

open **RU, ULU, RKU, ULKU**
closed **ULUZ, ULKUZ**

54–55 Single row radial deep groove ball bearings with flange, metric dimensions:

open **RK, ULK, ULKW**
closed **RKV, ULKZ, RKX, RKF**

56–59 Single row radial deep groove ball bearings with flange, inch dimensions:

open **RK, ULK**
closed **ULKZ, RKX, RKF**

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Product Accessories

60–61 Removable angular contact ball bearings, metric dimensions: **RA**

62–63 Removable angular contact ball bearings, inch dimensions: **RA**

64–65 Removable angular contact ball bearings with flange, metric dimensions: **RKA**

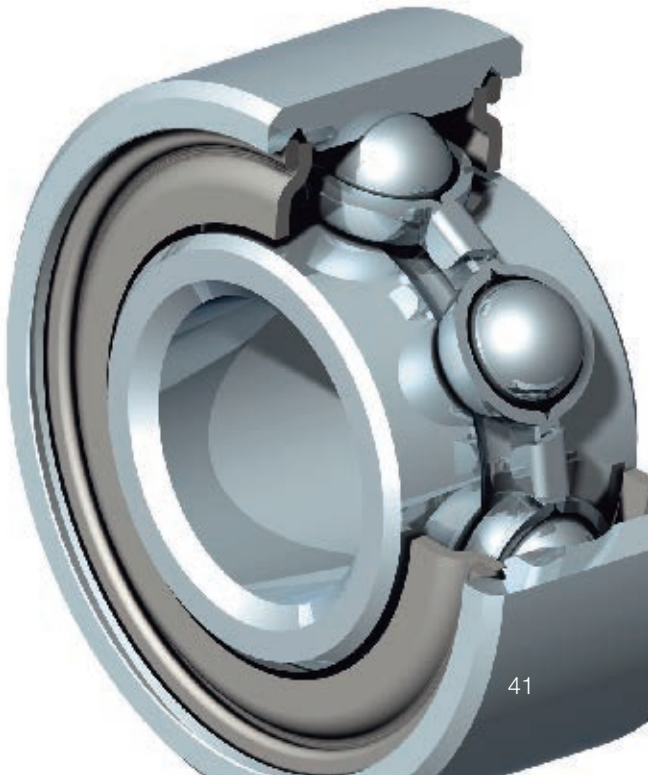
64–65 Removable angular contact ball bearings with flange, inch dimensions: **RKA**

66 Axial deep groove ball bearings, metric dimensions: **B**

68–69 Circlips for shafts and bore holes: **WSR, BSR**

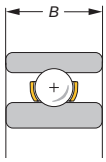
70–71 Precision circlips: **FS**

72–73 Precision shims: **PS**

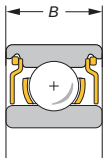


Single row radial deep groove ball bearings

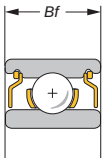
R/UL
open



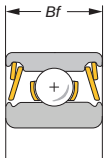
RV/ULV
with shields



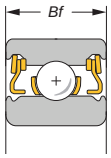
ULZ
with shields



RX
with shields



RF
with capillary covers



Metric dimensions

Original size	d mm	D mm	B mm	Bf mm	Designation **open** **ball bearings**	Designation **closed** **ball bearings**
	1	3	1		**UL 103X**	
	1.5	4	1.2	2	**UL 154X**	**ULZ 154X**
	1.5	5	2	2	**R 1550X**	**RX/RF 155X**
	2	4	1.2		**UL 204X**	
	2	5	1.5	2.3	**UL 205X**	**ULZ 205X**
	2	6	2.3	2.3	**R 2060X**	**RX/RF 206X**
	2.5	5	1.5		**UL 255X**	
	2.5	6	1.8	2.6	**UL 256X**	**ULZ 256X**
	2.5	7	2.5		**R 2570X**	**RV 257X**
	2.5	8	2.8	2.8	**R2580X**	**RF 258X**
	3	6	2	2.5	**UL 306X**	**ULZ 306X**
	3	6	2			**ULV 306X**
	3	7	2	3	**UL 307X**	**ULZ 307X**
	3	8	3	4	**R 3080X**	**RF 308X**
	3	8	3			**RV 308X**
	3	10	4	4	**R 3100X**	**RX/RF 310X**
	4	7	2	2.5	**UL 407X**	**ULZ 407X**
	4	7	2			**ULV407X**
	4	9	2.5	4	**UL 409X**	**ULZ 409X**
	4	10		4		**RX/RF410X**
	4	11	4		**R 4110X**	**RV 411X**
	4	13	5	5	**R 4130X**	**RX/RF 413X**
	4	16	5		**R 4160X**	**RV416X**
	5	8	2	3	**UL 508X**	**ULZ 508X**
	5	8	2			**ULV 508X**

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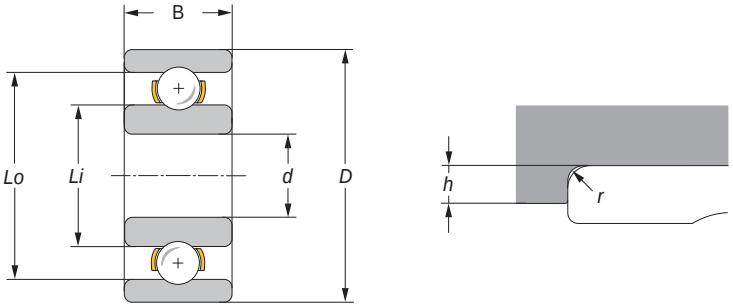
Single row radial deep groove ball bearings

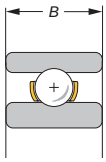


Metric dimensions

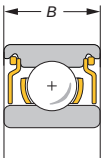
B Designation DIN	**Bf** Designation DIN	**Li** mm	**Lo** mm	**r max** mm	**h min** mm	**Balls n x Ø** mm	**Load ratings dynamic C** N	**static Co** N
618/1	-	1.60	2.40	0.08	0.3	7 x 0.500	38	6
618/1.5	638/1.5	2.12	3.38	0.1	0.3	6 x 0.794	87	17
619/1.5	619/1.5	2.68	3.97	0.15	0.4	7 x 0.794	100	21
617/2	-	2.48	3.55	0.05	0.25	7 x 0.700	84	18
618/2	638/2	2.86	4.14	0.1	0.4	7 x 0.794	101	22
619/2	619/2	3.16	4.75	0.15	0.5	7 x 1.000	165	38
617/2.5	-	3.15	4.40	0.08	0.3	8 x 0.794	111	25
618/2.5	638/2.5	3.54	5.02	0.15	0.5	7 x 1.000	167	40
619/2.5	-	3.95	5.53	0.15	0.6	8 x 1.000	184	47
60/2.5	60/2.5	4.22	6.23	0.15	0.6	7 x 1.250	258	65
617/3	-	3.75	5.26	0.08	0.35	8 x 1.000	183	46
617/3	-	3.75	5.26	0.08	0.35	8 x 1.000	183	46
618/3	638/3	4.14	5.85	0.15	0.5	8 x 1.150	247	66
619/3	639/3	4.40	6.61	0.15	0.6	7 x 1.450	335	86
619/3	-	4.40	6.61	0.15	0.6	7x 1.450	335	86
623	623	5.33	7.87	0.15	0.7	7 x 1.588	407	110
617/4	-	4.75	6.25	0.08	0.35	9 x 1.000	200	55
617/4	-	4.75	6.25	0.08	0.35	9 x 1.000	200	55
618/4	638/4	5.33	7.87	0.15	0.5	7 x 1.588	407	110
-	-	5.33	7.87	0.15	0.7	7 x 1.588	407	110
619/4	-	5.90	9.10	0.15	0.7	6 x 2.100	667	189
624	624	6.65	10.35	0.2	0.8	6 x 2.381	920	290
634	-	8.00	13.08	0.3	1	6 x 3.175	1192	329
617/5	637/5	5.75	7.25	0.08	0.4	11 x 1.000	226	71
617/5	-	5.75	7.25	0.08	0.4	11 x 1.000	226	71

Single row radial deep groove ball bearings

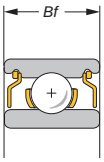
R/UL
open



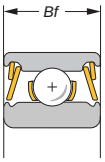
RV/ULV/ULZT
with shields



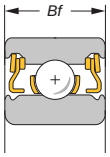
ULZ
with shields



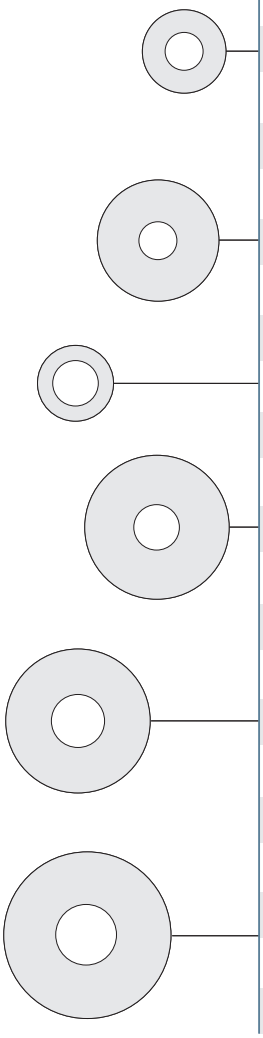
RX
with shields



RF
with capillary covers



Metric dimensions



Original size	d mm	D mm	B mm	Bf mm	Designation **open** **ball bearings**	Designation **closed** **ball bearings**
	5	11	3	5	**UL 511X**	**ULZ 511X**
	5	13	4		**R 5130X**	**RV 513X**
	5	16	5		**R 5160X**	**RV 516X**
	5	19	6		**R 5190X**	**RV 519X**
	6	10	2.5	3	**UL 610X**	**ULZ 610X**
	6	13	3.5	5	**UL 613X**	**ULZ 613X**
	6	15	5		**R 6150X**	**RV 615X**
	6	19	6		**R 6190X**	**RV 619X**
	7	11	2.5	3	**UL 711X**	**ULZ 711X**
	7	14	3.5	5	**UL 714X**	**ULZ 714X**
	7	19	6		**R 7190X**	**RV 719X**
	7	22	7		**R 7220X**	**RV 722X**
	8	12	2.5		**UL 812X**	
	8	16	4		**UL 816X**	
	8	16	5			**ULZT 816X**
	8	16		6		**ULZ 816X**
	8	22	7		**R 8220X**	**RV 822X**
	9	14	3		**UL 914X**	
	9	17	4	6	**UL 917X**	**ULZ 917X**
	10	15	3		**UL 1015X**	
	10	19	5		**UL 1019X**	**ULV 1019X**
	10	19		7		**ULZ 1019X**

