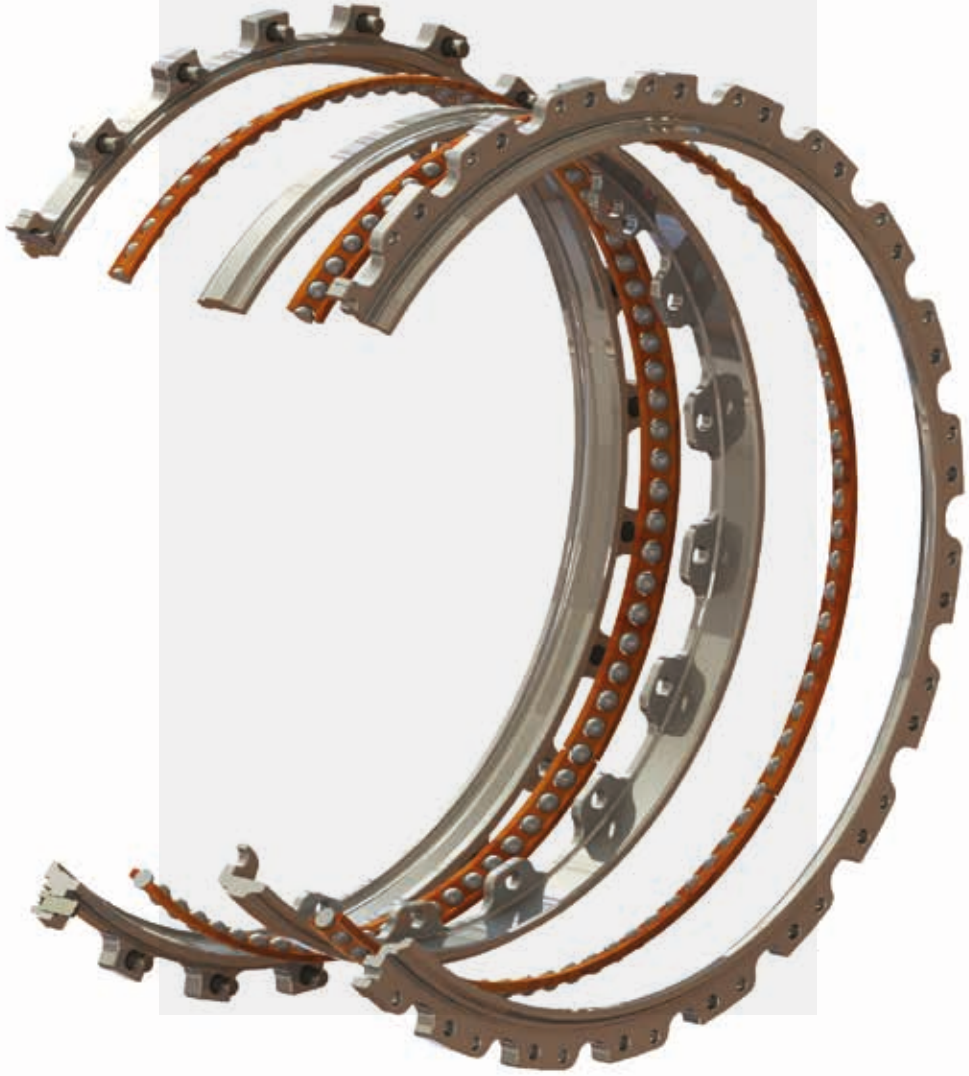
ADR

ALCEN

HIGH PRECISION BALL BEARINGS

technology in **motion**



The data in this catalogue is based on our current production.

ADR reserves the right to make changes which are necessary by technological development. ADR also reserves the right to change without notice the technical characteristics of illustrated components.

ADR disclaims any responsibility in case technical information is misused or misinterpreted.

ADR

ALCEN

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CONTENTS

1 ≡ FOREWORD

PRESENTATION

Founded in 1925, **ADR** is a **leading company** in the field of high precision ball bearings.

Located in Thomery in the heart of the Fontainebleau forest, ADR offers **specific technical solutions** and associated services, by drawing on its skills in bearing technology, mechatronics and its human values.

By implementing a policy focused on **customer satisfaction, innovation** and the search for **performance,** ADR offers innovative and very high-technology products.

Thanks to its know-how and its network of representatives, ADR generates more than half of its activity **internationally.**

ADR
ALCEN

PRODUCTS

INNOVATIVE CUSTOMISED SOLUTIONS

With the best performance in stiffness and friction torque.
Each product fulfils customer's specific requirements:

- Very High Precision
- Extreme Temperatures
- High & Low Speed
- Reliability
- Repeatability
- Vacuum & Oxidation

HIGH PRECISION BALL BEARINGS (Miniature, Thin section and Integrated)

MECHATRONIC SYSTEMS
(Electromechanical Actuators, Motorised Bearings, Servomotors, Precision Positioning Equipment)

1 ☰ FOREWORD
ADR'S STRATEGY

Today, ADR has the ability to offer technical solutions for rotating systems, based on ball bearing technology thanks to its many skills in terms of:

- Design
- Grinding
- Assembly (clean room)

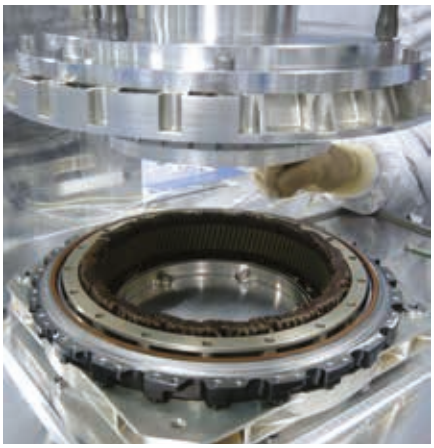
The objective is to be as attentive as possible to customers in order to understand and to be able to respond optimally to their different requirements.

INNOVATION & PARTNERSHIP

ADR invests a substantial proportion of its turnover in Research and Development, the key pillar on which its ongoing innovation is based.

ADR is heavily involved in some long-term R&D projects, at the ASTECH competitiveness cluster in particular, working in partnership with some large multinationals and well-known research centres, as well as with RAPID - Régime d'Appui pour l'Innovation Duale (Dual support system for innovation).

Thanks to its expertise, ADR has evolved its products by offering fully integrated ball bearing systems.



Indeed, thanks to its experience and expertise in large bearings, ADR has the capacity to supply complete equipment and sub-systems.