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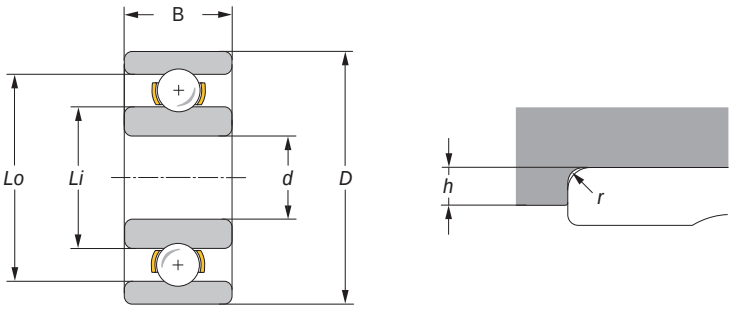
Single row radial deep groove ball bearings

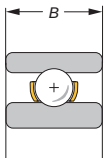


Metric dimensions

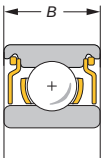
B Designation DIN	**Bf** Designation DIN	**Li** mm	**Lo** mm	**r max** mm	**h min** mm	**Balls n x Ø** mm	**Load ratings dynamic C** N	**static Co** N
618/5	638/5	6.69	9.32	0.15	0.7	8 x 1.750	524	152
619/5	-	7.40	11.00	0.15	0.7	7 x 2.381	824	237
625	-	8.00	13.08	0.3	1	6 x 3.175	1192	329
635	-	9.75	14.84	0.3	1	7 x 3.175	1377	415
617/6	-	7.00	9.00	0.1	0.45	10 x 1.250	330	107
618/6	628/6	7.90	11.11	0.15	0.7	8 x 2.100	726	219
619/6	-	8.79	12.24	0.15	0.8	7 x 2.500	1027	327
626	-	9.75	14.84	0.3	1	7 x 3.175	1377	415
617/7	-	8.00	10.00	0.1	0.45	12 x 1.250	368	132
618/7	628/7	8.90	12.11	0.15	0.7	8 x 2.100	731	226
607	-	9.75	14.84	0.3	1	7 x 3.175	1377	415
627	-	11.75	18.05	0.3	1	7 x 3.969	2154	698
617/8	-	9.00	11.00	0.1	0.5	13 x 1.250	382	146
618/8	-	10.20	13.81	0.2	0.8	9 x 2.381	992	329
-	-	10.20	13.81	0.2	0.8	9 x 2.381	992	329
-	638/8	10.20	13.81	0.2	0.8	9 x 2.381	992	329
608	-	11.75	18.05	0.3	1	7 x 3.969	2154	698
617/9	-	10.23	12.77	0.1	0.6	12 x 1.588	281	223
618/9	638/9	11.20	14.81	0.2	0.8	10 x 2.381	1065	374
61700	-	11.23	13.77	0.1	0.6	13 x 1.588	606	245
61800	-	12.32	16.68	0.3	1	9 x 2.778	1314	455
-	63800	12.32	16.68	0.3	1	9 x 2.778	1314	455

Single row radial deep groove ball bearings

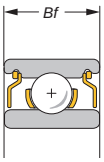
R/UL
open



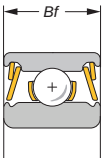
RV/ULV
with shields



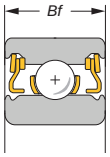
ULZ
with shields



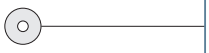
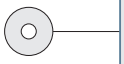
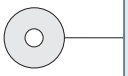
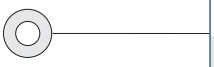
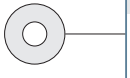
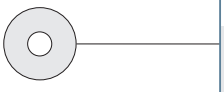
RX
with shields



RF
with capillary covers

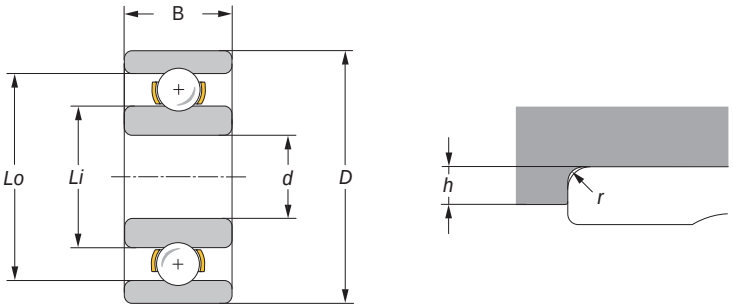


Inch dimensions

Original size	d mm	D mm	B mm	Bf mm	Designation **open** **ball bearing**	Designation **closed** **ball bearing**
	1.016 .0400	3.175 .1250	1.191 .0469		**UL 1304X**	
	1.191 .0469	3.969 .1562	1.588 .0625	2.381 .0938	**UL 1505X**	**ULZ 1505X**
	1.397 .0550	4.763 .1875	1.984 .0781	2.778 .1094	**R 1706X**	**RX/RF 1706X**
	1.984 .0781	6.350 .2500	2.381 .0938	3.572 .1406	**R 2508X**	**RX/RF 2508X**
	2.381 .0938	4.763 .1875	1.588 .0625	2.381 .0938	**UL 3006X**	**ULZ 3006X**
	2.381 .0938	7.938 .3125	2.778 .1094	3.572 .1406	**R 3010X**	**RX/RF 3010X**
	3.175 .1250	6.350 .2500	2.381 .0938		**UL 4008X**	**ULV 4008X**
	3.175 .1250	6.350 .2500		2.778 .1094		**ULZ 4008X**
	3.175 .1250	7.938 .3125	2.778 .1094	3.572 .1406	**R 4010X**	**RX/RF 4010X**
	3.175 .1250	9.525 .3750	3.969 .1563	3.969 .1563	**R 4012X**	**RX/RF 4012X**

myonic

Single row radial deep groove ball bearings

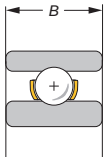


Inch dimensions

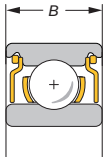
Designation **US**	**Li** mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings** **dynamic** **C** N	**static** **Co** N
	1.60	2.40	0.08	0.3	7 x 0.500	38	6
R 09	.0630	.0945	.003	.012	.0197		
	1.93	3.18	0.13	0.4	6 x 0.794	85	16
R 0	.0760	.1252	.005	.016	.03125		
	2.35	3.83	0.13	0.4	6 x 1.000	138	29
R 1	.0925	.1508	.005	.016	.0394		
	3.16	4.75	0.13	0.5	7 x 1.000	165	38
R 1-4	.1244	.1870	.005	.020	.0394		
	2.86	4.14	0.13	0.4	7 x 0.794	101	22
R 133	.1126	.1630	.005	.016	.03125		
	4.13	6.67	0.13	0.5	6 x 1.588	351	86
R 1-5	.1626	.2626	.005	.020	.0625		
	3.95	5.53	0.13	0.5	8 x 1.000	184	47
R 144	.1555	.2177	.005	.020	.0394		
	3.95	5.53	0.13	0.5	8 x 1.000	184	47
R 144	.1555	.2177	.005	.020	.0394		
	4.13	6.67	0.13	0.5	6 x 1.588	351	86
R 2-5	.1626	.2626	.005	.020	.0625		
	5.33	7.87	0.13	0.7	7 x 1.588	407	110
R 2	.2098	.3098	.005	.028	.0625		

Single row radial deep groove ball bearings

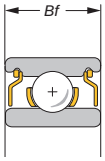
R/UL
open



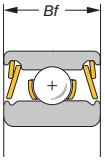
RV/ULV
with shields



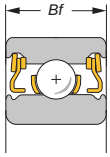
ULZ
with shields



RX
with shields



RF
with capillary covers



Inch dimensions

Original size	d mm	D mm	B mm	Bf mm	Designation **open ball bearing**	Designation **closed ball bearing**
	3.969	7.938	2.778	3.175	**UL 5010X**	**ULZ 5010X**
	.1563	.3125	.1094	.1250		
	4.763	7.938	2.778	3.175	**UL 6010X**	**ULZ 6010X**
	.1875	.3125	.1094	.1250		
	4.763	9.525	3.175	3.175	**UL 6012X**	**ULZ 6012X**
	.1875	.3750	.1250	.1250		
	4.763	12.700	3.969		**R 6016X**	
	.1875	.5000	.1563			**RV 6016X**
	4.763	12.700		4.978		**RX/RF 6016X**
	.1875	.5000		.1960		
	6.350	9.525	3.175	3.175	**UL 8012X**	**ULZ 8012X**
	.2500	.3750	.1250	.1250		
	6.350	12.700	3.175	4.763	**UL 8016X**	**ULZ 8016X**
	.2500	.5000	.1250	.1875		
	6.350	15.875	4.978	4.978	**R 8020X**	**RX/RF 8020X**
	.2500	.6250	.1960	.1960		
	7.938	12.700	3.969	3.969	**UL 10016X**	**ULZ 10016X**
	.3125	.5000	.1563	.1563		
	9.525	22.225	7.144	7.144	**R 12028X**	**RZ 12028X**
	.3750	.8750	.2813	.2813		
	12.700	19.050		4.978		**ULZ 16024X**
	.5000	.7500		.1960		

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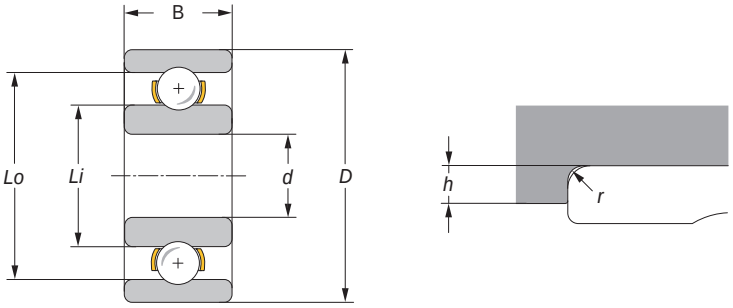
Single row radial deep groove ball bearings

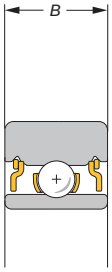


Inch dimensions

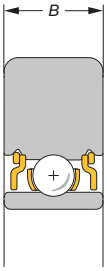
Designation **US**	**Li** mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings dynamic C** N	**static Co** N
	4.98	6.82	0.13	0.5	8 x 1.150	250	69
R 155	.1961	.2685	.005	.020	.0453		
	5.57	7.10	0.13	0.5	9 x 1.000	198	58
R 156	.2193	.2795	.005	.020	.0394		
	5.95	8.35	0.13	0.6	8 x 1.588	450	130
R 166	.2343	.3287	.005	.024	.0625		
	7.00	10.70	0.30	0.8	7 x 2.381	1028	346
R 3	.2756	.4213	.012	.031	.09375		
	7.00	10.70	0.30	0.8	7 x 2.381	1028	346
R 3	.2756	.4213	.012	.031	.09375		
	7.22	8.77	0.13	0.6	11 x 1.000	220	74
R 168	.2843	.3453	.005	.024	.0394		
	7.90	11.11	0.13	0.6	8 x 2.100	726	219
R 188	.3110	.4374	.005	.024	.0827		
	9.26	12.96	0.30	0.8	8 x 2.381	1145	435
R 4	.3646	.5102	.012	.031	.09375		
	9.23	11.40	0.13	0.6	11 x 1.588	555	199
R 1810	.3634	.4488	.005	.024	.0625		
	13.21	18.87	0.40	0.8	7 x 3.969	2183	719
R 6	.5201	.7429	.016	.031	.1562		
	14.90	17.10	0.20	0.8	14 x 1.588	608	275
-	.5866	.6732	.008	.031	.0625		

Single row radial deep groove ball bearing with reinforced outer ring

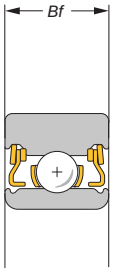
MV
with shields



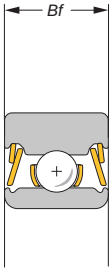
MVT
with shields



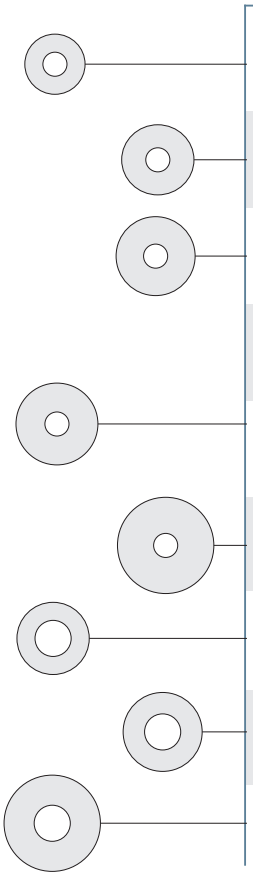
MX/MZ
with shields



MF
with capillary covers

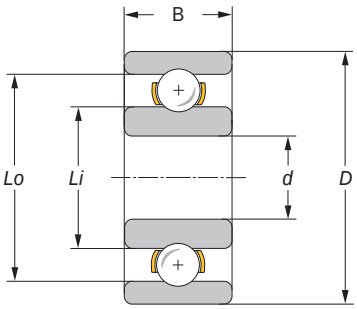


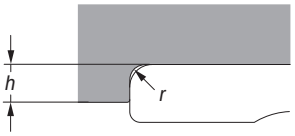
Inch dimensions

Original size	d mm inches	D mm inches	B mm inches	Bf mm inches	Designation **closed ball bearing** **MV**	 **MVT**	Designation **closed ball bearing** **MX/MZ**	 **MF**
	3.175 .1250	7.938 .3125	2.778 .1094		**MV 40100X**			
	3.175 .1250	9.525 .3750		3.572 .1406			**MF 40120X**	**MX 40120X**
	3.175 .1250	10.414 .4100	2.381 .0938			**MVT 40131X**		
	3.175 .1250	10.414 .4100	2.778 .1094		**MV 40131X**			
	3.175 .1250	10.795 .4250	2.778 .1094		**MV 40136X**			
	3.175 .1250	12.70 .5000		4.366 .1719				**MX 40160X**
	4.763 .1875	9.525 .3750	2.778 .1094		**MV 60120X**			
	4.763 .1875	10.414 .4100	2.778 .1094		**MV 60131X**			
	4.763 .1875	12.70 .5000	2.778 .1094	3.969 .1563	**MV 60160X**			**MZ 60160X**

myonic

Single row radial deep groove ball bearing with reinforced outer ring



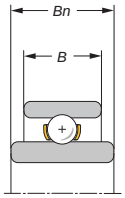


Inch dimensions

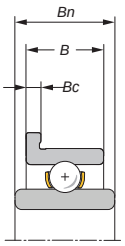
Li mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings** **dynamic** **C** N	**static** **Co** N
3.95 .1555	5.53 .2177	0.10 .004	0.40 .016	8 x 1.000 .0394	184	47
4.13 .1626	6.67 .2626	0.13 .005	0.50 .020	6 x 1.588 .0625	351	86
3.95 .1555	5.53 .2177	0.13 .005	0.50 .020	8 x 1.000 .0394	184	47
5.57 .2193	7.10 .2795	0.20 .008	0.70 .028	9 x 1.000 .0394	198	58
5.57 .2193	7.10 .2795	0.20 .008	0.70 .028	9 x 1.000 .0394	198	58
5.33 .2098	7.87 .3098	0.20 .008	0.70 .028	7 x 1.588 .0625	407	110
5.57 .2193	7.10 .2795	0.10 .004	0.60 .024	9 x 1.000 .0394	198	58
5.57 .2193	7.10 .2795	0.20 .008	0.70 .028	9 x 1.000 .0394	198	58
5.95 .2343	8.35 .3287	0.13 .005	0.60 .024	8 x 1.588 .0625	450	130

Single row radial deep groove ball bearings with wide inner ring

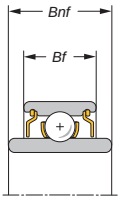
RU/ULU open



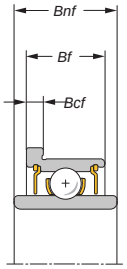
RKU/ ULKU open



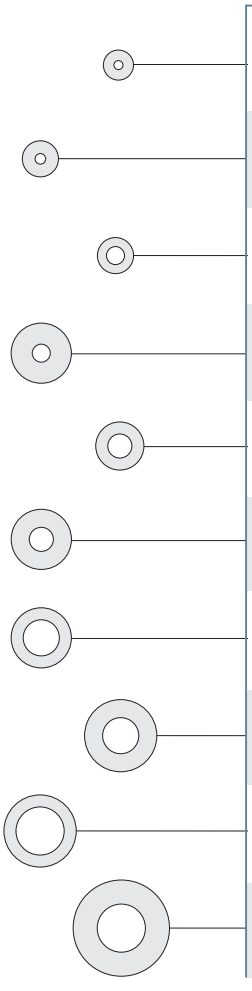
ULUZ with shields



ULKUZ with shields

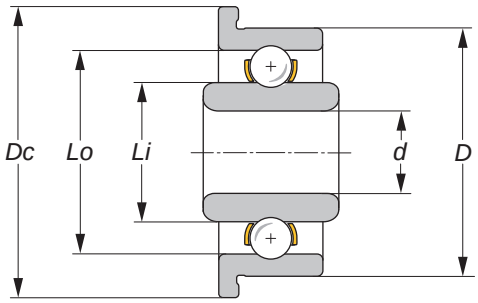


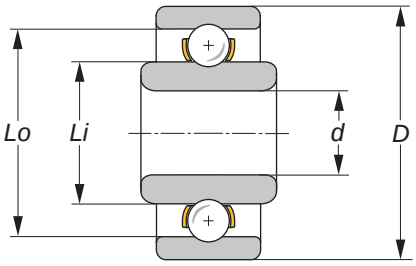
Inch dimensions

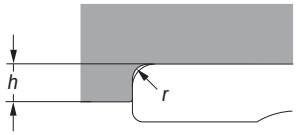
Original size	d mm inches	D mm inches	B mm inches	Bf mm inches	Designation **open ball bearing** **RU/ULU**	 **RKU/ULKU**	Designation **closed ball bearing** **ULUZ**	 **ULKUZ**
	1.191 .0469	3.969 .1563	1.588 .0625		**ULU 1505X**	**ULKU 1505X**		
	1.397 .0550	4.763 .1875	1.984 .0781		**RU 1706X**	**RKU 1706X**		
	2.381 .0938	4.763 .1875	1.588 .0625		**ULU 3006X**	**ULKU 3006X**		
	2.381 .0938	7.938 .3125	2.778 .1094		**RU 3010X**	**RKU 3010X**		
	3.175 .1250	6.350 .2500	2.381 .0938	2.778 .1094	**ULU 4008X**	**ULKU 4008X**	**ULUZ 4008X**	**ULKUZ 4008X**
	3.175 .1250	7.938 .3125	2.778 .1094		**RU 4010X**	**RKU 4010X**		
	4.763 .1875	7.938 .3125		3.175 .1250			**ULUZ 6010X**	**ULKUZ 6010X**
	4.763 .1875	9.525 .3750	3.175 .1250	3.175 .1250	**ULU 6012X**	**ULKU 6012X**	**ULUZ 6012X**	**ULKUZ 6012X**
	6.350 .2500	9.525 .3750	3.175 .1250	3.175 .1250	**ULU 8012X**	**ULKU 8012X**	**ULUZ 8012X**	**ULKUZ 8012X**
	6.350 .2500	12.700 .5000		4.763 .1875			**ULUZ 8016X**	**ULKUZ 8016X**