This makes it possible to respond to positioning applications, in order to meet new technological requirements, while integrating elements such as an encoder or a motor.

ADR X-SPACE BALL BEARINGS

ADR created the ADR X-SPACE range to respond quickly to requests from space customers.

This range exists in super duplex versions for metric and inch thin section ball bearings.

While maintaining an exceptional level of performance, this range allows a reduction in development time and cost.

Typology of mechanisms targeted mainly concerns SADM (solar panels), APM (antennas), filter wheels or small mechanisms, a market where ADR is widely present with its high-precision ball bearings.

ADR - SPACE PRODUCTS, THE SO-CALLED "ADR X-SPACE" RANGE

- Based on ADR's extensive Space heritage
- More than 20 duplex ball bearings
- From 8 mm bore up to 130 mm outer diameter
- Fluid space lubrication in standard – Possibility of solid lubricant on specification
- Quality material for space application and outgassing tested
- Development phase reduced
- Manufacture and test tooling available
- 3 parameters always taken into account:
  - Performance: Load capacity - Torque - Stiffness
  - Reliability thanks to robust design
  - Industrial optimisation

Find our dimensional values on page 136 & 137

1 ☰ FOREWORD
ACTIVITY AREA

Custom-made, our products have features that allow them to evolve in very specific environments where high precision and high sensitivity are required.

DEFENCE & SECURITY

- Electro-optical systems
- Missile seekers
- DIRCM (Direct InfraRed Counter Measure)
- Terrestrial & Naval sights

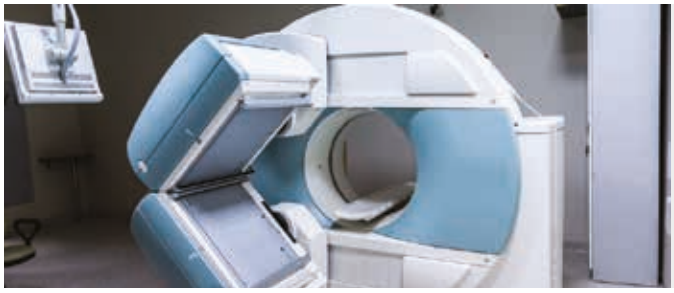
AEROSPACE

- SADM (Solar Array Drive Mechanisms)
- Antenna Pointing Mechanisms
- Rotating instruments
- Filter Wheels
- Reaction Wheels
- Engine fittings

ENERGY

- Nuclear
- Oil & Gas
- Hydraulic

MEDICAL



- Medical imaging (X-RAY tubes, etc.)
- Exoskeletons
- Robotic surgery

MANUFACTURING

GRINDING

As a manufacturer of very **high technology systems,** ADR has the latest machinery for grinding, super finishing and controlling.

Our precision is measured in tolerances of **one tenth of a micron.**

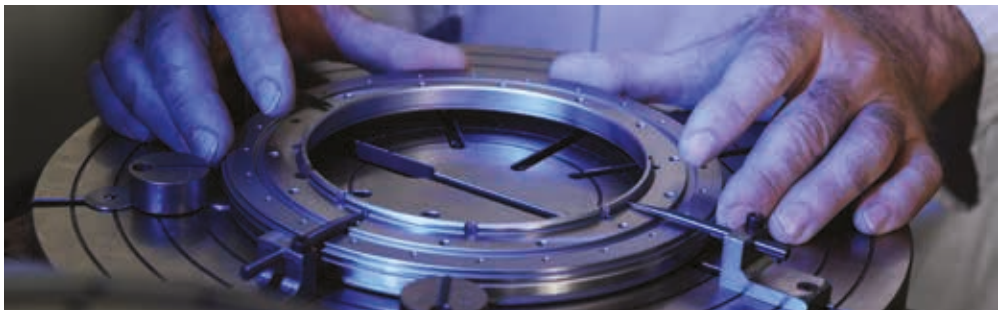
ASSEMBLY

Each ADR product is assembled **in clean rooms** categorised ISO 5 to ISO 8.
This allows us to obtain a very low and stable **friction torque.**

QUALITY CONTROL & EXPERTISE

As quality is the priority of ADR, many technical, material and documentary resources are implemented to meet the various requirements.

ADR holds **ISO 9001** and **EN 9100** certifications.



afaq EN/AS/JISQ 9100 Aerospace AFNOR CERTIFICATION

afaq ISO 9001 Quality AFNOR CERTIFICATION

2 ≡ DESIGN

A. ADR BALL BEARING DESIGNATIONS

The designation of the ADR products is subdivided into 15 positions (filled in or not). The table below summarises the composition of the designation. Each position is detailed in the following chapters.

The ADR designation is a guideline to help understand the definition of a product by its designation.

Position	1	2	3	4	5	6	7
Definition	**Material**	**Outer shape**	**Dimension reference**	**Inner shape**	**Shields/ seals**	**Cage**	**Tolerances**
Codes currently used	— W Z	F L E K	AX 6000 A412 AD8112 SP12987	H B X	Z ZZ F -2RS	— R E N	T4 TA4 T5 TA5
Pages	14 to 17	18 to 19	20 to 23	24 to 25	26 to 27	28 to 31	32 to 39
Designation exemples							
WA725NTA4DOK2458	W	—	A725	—	—	N	TA4
FR2BJ1830C42G68	—	F	R2	B	—	—	—
WSP11293TA4K2440	W	—	SP11293	—	—	—	TA4
W6201ZZT46W201PMLH47	W	—	6201	—	ZZ	—	T4

DESIGN HELP

Chapter 3 Ball bearing characteristics: 63
Chapter 4 Mounting study: 67

These chapters allow the reader to have a general understanding of the dimensions and mounting methods of our products. Our Design & Engineering Department (contact details on the back of the catalogue) is available to help you with definitions and to propose suitable technical solutions for ball bearings as well as designs for your rotating systems.

The technical capabilities of our company go beyond this simple framework. Specific dimensional references linked to a drawing (designation type SP...) and customer specifications linked to specific technical descriptions (designation type K.....) are frequently considered.

In this case, ADR will supply Technical Definitions of Products (so-called TDPs) as well as drawings on request from our Design & Engineering Department.

8	9	10	11	12	13	14	15
Radial internal clearance	Preload and duplex configuration	Vibration level	Surface treatment and coating	Torque	Diameter calibration	Lubrication	Specification
3 J1015	DO DX	W201	P	ML MR	C CL12	H47 G128 G68R	K1837
40 to 43	44 to 49	50	51	52 to 54	55 to 57	58 to 61	62
—	DO	—	—	—	—	—	K2458
J1830	—	—	—	—	C42	G68	—
—	—	—	—	—	—	—	K2440
6	—	W201	P	ML	—	H47	—

Need help?

Tel. +33 (0)1 64 70 59 50 I mail@adr-alcen.com

B. TECHNICAL DEFINITION OF PRODUCTS

POSITION 1. MATERIALS FOR RINGS AND BALLS

In any mechanical design, the choice of materials is of primary importance.
To respond to the needs of your applications, we propose various solutions to manufacture your rotating systems.
The quality of our supply requirements guarantees the cleanliness and traceability of our materials. Here is an explanatory list of the most commonly encountered materials.

W = STAINLESS STEEL

As standard

Steel designated **X105CrMo17** according to the EN standard (former denomination: Z100CD17) and **440C** according to the AISI standard is commonly used for the manufacture of bearings at ADR. This martensitic stainless steel presents strong hardness of 58 HRC minimum and excellent resistance to abrasion. Its high chromium content makes it highly resistant to corrosion.

The core heat treatment processes include one or more cooling cycles depending on the expected characteristics. These ADR controlled processes provide the material with an excellent dimensional stability for a standard utilisation between -80°C and +150°C.

On specification (K...)

For applications in a wider temperature range, a specific heat treatment of the stainless steel **X105CrMo17** allows the use of stainless steel between -260°C and +315°C.

For applications with greater constraints, we propose this same stainless steel **X105CrMo17** type **VAR** (Vacuum Arc Remelting) obtained by a remelting under vacuum **CEVM** (Consumable Electrode Vacuum Melt). This technology reduces the gas content and non-metallic inclusions in the material, and therefore increases its breaking strength.

For applications with extreme constraints (very heavy loads, very high speed, very aggressive environment, etc.), we use notably two nitrogen-doped steel grades:

- **X40CrMoVN16.2** according to the EN standard (former denomination: E-Z40CDV16.2+Az and commercial name: **XD15NW**).
  This steel remelted by a consumable electrode **ESR** (Electroslag Remelting) simultaneously presents an outstanding corrosion resistance and strong hardness of 58 HRC minimum. Its balanced composition yields a fine structure without coarse carbide, assuring excellent fatigue strength.
  A specific high-temperature heat treatment allows the utilisation of **X40CrMoVN16.2** up to +450°C, while maintaining strong hardness.
  A biocompatible grade can be proposed for medical applications.

- **X30CrMoN15.1** according to the EN standard (commercial name: **CRONIDUR® 30** or N360).
  This second grade similarly elaborated under high pressure **PESR** (Pressurised Electroslag Remelting) obtains performances equivalent to X40CrMoVN16.2.

– = CHROMIUM STEEL

As standard

The grade designated **100Cr6** according to the EN standard (former denomination 100C6) and **52100** according to the SAE standard presents a high hardness greater than 62 HRC and a high dimensional stability allowing it to resist heavy loads and to be usable at up to +150°C. Thanks to its homogeneous structure at both macroscopic and microscopic levels, it is able to respond to requirements of small torques and high rotating velocities. This chromium steel is not recommended for corrosive environments.

On specification (K...)

For applications with high constraints, we propose this same **VAR** type (Vacuum Arc Remelting) **100Cr6** steel obtained by a remelting under vacuum **CEVM** (Consumable Electrode Vacuum Melt). This technology reduces the gas content and non-metallic inclusions in the material and therefore increases its breaking strength.

For applications with extreme constraints (very heavy loads, very high speed, etc.), we recommend **VIM-VAR** type (Vacuum Induction Melting - Vacuum Arc Remelting) **100Cr6** steel obtained by a double melting under vacuum. This increases the breaking strength thanks to a more uniform microstructure.

Z = HIGH-SPEED STEEL

On specification (K...)

High-speed tungsten steel designated **HS 18-0-1** according to the EN standard (former denomination: Z80WCV18.04.01) and T1 according to the AISI standard is used for very high temperature applications of up to +550°C. Its fine structure makes it particularly ideal for applications with a very low noise level.

High-speed steels elaborated from powder metallurgy with or without cobalt designated **HS 6-5-3-8** or **HS 6-5-3** according to the EN standard (commercial name: ASP®2023 or ASP®2030) possess stronger hardness due to a high concentration of carburised elements. The homogeneous distribution of the carburised elements and the absence of segregation increase the resilience and fatigue strength of the steel.

High-speed molybdenum steel designated **80MoCrV40** according to the EN standard (former denomination 80DCV40) and **M50** according to the AISI standard is generally used for applications combining strong mechanical stresses and high temperatures (up to +300°C). In order to increase its breaking strength, we recommend **VIM-VAR** type (Vacuum Induction Melting - Vacuum Arc Remelting) steel obtained by a double melting under vacuum.

Another high-speed steel grade designated **AMS 5749** (commercial name: **BG42®** VIM VAR) also accepts high-temperature utilisation with, in addition, better resistance to corrosion.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

D = SUPERALLOY

On specification (K...)

We use mainly **ALACRITE** or **STELLITE® alloys** which are cobalt based alloys with a high chromium and tungsten content. They are intended for utilisations:

- for utilisations over a wide temperature range from -180°C to +800°C,
- for highly corrosive environments (thanks to an exceptional resistance to oxidation),
- for applications requiring non-magnetic materials (due to their very low steel content).

Cobalt confers good rubbing characteristics and excellent resistance to abrasion and decreases the risk of seizure. The additions of chromium and tungsten form very hard and stable carbides which obtain strong hot and cold hardness for this type of alloy (more than 50 HRC). However, the dynamic load capacity of ball bearings (C) drops 50 % compared to 100Cr6 chromium steel. Other cobalt-free grades can be studied for applications in an irradiated environment.

T = LIGHT ALLOY

On specification (K...)

These alloys are generally used for structural parts in the designs of specific ball bearings **(SP...)** due to their low density or their non-magnetism.

Ti 6Al-4V-type titanium alloy (former denomination **TA6-V)** offers an excellent combination of mechanical properties, with low density, good corrosion resistance and high temperatures (of up to +400°C), in addition to being non-magnetic.

For use in a bearing ring, please consult the Design & Engineering Department to find out what are the acceptable load capacities.