myonic

Single row radial deep groove ball bearings with wide inner ring







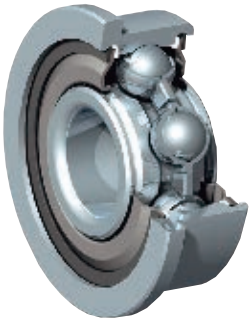
Inch dimensions

Bn mm inches	**Dc**[1] mm inches	**Bc**[2] mm inches	**Bcf**[2] mm inches	**Bnf** mm inches	**Li** mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm	**Load ratings dynamic C** N	**static Co** N
2.381	5.156	0.330			1.93	3.18	0.13	0.4	6 x 0.794	85	16
.0938	.0230	.0130			.0760	.1252	.005	.016	.03125		
2.778	5.944	0.584			2.35	3.83	0.13	0.4	6 x 1.000	138	29
.1094	.2340	0.230			.0925	.1508	.005	.016	.0394		
2.381	5.944	0.457			2.86	4.14	0.13	0.4	7 x 0.794	101	22
.0938	.2340	.0180			.1126	.1630	.005	.016	.03125		
3.572	9.119	0.584			4.13	6.67	0.13	0.5	6 x 1.588	351	86
.1406	.3590	.0230			.1626	.2626	.005	.020	.0625		
3.175	7.518	0.584	0.787	3.572	3.95	5.53	0.13	0.5	8 x 1.000	184	47
.1250	.2960	.0230	.0310	.1406	.1555	.2177	.005	.020	.0394		
3.572	9.119	0.584			4.13	6.67	0.13	0.5	6 x 1.588	351	86
.1406	.3590	.0230			.1626	.2626	.005	.020	.0625		
	9.119		0.914	3.969	5.57	7.10	0.13	0.5	9 x 1.000	198	58
	.3590		.0360	.1563	.2193	.2795	.005	.020	.0394		
3.969	10.719	0.584	0.787	3.969	5.95	8.35	0.13	0.6	8 x 1.588	450	130
.1563	.4220	.0230	.0310	.1563	.2343	.3287	.005	.024	.0625		
3.969	10.719	0.584	0.914	3.969	7.22	8.77	0.13	0.6	11 x 1.000	220	74
.1563	.4220	.0230	.0360	.1563	.2843	.3453	.005	.024	.0394		
	13.894		1.143	5.556	7.90	11.11	0.13	0.6	8 x 2.100	726	219
	.5470		.0450	.2187	.3110	.4374	.005	.024	.0827		

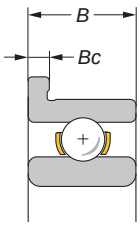
[1] Tolerance for Dc: 0 -125 µm 0 -.005"

[2] Tolerance for Bc and Bcf: 0 -50 µm 0 -.002"

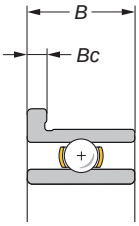
Single row radial deep groove ball bearings with flange



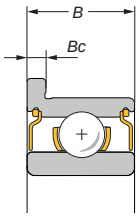
RK
open



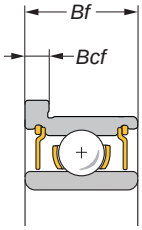
ULK/ULKW
open



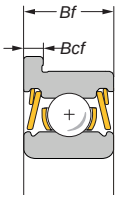
RKV
with shields



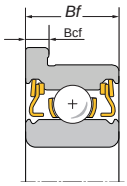
ULKZ
with shields



RKX
with shields



RKF
with capillary covers

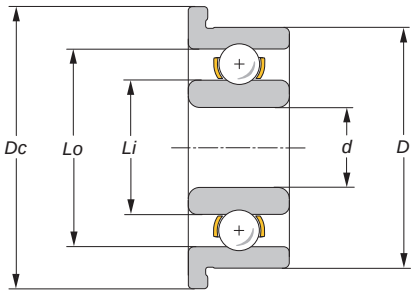


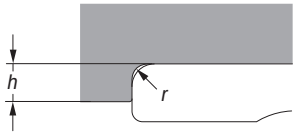
Metric dimensions

Original size	d mm	D mm	B mm	Bf mm	Designation **open** **Ball bearing**	Designation **closed** **Ball bearing**
	1.5	4	1.2	2	**ULK 154X**	**ULKZ 154X**
	2	5	1.5	2.3	**ULK 205X**	**ULKZ 205X**
	2	6	2.3	2.3	**RK 2060X**	**RKX/RKF 206X**
	2.5	6	1.8	2.6	**ULK 256X**	**ULKZ 256X**
	2.5	8	2.8	2.8	**RK 2580X**	**RKF 258X**
	3	7	2	3	**ULK 307X**	**ULKZ 307X**
	3	8	3	4	**RK 3080X**	**RKF 308X**
	3	10	4	4	**RK 3100X**	**RKX/RKF 310X**
	4	9	2.5	4	**ULK 409X**	**ULKZ 409X**
	4	10	-	4		**RKX/RKF 410X**
	5	11	3	5	**ULK 511X**	**ULKZ 511X**
	5	13	4	-	**RK 5130X**	**RKV 513X**
	6	13	3.5	5	**ULKW 613X**	**ULKZ 613X**
	6	13	3.5	-	**ULK 613X**	
	7	14	3.5	5	**ULK 714X**	**ULKZ 714X**
	8	16	4	6	**ULK 816X**	**ULKZ 816X**
	9	17	5	6	**ULK 917X**	**ULKZ 917X**
	10	19	5	7	**ULK 1019X**	**ULKZ 1019X**

myonic

Single row radial deep groove ball bearings with flange





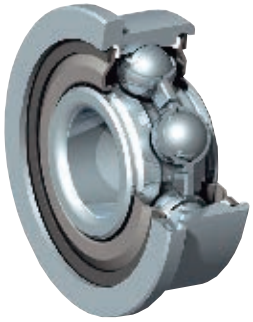
Metric dimensions

B Designation DIN	**Bf** Designation DIN	**Dc**[1] mm	**Bc**[2] mm	**Bcf**[2] mm	**Li** mm	**Lo** mm	**r max** mm	**h min** mm	**Balls n x Ø** mm	**Load ratings** **dynamic C** N	**static Co** N
618/1.5R	638/1.5R	5	0.4	0.6	2.12	3.38	0.1	0.4	6 x 0.794	87	17
618/2R	638/2R	6.1	0.5	0.6	2.86	4.14	0.1	0.4	7 x 0.794	101	22
619/2R	619/2R	7.5	0.6	0.6	3.16	4.75	0.2	0.5	7 x 1.000	165	38
618/2.5R	638/2.5R	7.1	0.5	0.8	3.54	5.02	0.1	0.5	7 x 1.000	167	40
60/2.5R	60/2.5R	9.5	0.7	0.7	4.22	6.23	0.2	0.6	7 x 1.250	258	65
618/3R	638/3R	8.1	0.5	0.8	4.14	5.85	0.1	0.5	8 x 1.150	247	66
619/3R	639/3R	9.5	0.7	0.9	4.40	6.61	0.2	0.6	7 x 1.450	335	86
623R	623R	11.5	1	1	5.33	7.87	0.2	0.7	7 x 1.588	407	110
618/4R	638/4R	10.3	0.6	1	5.33	7.87	0.1	0.5	7 x 1.588	407	110
-	-	11.5	-	1	5.33	7.87	0.2	0.7	7 x 1.588	407	110
618/5R	638/5R	12.5	0.8	1	6.69	9.32	0.2	0.7	8 x 1.750	524	152
619/5R	619/5R	15	1	-	7.40	11.00	0.2	0.7	7 x 2.381	824	237
618/6R	628/6R	15	1	1.1	7.90	11.11	0.2	0.7	8 x 2.100	726	219
618/6R	-	14.5	0.7	-	7.90	11.11	0.2	0.7	8 x 2.100	726	219
618/7R	628/7R	16	1	1.1	8.90	12.11	0.2	0.7	8 x 2.100	731	226
618/8R	638/8R	18	1	1.3	10.20	13.81	0.2	0.8	9 x 2.381	992	329
-	638/9R	19	-	1.3	11.20	14.81	0.2	0.8	10 x 2.381	1065	374
61800R	63800R	21	1	1.5	12.32	16.68	0.3	1	9 x 2.778	1314	455

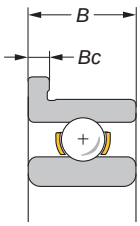
[1] Tolerance for Dc: 0
-125 µm

[2] Tolerance for Bc and Bcf: 0
-50 µm

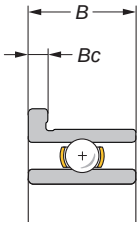
Single row radial deep groove ball bearings with flange