BASIC DATA TABLE OF THE MAIN MATERIALS

Code	EN standard (Chemical composition)	AISI	Standards	Name
W	X105CrMo17	440 C	AMS 5630, 5618	Z100CD17
W	X40CrMoVN16.2	—	AMS 5925	XD15NW™
W	X30CrMoN15.1	—	AMS 5898	CRONIDUR® 30 or N360
—	100Cr6	SAE 52100	AMS 6440, 6444	100C6
Z	HS 18-0-1	T1	AMS 5626	High-speed steel
Z	80MoCrV40	M50	AMS 6490, 6491	Semi high-speed steel
Z	X115CrMoV14.4.1	—	AMS 5749	BG42®
D	CoCr30W8	—	—	ALACRITE 554
D	CoCr32W13	—	—	ALACRITE 505
T	Ti 6Al-4V	—	AMS 4911, 4928, 4935, 4965, 4967	Titanium alloy TA6-V Grade 5
	Si_3N_4	—	—	Silicon nitride (ceramic)

CERAMIC – HYBRID BALL BEARINGS

On specification (K...)

We can propose so-called "hybrid" ball bearings with steel rings and ceramic balls (accordingly with a suitable design) mainly for utilisations:

- at high speed,
- in a corrosive environment,
- with limited lubrication,
- in a magnetic environment,
- etc...

Balls made of **Si_3N_4** (Silicon Nitride) ceramic have less than half the density of steel balls, which allows the limiting speed of the bearings to increase.

Using ceramic reduces the friction in contacts, decreases the risk of seizure and lowers operational heating. The homogeneity and the hardness of balls made of new ceramic grades give an excellent breaking strength and provide very good resistance to compression.

Other grades can be proposed, such as **ZrO_2** (Zirconium Oxide), whose expansion coefficient close to that of steel minimises impacts due to heat variations.

Density (g/cm³)	Coefficient of Thermal Expansion (K^{-1})	Hardness	Magnetism	Code
7.70	1.02 x10^{-5}	675 HV / 58 HRC	Yes	W
7.70	1.04 x10^{-5}	675 HV / 58 HRC	Yes	W
7.72	9.90 x10^{-6}	690 HV / 59 HRC	Yes	W
7.80	1.14 x10^{-5}	765 HV / 62 HRC	Yes	–
8.67	9.80 x10^{-6}	750 HV / 62 HRC	Yes	Z
7.87	1.121 x10^{-5}	720 HV / 61 HRC	Yes	Z
7.76	1.013 x10^{-5}	720 HV / 61 HRC	Yes	Z
8.40	1.24 x10^{-5}	530 HV / 51 HRC	No	D
8.60	1.16 x10^{-5}	640 HV / 56 HRC	No	D
4.43	9.00 x10^{-6}	270 HV / 28 HRC to 350 HV / 36 HRC	No	T
3.21	3.20 x10^{-6}	1400 to 1600 HV	No	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

POSITION 2. OUTER SHAPE

To increase the ball bearing's performances and to adapt to your configuration, we propose a design change by integrating a flange, larger rings or any other geometric specificity studied jointly with your Design & Engineering Department.

– = NORMAL OUTER RING

Unless otherwise specified, the ball bearing's outer ring is standard and has normal overall dimensions as shown opposite.

F = FLANGED OUTER RING

By rigidifying the ball bearing, the flange limits deformations linked to its fitting in the system. This facilitates its mounting, simplifies the machining of its housing and increases its positioning precision.

ADR also proposes on request specific flanges adaptable to your design. They may be circular or be obtained by milling.

K = DRILLED FLANGE ON OUTER RING

This version of a ball bearing with a specific mounting flange adapts to the design of the system.

It is equipped with holes or threaded holes, smooth or any other specific shape and the geometry of the flange can be circular or obtained by milling.

The drilled flange is fixed directly onto the housing or onto the shaft which limits geometric dispersions and reduces thermomechanical constraints on pairs of preloaded ball bearings.

This solution of a drilled flange also facilitates the installation and fixing of the ball bearing by elimination of mechanical parts used to clamp the bearing in its housing.

L = EXTENDED INNER RING WITH SYMMETRICAL EXTENSION

These ball bearings used as hubs facilitate stackings, particularly in gear trains. Their widths are modified according to the following data:

- Ball bearings in metric series – the inner ring is wider by an additional **.800 mm,**
- Ball bearings in inch series – the inner ring is wider by an additional **.792 mm (.0312 inch),**
- Ball bearings in thin section series – refer to the tables of dimensions of each series or please contact us.

E = EXTENDED INNER AND OUTER RINGS

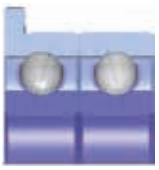
This version improves the ball bearing's seating in its housing. It also presents an increased inner volume, allowing in most of the cases, the mounting of a crown-type cage (type R) combined with two shields (type ZZ).

The widths of both rings are increased by the same value as in the version L presented above.

FL = FLANGED OUTER RING AND EXTENDED INNER RING

This solution can be used to simultaneously combine the advantages of solutions F and L detailed above.

FN = FLANGED BALL BEARING + NORMAL BALL BEARING ASSEMBLY



This codification applies to a pair of ball bearings. The assembly consisting of a flanged ball bearing and a normal ball bearing facilitates the positioning of the pair in its housing.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

POSITION 3. DIMENSION REFERENCE

Depending on their size, the ball bearings presented in this catalogue are part of a well defined referential series. However, since we work to order and on specification, any geometry is feasible. So please consult us directly when your designs require specific dimensions. The reference series are listed below. The entire designations according to diameters are given in the dimension tables in part 5 of this catalogue.

– = RIGID BALL BEARINGS (see pages 74 to 97)

The rigid ball bearings series differ by their cross-section according to the following drawings.

618 = THIN SECTION BALL BEARINGS - Metric series (see page 126)

The thin section ball bearings in metric series are available with a cross-section that increases with the diameter.

619 = ANGULAR CONTACT BALL BEARINGS - Metric series (see page 92)

A = THIN SECTION BALL BEARINGS (see pages 98 to 109)

The thin section ball bearings are available in various series with the following constant cross-sections.

Super duplex thin section ball bearings, 4 series: AA, AB, AD, AF.

These super duplex ball bearings improve the rotating precision and the friction torque compared to a conventional pair. Operation is improved, better performances are obtained and ball bearing life is longer. Super duplex ball bearings AA and AD are designed with a monobloc double-groove outer ring for a preloaded configuration in back-to-back DO. Super duplex ball bearings AB and AF are designed with a monobloc double-groove inner ring for a preloaded configuration in face-to-face DX. These solutions offer the following advantages to limit misalignment between the two ball bearing raceways at mounting and to increase angular stiffness by rigidifying the ball bearing (please see the next page).

Super duplex thin section ball bearings with reduced width compared to an equivalent pair, 2 series: AD, AF.

AD = BACK-TO-BACK (DO) preloaded super duplex (see pages 110 to 115)

One-piece outer ring

This configuration of super duplex ball bearings AD has a reduced width compared to a pair of thin section ball bearings (so-called duplex) except for the AD4 series.

AD4 **AD6** **AD7** **AD8** **AD9** **AD10**

AF = FACE-TO-FACE (DX) preloaded super duplex

One-piece inner ring

This configuration is equivalent to the face-to-face preloaded configuration DX of the AD series. The inner ring here is a one-piece double-groove ring. The width of super duplex AF is reduced compared to a pair of thin section ball bearings (so-called duplex) except for the AF4 series. *Please refer to the dimension tables of each AD series which are equivalent in dimensions and load ratings; only the mass of the AF super duplex ball bearings differs slightly.*

AF4 **AF7** **AF8** **AF9** **AF10** **AF12**

Super duplex thin section ball bearings with similar width compared to an equivalent pair, 2 series: AA, AB.

AA = BACK-TO-BACK (DO) preloaded super duplex (see pages 116 to 125)

One-piece outer ring

This configuration of super duplex ball bearings is designed with a width and a ball diameter identical to those of a pair of thin section ball bearings. These designations also exist in dimension AA12, AA13, AA16 and AA24.

AA6 **AA7** **AA8** **AA9** **AA10** **AA11**

AB = FACE-TO-FACE (DX) preloaded super duplex

One-piece inner ring

This configuration is equivalent to the face-to-face preloaded configuration DX of the AA series. The inner ring is here a one-piece double-groove ring. *Please refer to the dimension tables of each AA series which are equivalent in dimensions and load ratings.*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

KADV = INTEGRATED BALL BEARINGS

Integrated super duplex ball bearings with hard preload improve the overall rotating system behaviour. Its rotation precision is obtained thanks to its two grooves outer ring design which limits geometric defaults and reduces the running torque. KADV ball bearings are proposed in back-to-back configuration with centred inner rings allowing a very good bending load capacity and increasing its angular stiffness.

Its hard preload applied with CHC screws guarantees the repetitiveness of this parameter from one ball bearing to the other and a perfect control of the aimed stiffness performances.

KADV ball bearings avoid user having to deal with the preload set up on the system which is always a sensitive operation. This type of ball bearings with a flanged outer ring equipped with fixing holes on the flange limits mechanism interfaces. A precise positioning dimension may be requested between the ball bearing inner and outer ring in order to precisely position the housing in relation to the shaft (therefore facilitating coder integration, collector, etc.).

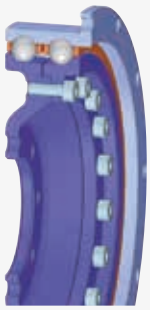
The preload value is determined according to the loads that the ball bearing has to support. Preload screws are dimensioned for a limited preload and external loads. It is recommended to contact our Engineering Department to make sure that the ball bearing is well dimensioned with respect to the application and environment.

Example of integration

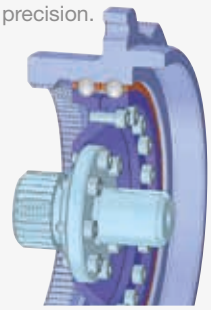
Controlled preload pair of ball bearings. Curve of preloads delivered with each pair.

Super duplex design with a singlepiece outer ring. Gain in performance, rotating precision and ball bearing life.

Integration of a flange. Easy to mount and a time saving, enhanced system rigidity, less critical housing precision.



Solid preloading. All the ball bearing's characteristics and performances are calculated, measured and under ADR's responsibility. Such a cartridge is very easy to mount with guaranteed performances.



Design and manufacture of complete complex integrated systems at ADR to guarantee the best performances with more compact and more reliable systems.

SP = SPECIFIC BALL BEARINGS

Specific ball bearings are designed to respond precisely to the specific requirements of your application. Any ball bearing with a dimension that is not standard is named SP… followed by a digital increment. Ball bearings can be specific from a dimensional point of view to respond to given load cases, stiffnesses or overall dimensions.
They can integrate your mechanism's functions to simplify the final mounting and reduce the geometric dispersion of the assembly by minimising the number of interfaces.
These solutions improve rotating precision and the global friction torque of the system.
An axial positioning value between two mechanical parts can be assured by design and manufacture.
The right hand drawing represents an example of specific ball bearing, the illustrations on the left page show another example of a specific design.

EM = MECHANICAL ASSEMBLY

ADR offers its skills and expertise for engineering, integration and industrialisation of complete sub-systems which allows optimisation of the geometric and dimensional precision of the equipment and also improves the overall dimensions, mass and rigidity performance.
To achieve its customers' objectives, ADR's experience in ball bearing technology is a key element of success for the solutions provided.
Calculation models that are specifically developed at ADR ensure a high level of reliability in predicting the behaviour of the complete system.
ADR combines its permanent research for enhancing performance with a logic based on lower final costs to the quality of its production and its capacities and expertise for precision assembly in a clean environment.
Additional skills such as project management, industrialisation of complex products, production management under aerospace and defence standards, and know-how in technology transfer have positioned ADR as a key partner for the integration of demanding and high-technology sub-systems.

SM = MECHATRONIC SYSTEMS

ADR offers mechatronic architectures around the rotating function.
This system provides rotational guidance while favouring positioning.
The addition of motors and encoders or other electromechanical components makes it possible to obtain a compact and precise assembly.
This assembly also saves space and weight and ensures overall equipment efficiency.
The mechatronic systems developed by ADR meet the specifications of its customers and are adapted to each application.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

POSITION 4. INNER SHAPE

The axial and radial loads applied to ball bearings are mainly those which determine the internal geometry of the bearings. The best known ball bearing type, the “deep groove”, can sustain radial and axial loads in both directions. High speed and a large axial load require using “angular contact” ball bearings.

– = DEEP GROOVE BALL BEARINGS

It is the most conventional ball bearing for multiple applications. Its grooves are complete tracks with symmetrical shoulders. These ball bearings can sustain mainly radial loads and support axial loads in both directions.