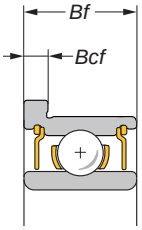
RK
open



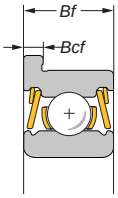
ULK
open



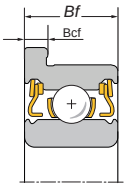
ULKZ
with shields



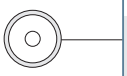
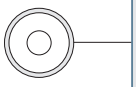
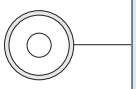
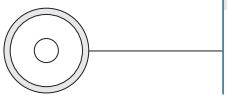
RKX
with shields



RKF
with capillary covers

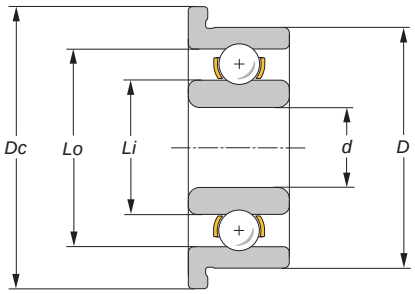


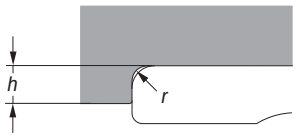
Inch dimensions

Original size	d mm inches	D mm inches	B mm inches	Bf mm inches	Designation **open** **ball bearing**	Designation **closed** **ball bearing**
	1.016 .0400	3.175 .1250	1.191 .0469		**ULK 1304X**	
	1.191 .0469	3.969 .1563	1.588 .0625	2.381 .0938	**ULK 1505X**	**ULKZ 1505X**
	1.397 .0550	4.763 .1875	1.984 .0781	2.778 .1094	**RK 1706X**	**RKX/RKF 1706X**
	1.984 .0781	6.350 .2500	2.381 .0938	3.572 .1406	**RK 2508X**	**RKX/RKF 2508X**
	2.381 .0938	4.763 .1875	1.588 .0625	2.381 .0938	**ULK 3006X**	**ULKZ 3006X**
	2.381 .0938	7.938 .3125	2.778 .1094	3.572 .1406	**RK 3010X**	**RKX/RKF 3010X**
	3.175 .1250	6.350 .2500	2.381 .0938	2.778 .1094	**ULK 4008X**	**ULKZ 4008X**
	3.175 .1250	7.938 .3125	2.778 .1094	3.572 .1406	**RK 4010X**	**RKX/RKF 4010X**
	3.175 .1250	9.525 .3750	3.969 .1563	3.969 .1563	**RK 4012X**	**RKX/RKF 4012X**

myonic

Single row radial deep groove ball bearings with flange





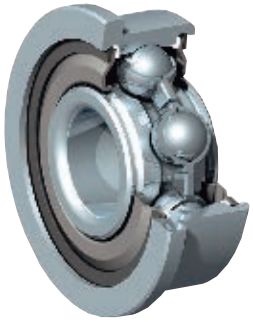
Inch dimensions

Designation **US**	**Dc**[1] mm inches	**BC**[2] mm inches	**Bcf**[2] mm inches	**Li** mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings dynamic C** N	**static Co** N
	4.343	0.330		1.60	2.40	0.10	0.3	7 x 0.500	38	6
FR 09	.1710	.0130		.0630	.0945	.004	.012	.0197		
	5.156	0.330	0.787	1.93	3.18	0.13	0.4	6 x 0.794	85	16
FR 0	.2030	.0130	0.310	.0760	.1252	.005	.016	.03125		
	5.944	0.584	0.787	2.35	3.83	0.13	0.4	6 x 1.000	138	29
FR 1	.2340	.0230	.0310	.0925	.1508	.005	.016	.0394		
	7.518	0.584	0.787	3.16	4.75	0.13	0.5	7 x 1.000	165	38
FR 1-4	.2960	.0230	.0310	.1244	.1870	.005	.020	.0394		
	5.944	0.457	0.787	2.86	4.14	0.13	0.4	7 x 0.794	101	22
FR 133	.2340	.0180	.0310	.1126	.1630	.005	0.16	.03125		
	9.119	0.584	0.787	4.13	6.67	0.13	0.5	6 x 1.588	351	86
FR 1-5	.3590	.0230	.0310	.1626	.2626	.005	.020	.0625		
	7.518	0.584	0.787	3.95	5.53	0.13	0.5	8 x 1.000	184	47
FR 144	.2960	.0230	.0310	.1555	.2177	.005	.020	.0394		
	9.119	0.584	0.787	4.13	6.67	0.13	0.5	6 x 1.588	351	86
FR 2-5	.3590	.0230	.0310	.1626	.2626	.005	.020	.0625		
	11.176	0.762	0.762	5.33	7.87	0.30	0.7	7 x 1.588	407	110
FR 2	.4400	.0300	.0300	.2098	.3098	.012	.028	.0625		

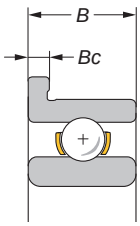
[1] Tolerance for Dc: 0 -125 µm | 0 -.005"

[2] Tolerance for Bc and Bcf: 0 -50 µm | 0 -.002"

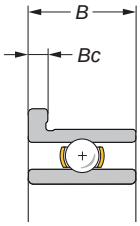
Single row radial deep groove ball bearings with flange



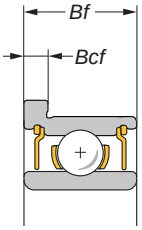
RK
open



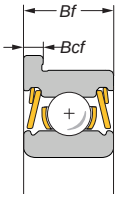
ULK
open



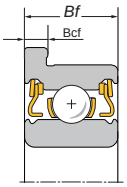
ULKZ
with shields



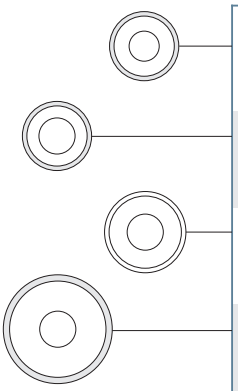
RKX
with shields



RKF
with capillary covers

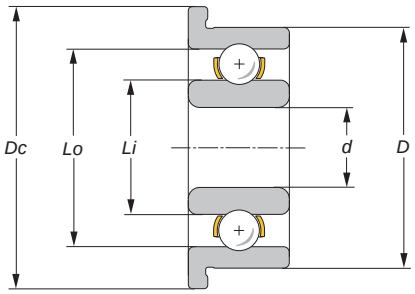


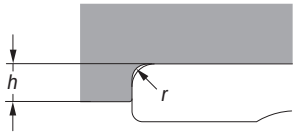
Inch dimensions

Original size	d mm inches	D mm inches	B mm inches	Bf mm inches	Designation **open** **ball bearing**	Designation **closed** **ball bearing**
	3.969 .1563	7.938 .3125	2.778 .1094	3.175 .1250	**ULK 5010X**	**ULKZ 5010X**
	4.763 .1875	7.938 .3125	2.778 .1094	3.175 .1250	**ULK 6010X**	**ULKZ 6010X**
	4.763 .1875	9.525 .3750	3.175 .1250	3.175 .1250	**ULK 6012X**	**ULKZ 6012X**
	4.763 .1875	12.700 .5000	4.978 .1960	4.978 .1960	**RK 6016X**	**RKX/RKF 6016X**
	4.763 .1875	12.700 .5000	3.969 .1563		**RKT 6016X**	
	6.35 .2500	9.525 .3750	3.175 .1250	3.175 .1250	**ULK 8012X**	**ULKZ 8012X**
	6.35 .2500	12.700 .5000	3.175 .1250	4.763 .1875	**ULK 8016X**	**ULKZ 8016X**
	6.35 .2500	15.875 .6250	4.978 .1960	4.978 .1960	**RK 8020X**	**RKX/RKF 8020X**
	7.938 .3125	12.700 .5000	3.969 .1563	3.969 .1563	**ULK 10016X**	**ULKZ 10016X**
	9.525 .3750	22.225 .8750	7.144 .2813	7.144 .2813	**RK 12028X**	**RKZ 12028X**

myonic

Single row radial deep groove ball bearings with flange





Inch dimensions

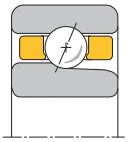
Designation **US**	**Dc**[1] mm inches	**BC**[2] mm inches	**Bcf**[2] mm inches	**Li** mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings dynamic C** N	**static Co** N
	9.119	0.584	0.914	4.98	6.82	0.13	0.5	8 x 1.150	250	69
FR 155	.3590	.0230	.0360	.1961	.2685	.005	.020	.0453		
	9.119	0.584	0.914	5.57	7.10	0.13	0.5	9 x 1.00	198	58
FR 156	.3590	.0230	.0360	.2193	.2787	.005	.020	.0394		
	10.719	0.584	0.787	5.95	8.35	0.13	0.6	8 x 1.588	450	130
FR 166	.4220	.0230	.0310	.2343	.3287	.005	.024	.0625		
	14.351	1.067	1.067	7.00	10.70	0.30	0.8	7 x 2.381	1028	346
FR 3	.5650	.0420	.0420	.2756	.4213	.012	.031	.09375		
	14.351	1.067		7.00	10.70	0.30	0.8	7 x 2.381	1028	346
FR 3	.5650	.0420		.2756	.4213	.012	0.31	.09375		
	10.719	0.584	0.914	7.22	8.77	0.13	0.6	11x 1.000	220	74
FR 168	.4220	.0230	.0360	.2843	.3453	.005	.024	.0394		
	13.894	0.584	1.143	7.90	11.11	0.13	0.6	8 x 2.100	726	219
FR 188	.5470	.0230	.0450	.3110	.4374	.005	.024	.0827		
	17.526	1.067	1.067	9.26	12.96	0.30	0.8	8 x 2.381	1145	435
FR 4	.6900	.0420	.0420	.3646	.5102	.012	.031	.09375		
	13.894	0.787	0.787	9.23	11.40	0.13	0.6	11 x 1.588	555	199
FR 1810	.5470	.0310	.0310	.3634	.4488	.005	.024	.0625		
	24.613	1.575	1.575	13.21	18.87	0.40	0.8	7 x 3.969	2183	719
FR 6	.9690	.0620	.0620	.5201	.7429	.016	.031	.1563		