Deep groove ball bearings can be mounted in pairs, preloaded at ADR to meet application requirements and operate at a specified contact angle.

H = NON-SEPARABLE ANGULAR CONTACT BALL BEARINGS

This design allows the integration of more balls than a deep groove ball bearing thus increasing the load ratings. These ball bearings can be constructed with large contact angles. This increases the ball bearing’s axial rating within the limit of the groove depths and the ellipsoidal truncation.

These ball bearings are usually mounted in a preloaded pair to place them in angular contact and cancel axial and radial internal clearances. For utilisation as a single ball bearing, the axial clearance must be compensated.

B = SEPARABLE ANGULAR CONTACT BALL BEARINGS

Separable angular contact ball bearings are delivered mounted, but their inner ring may be separated from the rest of the ball bearing to facilitate its mounting on the system.

The balls remain held solidly in the cage with the outer ring.

They have the same properties as non-separable angular contact ball bearings.

Q = FULL COMPLEMENT BALLS BEARINGS WITH BALL ENTRY

They are deep groove ball bearings equipped with notches to allow complete filling with balls. This particularity improves load ratings. Nonetheless, the friction torque becomes significantly higher than that of ball bearings equipped with a cage.

X = FOUR POINT CONTACT BALL BEARINGS

The ball bearing with four points of contact is defined by an ogival groove ring which provides for two points of contact on each of the rings. This means that higher ratings can be obtained than with a standard ball bearing. They are suitable for holding combined axial, radial and angular loads. But, on the other hand, its inner geometry increases the friction torque.

ADR has developed a new range of 4-point contact thin section ball bearings (see pages 132 to 134). The SA10, SA12 and SA16 series have been designed to support high capacities and combined axial, radial and angular loads. ADR offers on specification a solid preload on X-bearings with a controlled and mastered torque.

It is possible to make this type of ball bearing with a negative clearance in order to preload it. ADR can guarantee homogeneous friction torque on the batch and measure it on request.

However, this configuration cannot be comparable to a preloaded pair. In fact, an X type ball bearing is preloaded by construction. This method induces major dispersions on the preload value. In addition, the hyperstatism of the four points of contact causes large variations in friction torque.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

POSITION 5. SHIELDS/SEALS

Shields/seals are used on ball bearings mainly for two reasons:

- The ball bearing can be subjected to a polluting environment. A ball bearing's shield/seal guarantees a longer life to the rotating system.
- The ball bearing can be a pollution generator in a critical environment. It might be necessary to prevent a possible migration of the lubricant, for instance.

– = OPEN BALL BEARINGS

No symbol indicates an open ball bearing without shield/seal.

Z = BALL BEARINGS PROTECTED BY ONE SHIELD

ZZ = BALL BEARINGS PROTECTED BY TWO SHIELDS

As standard

The ball bearing is protected by one or two separable stainless steel shields held by circlips or a retaining ring. This mounting prevents ring deformation due to crimping.

A small gap between the shield and the inner ring limits the size of dust particles liable to penetrate into the ball bearing. In addition, this protection limits the migration of lubricant into the system. The shield is not in contact with the inner ring.

Therefore, friction torque does not increase with respect to open ball bearings.

On specification (K...)

Unless otherwise specified, shields can be mounted by crimping, generally for low tolerance classes, type T0 or T6.

RS = BALL BEARINGS PROTECTED BY ONE NITRILE RUBBER SEAL

-2RS = BALL BEARINGS PROTECTED BY TWO NITRILE RUBBER SEALS

The ball bearing is rendered tight by one or two nitrile rubber seals reinforced by a metal reinforcement. The contact between the seal and the inner ring provides an excellent tightness. However, this leads to an increase in friction torque.

The utilisation temperatures are between –20° and +100°C for nitrile rubber seals.

Material variants are available (**RS2**: fluorinated elastomer: –30°C; 180°C) which offer better resistance to higher temperatures. Please consult the Design & Engineering Department for more information about other materials.

F = BALL BEARINGS PROTECTED BY ONE PTFE SEAL REINFORCED WITH FIBREGLASS

FF = BALL BEARINGS PROTECTED BY TWO PTFE SEALS REINFORCED WITH FIBREGLASS

The ball bearing is protected by one or two PTFE seals reinforced with fibreglass and held by circlips. This type of seal offers good tightness with lower friction torques than nitrile rubber seals.

These seals can be used for higher speed applications than rubber seals. The utilisation temperatures are between –60°C and +200°C.

= SPECIFIC SHIELDS/SEALS*

On specification (K...)

For special or complex rotating systems, specific shields/seals can be considered.

- Specific seal integrated on a ball bearing with low leak rate and low friction torque.
- Specific shield and raceway with very small gap to limit to the maximum the intrusion of particles in the ball bearing.

*Please consult the Design & Engineering Department for more information about these specific shields/seals.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 6. CAGE/RETAINER

Depending on the ball bearing's size and inner shape, the environment in which it will be forced to operate and the system's applications (speed, temperature, torque, the aggressivity of the environment) we propose many types of ball separators (different shapes and materials). You will find below a non-exhaustive presentation of the various designs and examples of materials.

1 I Cage designs:

– = STANDARD CAGES

Standard cages are defined according to the type of ball bearing, its size and its internal shape. Each type of cage listed below is detailed in its section.

- For rigid deep groove ball bearings (inner ring not filled in in position 4), the separators used are two-piece **pressed sheet-metal** cages.
- For non-separable angular contact ball bearings, type H, the standard cage is a **one-piece machined cage with cylindrical ball pockets.**
- For separable angular contact ball bearings, type B, the standard cage is a **one-piece machined cage with stepped ball pockets.**

The cage type and the material used can be specified according to the application's requirements.

Pressed sheet-metal cage (ribbon type cage)

It is a two-piece cage made of pressed sheet-metal. In this design, the two constituent pieces are rendered solid by crimping. This cage type is particularly ideal for small-sized deep groove ball bearings used at slow to high speeds. X8Cr17 stainless steel is commonly used, although CuZ33 brass can be used as an alternative.

One-piece machined cage, with cylindrical ball pockets

It is a machined, one-piece cage with cylindrical ball pockets. It is usually made of reinforced phenolic resin. This cage is particularly suitable for angular contact ball bearings used at moderate to very high speeds with low friction torque.
Steels, bronzes, polymers or sintered materials can also be proposed depending on the application's requirements.

One-piece machined cage, with stepped or conical ball pockets

This cage's shape is similar to that of the snap cage with the difference that the pockets contain ball retainers. This configuration holds the balls on the outer ring when the inner ring is dismounted. This cage is particularly suitable for angular contact ball bearings used at moderate to high speeds with low friction torque.

V = FLOATING SHEET-METAL CAGE

It is a two-piece pressed sheet-metal cage. In this design, the two constituent pieces are slightly floating. This cage type is perfect for small-sized deep groove ball bearings used at slow to high speeds with low friction torque. X8Cr17 stainless steel is commonly used.

A PTFE type coating can be proposed for moderate speeds and light loads. Its self-lubricating characteristic is suitable for applications under vacuum and/or at low and high temperatures, or when a conventional lubricant is not recommended.

R = CROWN-TYPE CAGE

It is a cage generally machined in the shape of a “comb” crown which clips onto the balls. This cage is particularly suitable for deep groove ball bearings used at moderate to high speeds with low friction torque. It is usually made of reinforced phenolic resin. For some applications, an acetal resin, technical polymers, steels, bronzes, or PTFEs loaded with glass fibres can also be proposed and adapted.

RA = MACHINED CAGE, RIVETED

Cage machined into two parts with cylindrical cells and assembled with rivets. This cage design is robust and suitable for radial ball bearings used at moderate to very high speeds. Made of phenolic resin with two metallic flanges or fully metallic or other materials depending on the application.

E = SEPARATOR TUBES

These tubes are inserted between each ball of the ball bearing. These separators are used in deep groove ball bearing designs, notably in applications with slow rotating speeds or oscillating motions. The tubes are made of PTFE to guarantee very low friction torque.

N = RING-SHAPED SPACERS

These spacers are set over every other ball for angular contact ball bearing designs. They are particularly suitable for applications with very low to moderate rotating speeds or oscillating motions. The ring-shaped spacers are made of PTFE to guarantee very low friction torque.

Q = FULL COMPLEMENT BALL BEARINGS

In this case, the ball bearing has no ball separator. The ball bearing design can be a “ball entry” type as described in position 4, but may also be an angular contact type. This type of mounting is used only in cases where heavy loads are applied, and is often detrimental to friction torque.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

2 I Materials for cages:

If the chosen material differs from the defined standard, a two-digit codification is indicated after the cage shape symbol. For specific requirements, our Design & Engineering Department is available to help you.

Phenolic resin

is used as standard for one-piece machined cages or crown-type cages. This material is made up of a thermosetting synthetic resin matrix reinforced by a fabric or rolled paper frame. This material's porosity allows a lubricant to impregnate, guaranteeing a long, service-free ball bearing life. The utilisation limit temperature of phenolic resin is between -70°C and +120°C.

PTFE (polytetrafluoroethylene)

is used essentially for separator tubes and ring-shaped spacers. This material offers the advantages of a very low friction coefficient and of an inert chemical composition. PTFE can be used over a wide temperature range (-200°C to +250°C) and is ideal for cryogenic applications where fluid lubrication is impossible.

MELDIN®

notably type 9000, is a sintered polyimide with good mechanical properties and high porosity which increases the cage's impregnation rate. It is generally used in applications where ball bearing life must be extremely long. MELDIN 9000 can be used over a wide temperature range between -204°C and +315°C.

VESPEL®

notably types SP1, SP22, SP3, are polyimides with exceptional mechanical properties and wear resistance. VESPEL® SP3 has a low friction coefficient thanks to the presence of MoS2 and is generally employed for space or cryogenic applications where temperatures can drop to 4°K. The two other references are essentially used for high-temperature applications of up to +400°C.

PGM-HT

is composed of PTFE filled with fibreglass and MOS2. It has an exceptional mechanical resistance and a low friction coefficient. It is only used for machined cages in space and vacuum applications. PGM-HT is used over a wide temperature range from -248°C to +280°C.

ARMALON®

consists of a PTFE coated fibreglass fabric frame. It has exceptional mechanical resistance and a very low friction coefficient. It is essentially used for machined cages in high-speed applications or applications in a cryogenic environment. ARMALON is used over a wide temperature range from -253°C to +260°C.

PEEK®

is a high-performance polymer (Polyetheretherketone) with high-temperature resistance properties (continuous utilisation of up to +260°C) and good wear resistance. In addition, wear resistance can be enhanced even more for grades loaded with carbon fibres. It is not subject to the hydrolysis phenomenon and can be used at a maximum temperature of +250°C in steam or water under high pressure, while preserving most of its mechanical properties. PEEK is particularly stable with respect to temperature and humidity, and resists chemical attacks or physical stresses. It is mainly employed in high temperature or high-speed applications.

Graphite

is a self-lubricating material with a low friction coefficient. It is generally used for high-temperature applications or applications in an aqueous environment.

Steel

one-piece machined or crown-type cages can be made of **42CrMo4, 35NiCrMo16** steels or **X105CrMo17** (440C) or **X2CrNi19-11** stainless steels to respond to either extreme mechanical stresses, very high speeds or high temperatures. These steels can accommodate a silver or MoS2 coating to reduce friction due to the sliding of balls with the cage's ball pockets and the guiding of the cage with bearing rings.

Copper alloy

machined cages are also proposed in various copper alloy grades to respond to specific environmental requirements (temperature, speed, non-magnetism, reduced lubrication, etc.).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 7. TOLERANCES

The manufacturing precision of ball bearing rings complies with the rules derived from international standards. We determined the dimensional tolerance classes expressed in microns and detailed hereafter. This ADR choice made for the various classes makes it possible to meet the most stringent standards.

Standard recommendations used and tolerance classes

- ISO 492 for normal ISO tolerance classes 0, 6, 5, 4, 2.
- ABMA STANDARD 12 for precision ball bearings for instruments, according to ABEC 5P, 7P, 9P and ABEC 5T, 7T.
- ABMA STANDARD 20.0 for thin section ball bearings, according to ABEC 5P, 7P, 9P and ABEC 5T, 7T.