[1] Tolerance for Dc: 0 -125 µm; 0 -.005”

[2] Tolerance for Bc and Bcf: 0 -50 µm; 0 -.002”

Removable angular ball bearings

RA
open



Metric dimensions

Original size	d mm	D mm	B mm	Designation
	2	6	2.3	**RA 2060X**
	2.5	8	2.8	**RA 2580X**
	3	10	4	**RA 3100X**
	4	13	5	**RA 4130X**
	4	16	5	**RA 4160X**
	5	16	5	**RA 5160X**
	6	19	6	**RA 6190X**
	8	22	7	**RA 8220X**

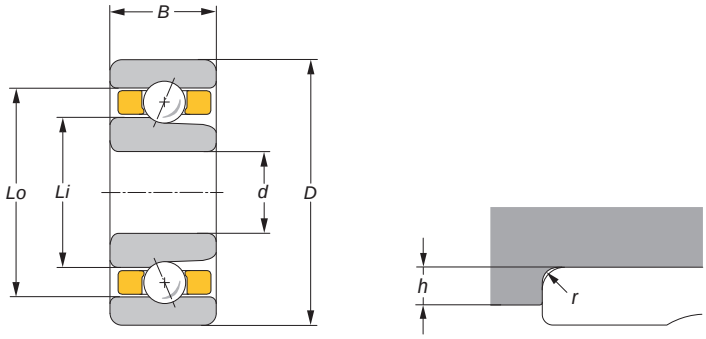
These bearings are supplied as follows:

- with a solid ball cage made of synthetic material (page 17)
- with an angle of contact from 17° to 22° (page 20)
- in the precision tolerances of quality P5P or better (page 18, 19)

The number of balls printed in blue in the column «Balls» corresponds to the standard design (page 61).

myonic

Removable angular ball bearings



Metric dimensions

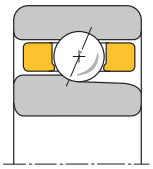
B Designation DIN	Li mm	Lo mm	r max mm	h min mm	Balls n x Ø mm		Load ratings for α° =20° dynamic C N	 static Co N	 axial Coa N
719/2	3.16	4.68	0.20	0.5	6 x	1,150	190	43	78
					7 x		210	50	91
70/2.5	3.95	6.23	0.20	0.6	**6** x	1,588	338	81	148
					6 x		375	95	173
723	5.63	7.87	0.20	0.7	6 x	1.588	356	92	167
					7 x		394	107	195
					8 x		431	123	224
724	6.88	10.35	0.20	0.8	**7** x	2,381	780	217	394
					8 x		853	248	451
734	7.62	12.38	0.30	1.0	**6** x	3,175	1145	311	566
					7 x		1268	362	659
725	7.62	12.38	0.30	1.0	**6** x	3,175	1145	311	566
					7 x		1268	362	659
726	9.92	14.68	0.30	1.0	7 x	3,175	1333	401	730
					8 x		1457	458	833
708	11.81	17.60	0.30	1.0	**7** x	3,969	1984	618	1125
					8 x		2168	706	1285

Standard ball set blue

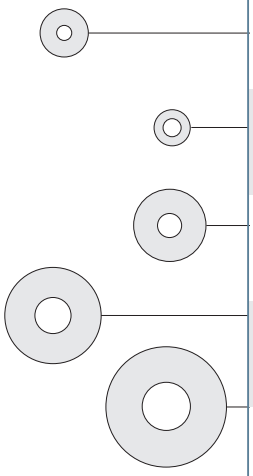
Removable angular ball bearings

RA

open



Inch dimensions



Original size	d mm inches	D mm inches	B mm inches	Designation
	1.984 .0781	6.35 .2500	2.381 .0938	**RA 2508X**
	2.381 .0938	7.938 .3125	2.778 .1094	**RA 3010X**
	3.175 .1250	9.525 .3750	3.969 .1563	**RA 4012X**
	4.763 .1875	12.70 .5000	3.969 .1563	**RA 6016X**
	6.35 .2500	15.875 .6250	4.978 .1960	**RA 8020X**

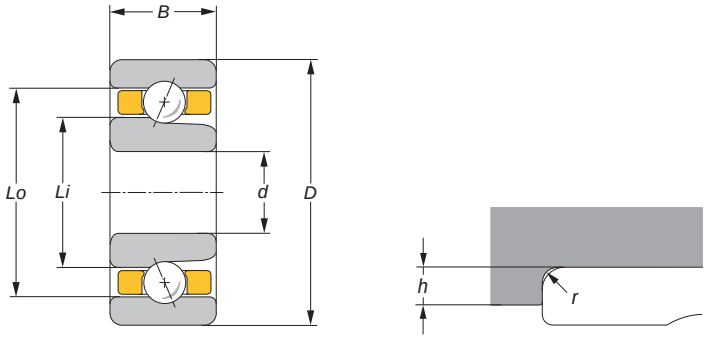
These bearings are supplied as follows:

- with a solid ball cage made of synthetic material (page 17)
- with an angle of contact from 17° to 22° (page 20)
- in the precision tolerances of quality “A5P” with inch dimensions or better (Pages 18, 19)

The number of balls printed in blue in the column «Balls» corresponds to the standard design (page 63).

myonic

Removable angular ball bearings

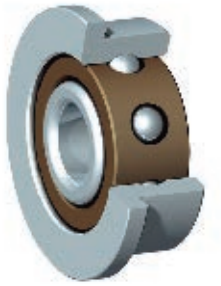


Inch dimensions

Designation **US**	**Li** mm inches	**Lo** mm inches	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings for α° =20°** **dynamic C** N	**static Co** N	**axial Coa** N
	3.16	4.68	0.13	0.5	6 x 1.150	190	43	78
R1-4B	.1244	.1843	.005	.020	**7** x .0453	210	50	91
	3.95	6.23	0.13	0.5	**6** x 1.588	338	81	148
R1-5B	.1555	.2453	.005	.020	7 x .0625	375	95	173
	5.08	7.32	0.30	0.7	6 x 1.588	353	89	162
R2B	.2000	.2882	.012	.028	**7** x .0625	391	104	189
	6.88	10.35	0.30	0.8	**7** x 2.381	780	217	395
R3B	.2709	.4075	.012	.031	8 x .09375	853	248	451
	9.48	12.96	0.30	0.8	**8** x 2.381	878	274	499
-	.3732	.5102	.012	.031	9 x .09375	950	308	561

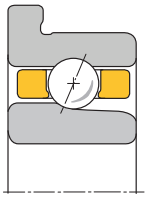
Standard ball set blue

Removable angular ball bearings with flange

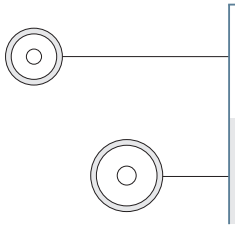


RKA

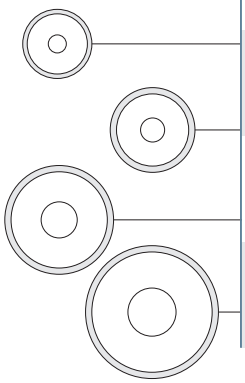
open



Metric dimensions

Original size	d mm	D mm	B mm	Designation	Dc mm	Bc mm	Li mm	Lo mm
	2	6	2.3	**RKA 2060X**	7.50	0.60	3.16	4.68
	2.5	8	2.8	**RKA 2580X**	9.50	0.70	3.95	6.23

Inch dimensions

Original size	d mm inches	D mm inches	B mm inches	Designation	Dc mm inches	Bc mm inches	Li mm inches	Lo mm inches
	2.381	7.938	2.778	**RKA 3010X**	9.12	0.58	3.95	6.23
	.0938	.3125	.1094		.3590	.023	.1555	.2453
	3.175	9.525	3.969	**RKA 4012X**	11.18	0.75	5.08	7.32
	.1250	.3750	.1563		.4401	.029	.2000	.2882
	4.763	12.70	3.969	**RKA 6016X**	14.35	1.06	6.88	10.35
	.1875	.5000	.1563		.5649	.042	.2709	.4075
	6.35	15.875	4.978	**RKA 8020X**	17.53	1.05	9.48	12.96
	.2500	.6250	.1960		.6830	.041	.3732	.5102

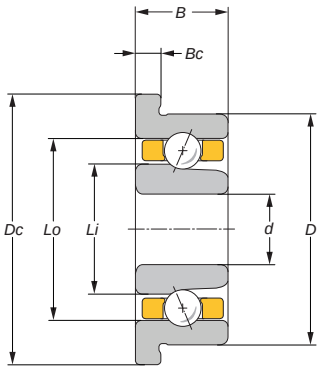
These bearings are supplied as follows:

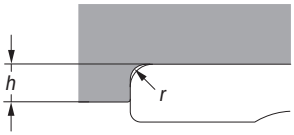
- with a solid ball cage made of synthetic material (page 17)
- with an angle of contact from 17° to 22° (page 20)
- in the precision tolerances of quality “A5P” with inch dimensions or better (page 18,19)

The number of balls printed in blue in the column «Balls» corresponds to the standard design (page 65).

myonic

Removable angular ball bearings with flange





Metric dimensions

Designation **DIN**	**r max** mm	**h min** mm	**Balls n x Ø** mm	**Load ratings for α° =20°** **dynamic** **C** N	**static** **Co** N	**axial** **Coa** N
719/2R	0.20	0.5	6 x 1.150 **7** x 1.150	216 216	52 52	94 94
70/2.5R	0.20	0.6	**6** x 1.588 7 x 1.588	338 375	81 95	147 173

Standard ball set blue

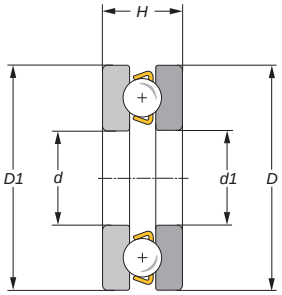
Inch dimensions

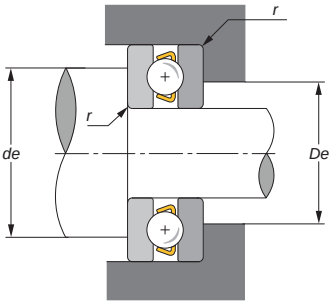
Designation **US**	**r max** mm inches	**h min** mm inches	**Balls n x Ø** mm inches	**Load ratings for α° =20°** **dynamic** **C** N	**static** **Co** N	**axial** **Coa** N
R1-5B	0.13 .005	0.5 .0200	**6** x 1.588 7 x .0625	338 375	81 95	147 173
R2B	0.30 .012	0.7 .0280	6 x 1.588 **7 x** .0625	353 391	89 104	162 189
R3B	0.3 .012	0.8 .3100	**7** x 2.381 8 x .09375	780 853	217 248	395 451
-	0.30 .012	0.8 .3100	**8 x** 2.381 9 x .09375	878 950	274 308	499 561

Standard ball set blue

Axial deep groove ball bearings

B





Metric dimensions

d mm	D mm	B mm	Designation	d1 mm	D1 mm	de min mm	De max mm	r max mm	Balls n x Ø mm
3	8	3.5	**B 308X**	3.2	7.8	6	5	0.10	6 x 1.588
4	10	4	**B 410X**	4.2	9.8	7.5	6.5	0.10	6 x 1.588
5	12	4	**B 512X**	5.2	11.8	9	8	0.10	8 x 1.588
6	14	5	**B 614X**	6.2	13.8	10.5	9.5	0.15	7 x 2.381
7	17	6	**B 717X**	7.2	16.8	13	11	0.15	8 x 2.778
8	19	7	**B 819X**	8.2	18.8	14.5	12.5	0.25	8 x 3.175
9	20	7	**B 920X**	9.2	19.8	15.5	13.5	0.25	8 x 3.175

d mm	D mm	H mm	Designation	n Max 1/min	axial load ratings dynamic Ca N	 static Coa N
3	8	3.5	**B 308X**	15000	783	675
4	10	4	**B 410X**	15000	728	675
5	12	4	**B 512X**	13000	831	900
6	14	5	**B 614X**	10000	1657	1702
7	17	6	**B 717X**	10000	2377	2661
8	19	7	**B 819X**	8000	3045	3492
9	20	7	**B 920X**	8000	2980	3692

The ball bearings are produced in quality P5P or better

Tolerance class	Ø d	Ø D ≤17 mm	Ø D ≥19 mm	H	Axial run-out	
P5	0/-8 µm	0/-11 µm	0/-13 µm	0/-100 µm	3 µm	**recommended tolerances:** Shafts: +4 / -4 µm Housing: +8 / 0 µm
P4	0/-7 µm	0/-11 µm	0/-13 µm		2 µm	

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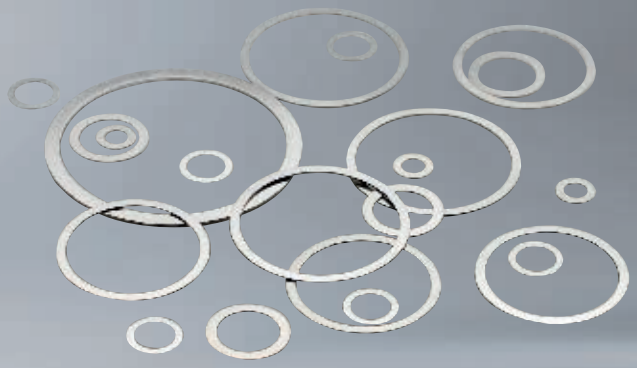
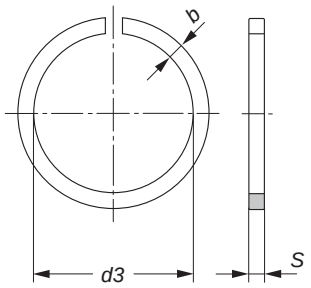
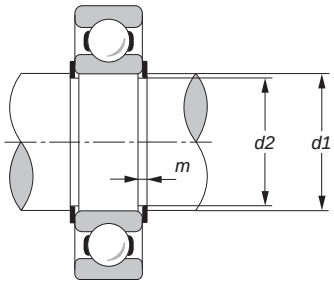


Product Accessories

Circlips for shafts

WSR





Designation	Shaft Ø d1	d3 max	Circlip b ±0.10	s*	Groove D2 -0.05	m +0.03	Suitable for ball bearings with inner diameter	
	mm	mm	mm	mm	mm	mm	mm	inches
WSR 3	3	2.60	0.50	0.30	2.70	0.33	3	.1250
WSR 4	4	3.60	0.50	0.30	3.70	0.33	4	.1562
WSR 5	5	4.50	0.70	0.40	4.60	0.44	5	
WSR 6	6	5.45	0.70	0.40	5.60	0.44	6	.2500
WRS 7	7	6.45	0.70	0.40	6.60	0.44	7	
WSR 8	8	7.35	0.90	0.50	7.50	0.55	8	.3125
WSR 9	9	8.30	0.90	0.50	8.50	0.55	9	
WSR 10	10	9.25	0.90	0.50	9.50	0.55	10	

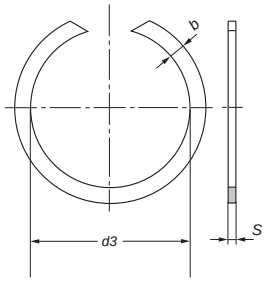
Material: stainless steel

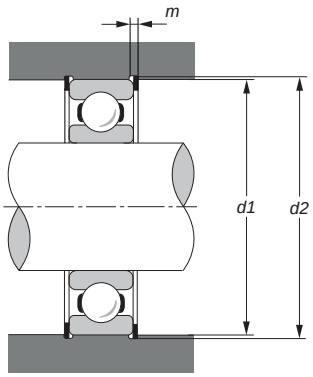
* Tolerance of **«s»**

Thickness mm	Tolerance mm
< 0.4	± 0.015
< 0.6	± 0.02

Circlips for bore holes

BSR





Designation	Housing Ø d1	d3 min	Circlip b ±0.10	s*	Groove d2 +0.05	m +0.03	Suitable for ball bearings with outer diameter	
	mm	mm	mm	mm	mm	mm	mm	inches
BSR 4	4	4.40	0.50	0.30	4.30	0.33	4	.1562
BSR 5	5	5.45	0.50	0.30	5.30	0.33	5	
BSR 6	6	6.45	0.50	0.30	6.30	0.33	6	
BSR 7	7	7.50	0.50	0.30	7.30	0.33	7	
BSR 8	8	8.60	0.70	0.40	8.40	0.44	8	.3125
BSR 9	9	9.60	0.70	0.40	9.40	0.44	9	
BSR 10	10	10.65	0.70	0.40	10.40	0.44	10	
BSR 11	11	11.65	0.70	0.40	11.40	0.44	11	
BSR 12	12	12.75	0.90	0.50	12.50	0.55	12	
BSR 13	13	13.75	0.90	0.50	13.50	0.55	13	
BSR 14	14	14.80	0.90	0.50	14.50	0.55	14	
BSR 15	15	15.80	0.90	0.50	15.50	0.55	15	
BSR 16	16	16.85	0.90	0.50	16.50	0.55	16	
BSR 17	17	17.85	0.90	0.50	17.50	0.55	17	
BSR 19	19	20.00	1.10	0.60	19.60	0.66	19	.7500

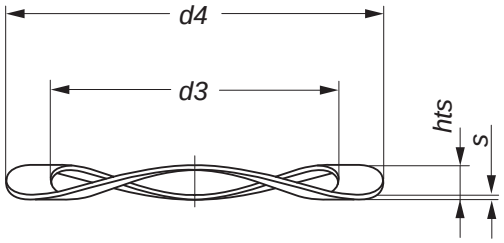
Material: stainless steel

* Tolerance of **«s»**

Thickness mm	Tolerance mm
< 0.4	± 0.015
< 0.6	± 0.02
< 0.8	± 0.025

Precision spring washers

FS



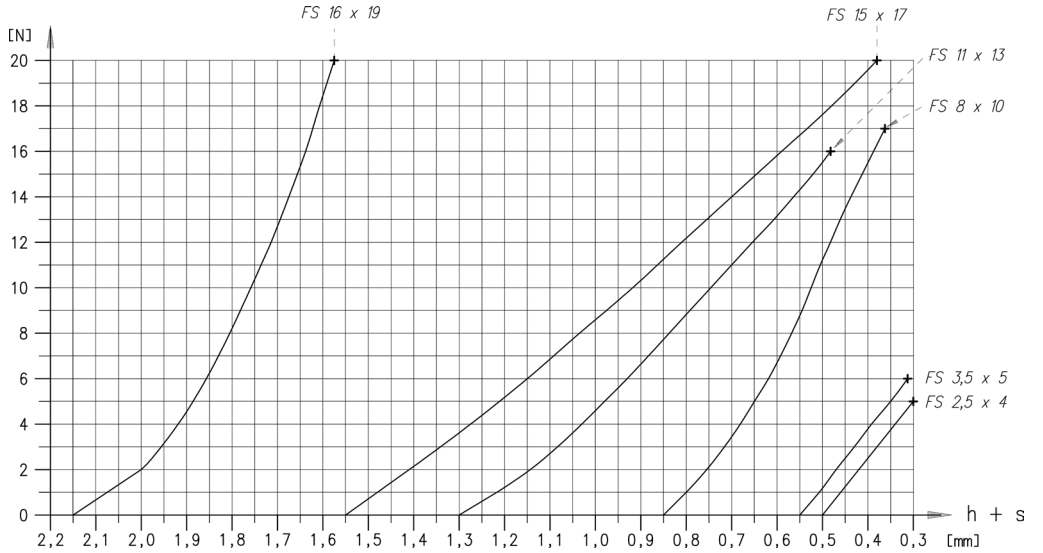
Designation	h+s ±0.05	s*	d3	d4	Suitable for ball bearings with Inner diameter		Outer diameter	
	mm	mm	mm	mm	mm	inches	mm	inches
FS 1.5 X 3	0.40	0.08	1.60	2.90	-	-	3	-
FS 2 X 3.5	0.45	0.08	2.15	3.10	2	-	-	.1250
FS 2.5 X 4	0.50	0.08	2.70	3.80	2.5	-	4	.1562
FS 3 X 4.5	0.50	0.10	3.20	4.30	3	.1250	-	-
FS 3.5 X 5	0.55	0.10	3.70	4.80	-	-	5	-
FS 4 X 6	0.65	0.12	4.20	5.75	4	.1562	6	-
FS 4.5 X 6.35	0.60	0.12	4.80	6.10	-	.1875	-	.2500
FS 5 X 7	0.65	0.12	5.20	6.75	5	-	7	-
FS 6 X 8	0.70	0.15	6.20	7.75	6	-	8	.3125
FS 7 X 9	0.90	0.15	7.20	8.70	7	-	9	-
FS 8 X 10	0.85	0.18	8.20	9.70	8	.3125	10	-
FS 9 X 11	1.15	0.18	9.20	10.70	9	-	11	-
FS 10 X 12	1.05	0.20	10.20	11.70	10	-	12	-
FS 11 X 13	1.30	0.20	11.20	12.70	-	-	13	-
FS 12 X 14	1.30	0.22	12.20	13.70	-	-	14	-
FS 13 X 15	1.30	0.22	13.20	14.70	-	-	15	-
FS 14 X 16	1.55	0.25	14.20	15.65	-	-	16	-
FS 15 X 17	1.55	0.25	15.20	16.65	-	-	17	-
FS 16 X 19	2.15	0.30	16.20	18.55	-	-	19	.7500

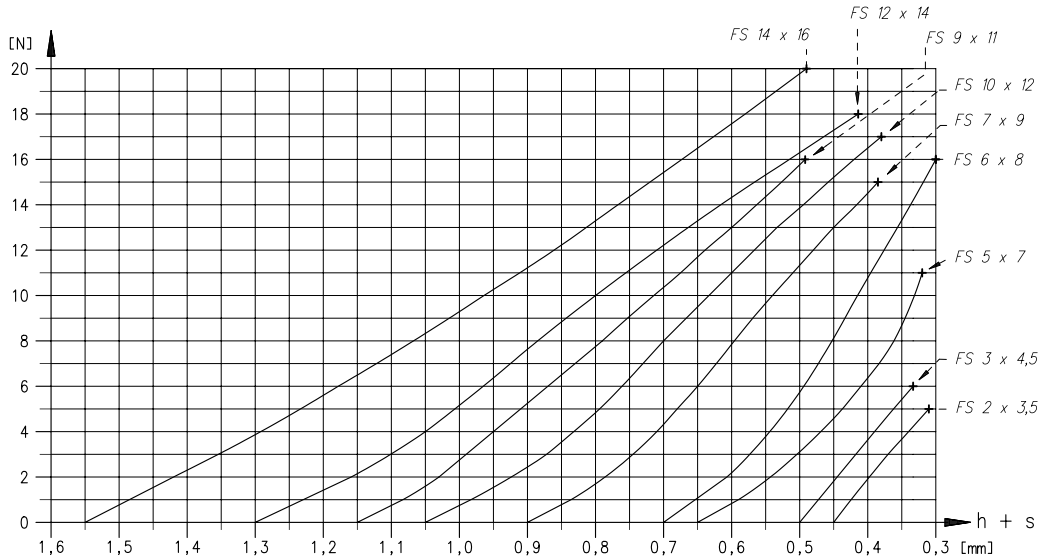
Material: stainless steel

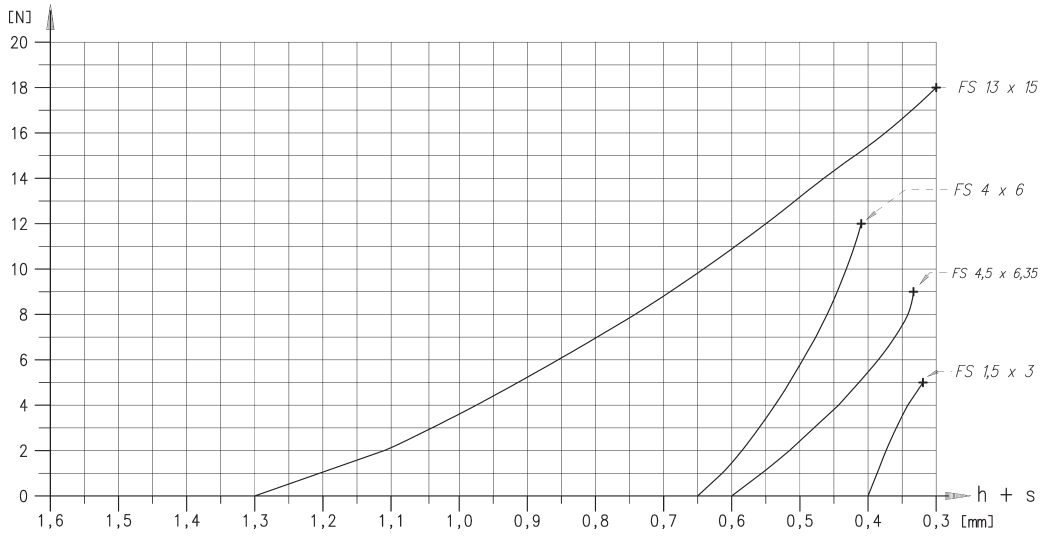
* Tolerance of **«s»**

Thickness mm	Tolerance mm
< 0.2	± 0.01
< 0.3	± 0.012
< 0.4	± 0.015

Characteristic curves of the precision spring washers



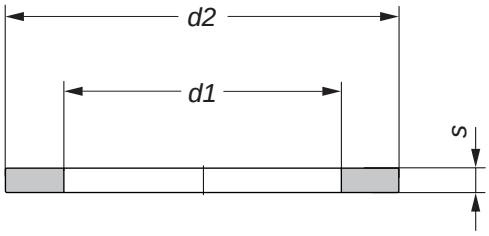




h+s at F=0N measured with 0.36N
Characteristic curves apply to not set precision spring washers

Precision shims

PS



Designation	s*	d1	d2	Suitable for ball bearings with inner diameter		outer diameter	
	mm	mm	mm	mm	inch	mm	inch
PS 1.5 X 3	0.08 0.10	1.68	2.97			3	
PS 2 X 3.5	0.08 0.10	2.25	3.20	2			.1250
PS 2.5 X 4	0.08 0.10	2.80	3.90	2.5		4	.1562
PS 3 X 4.5	0.08 0.10 0.12	3.30	4.40	3	.1250		
PS 3.5 X 5	0.08 0.10 0.12	3.80	4.90			5	
PS 4 X 6	0.10 0.12 0.15	4.30	5.85	4	.1562	6	
PS 4.5 X 6.35	0.10 0.12 0.15	4.90	6.20		.1875		.2500
PS 5 X 7	0.10 0.12 0.15	5.30	6.85	5		7	
PS 6 X 8	0.12 0.15 0.18	6.30	7.85	6		8	.3125
PS 7 X 9	0.12 0.15 0.18	7.30	8.80	7		9	

When ordering, the thickness **«s»** of the precision shim is to be specified.

Example: PS 8 X 10 X 0.18

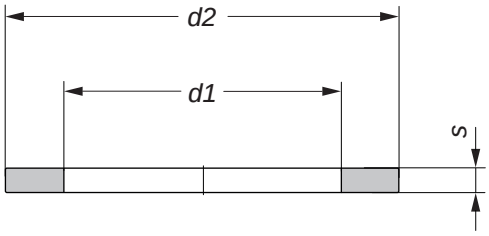
Material: stainless steel

Design: rounded edges, heat treated
finest surface quality

myonic

Precision shims

PS



Designation	s*	d1	d2	Suitable for ball bearings with inner diameter		outer diameter	
	mm	mm	mm	mm	inch	mm	inch
PS 8 X 10	0.15 0.18 0.20	8.30	9.80	8	.3125	10	
PS 9 X 11	0.15 0.18 0.20	9.30	10.80	9		11	
PS 10 X 12	0.18 0.20 0.22	10.30	11.80	10		12	
PS 11 X 13	0.18 0.20 0.22	11.30	12.80			13	
PS 12 X 14	0.20 0.22 0.25	12.30	13.80			14	
PS 13 X 15	0.20 0.22 0.25	13.30	14.80			15	
PS 14 X 16	0.22 0.25 0.30	4.35	15.80			16	
PS 15 X 17	0.22 0.25 0.30	15.35	16.80			17	
PS 16 X 19	0.25 0.30 0.35	16.40	18.80			19	.7500

* Tolerance of **«s»**

Thickness mm	Tolerance mm
< 0.2	± 0.01
< 0.3	± 0.012
< 0.4	± 0.015

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