ADR tolerance classes

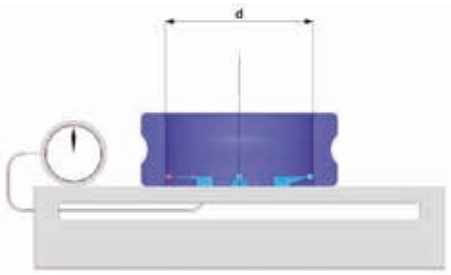
Comparison with reference Standards

ADR tolerance classes		Nominal bore d		ISO	ABEC
		>	≤		
Deep groove ball bearings	T0	0	50	0	1P
	T6	0	50	6	3P
	T5	0	18	5	5P
		18	320	5	-
	T4	0	18	-	7P
		18	250	4	-
		250	320	-	-
	T2	0	18	-	9P
		18	250	2	-
		250	320	-	-
Thin section ball bearings	TA5	13	80	-	5T
		80	320	-	-
	TA4	13	80	-	7T
		80	320	-	-

Definitions

Inner ring

- d nominal bore diameter
- d_s isolated bore diameter
- d_{mp} mean bore diameter in an isolated plane
- $d_{mp} = \frac{d_{s\,max} + d_{s\,min}}{2}$

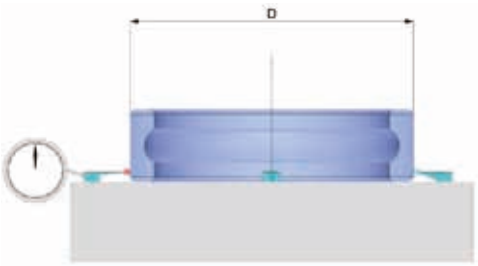


The bore is measured in two planes, and the smallest of the values (dmp) is retained.

Measurements are taken on the ring on its own

Outer ring

- D nominal outer diameter
- D_s isolated outer diameter
- D_{mp} mean outer diameter in an isolated plane
- $D_{mp} = \frac{D_{s\,max} + D_{s\,min}}{2}$



The outer diameter is measured in two planes, and the largest of the values (Dmp) is retained.

Measurements are taken on the ring on its own

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

Tolerances in µm for 0 < d ≤ 18 mm

I Non-thin section ball bearings

Tolerance classes T5 - T4 - T2

Inner ring

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included							
		0 to 18							
		Max	Min						
Isolated bore diameter	T5-T4	0	-5						
	T2	0	-2.5						
Bore out of round, taper	T5-T4	2.5							
	T2	1.3							
Radial runout	T5	3.5							
	T4	2.5							
	T2	1.3							
Bore runout with reference side	T5	7							
	T4	2.5							
	T2	1.3							
Raceway runout with reference side	T5	7							
	T4	2.5							
	T2	1.3							

Outer ring

Toleranced parameter	Tolerance class	Nominal outer diameter D in mm, from excluded to included							
		0 to 18		18 to 30		30 to 50			
		Max	Min	Max	Min	Max	Min	Max	Min
Mean outer diameter	T5-T4	0	-5	0	-5	0	-5		
Open ball bearing									
Isolated outer diameter	T5-T4	0	-5	0	-5	0	-5		
	T2	0	-2.5	0	-3.75	0	-3.75		
Outer diameter out of round	T5-T4	2.5		2.5		2.5			
	T2	1.3		2		2			
Shielded or sealed ball bearing									
Isolated outer diameter	T5-T4	+1	-6	+1	-6	+1	-6		
Outer diameter out of round	T5-T4	5		5		5			
All ball bearing types									
Radial runout – max.	T5	5		5		5			
	T4	3.5		3.5		5			
	T2	1.3		2.5		2.5			
Outside cylindrical runout with reference side	T5	7		7		7			
	T4	3.5		3.5		3.5			
	T2	1.3		1.3		1.3			
Raceway runout with reference side	T5	7		7		7			
	T4[1]	5		5		5			
	T2	1.3		2.5		2.5			
Flange diameter	T5-T4	0	-25	0	-25	0	-25		
Flange width	T5-T4	0	-50	0	-50	0	-50		

Inner and outer rings for nominal bore diameter d, from 0 to 18 mm inclusive

Toleranced parameter	Tolerance class	0 to 18							
		Max	Min						
Width of single bearing	T5-T4-T2	0	-25						
Width of duplex pair[1]	T5-T4-T2	0	-380						
Width variation[2]	T5	5							
	T4	2.5							
	T2	1.3							

Please contact our Design & Engineering Department for reduced tolerances compared to standards.

1 For an assembly comprising several ball bearings, the tolerance is equal to half this value multiplied by the number of ball bearings.

2 For a flanged ball bearing, this variation applies to the flange width.

3 For flanged ball bearing, apply value of tolerance class T5.

4 Only for ball bearings with d > 18 mm, in ISO series 8 and 9.

B. TECHNICAL DEFINITION OF PRODUCTS

Tolerances in µm for 18 < d < 305 mm

I Non-thin section ball bearings

Tolerance classes T5 - T4 - T2

Inner ring

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included															
		18 to 30		30 to 50		50 to 80		80 to 120		120 to 150		150 to 180		180 to 250		250 to 305	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Isolated bore diameter	T5	0	-6	0	-8	0	-9	0	-10	0	-13	0	-13	0	-15	0	-18
	T4	0	-5	0	-6	0	-7	0	-8	0	-10	0	-10	0	-12	0	-15
	T2	0	-2.5	0	-2.5	0	-4	0	-5	0	-7	0	-7	0	-8	0	-10
Bore out of round[3]	T5	6		8		9		10		13		13		15		18	
	T4	5		6		7		8		10		10		12		15	
	T2	2.5		2.5		4		5		7		7		8		10	
Bore taper	T5	3		4		5		5		7		7		8		9	
	T4	2.5		3		3.5		4		5		5		6		7	
	T2	1.3		1.5		2		2.5		3.5		3.5		4		5	
Radial runout	T5	4		5		5		6		8		8		10		13	
	T4	3		4		4		5		6		6		8		10	
	T2	2.5		2.5		2.5		2.5		2.5		5		5		7	
Bore runout with reference side	T5	8		8		8		9		10		10		11		13	
	T4	4		4		5		5		6		6		7		9	
	T2	1.5		1.5		1.5		2.5		2.5		4		5		7	
Raceway runout with reference side	T5	8		8		8		9		10		10		13		15	
	T4	4		4		5		5		7		7		8		10	
	T2	2.5		2.5		2.5		2.5		2.5		5		5		7	

Outer ring

Toleranced parameter	Tolerance class	Nominal outer diameter D in mm, from excluded to included															
		30 to 50		50 to 80		80 to 120		120 to 150		150 to 180		180 to 250		250 to 315		315 to 330	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Mean outer diameter	T5	0	-7	0	-9	0	-10	0	-11	0	-13	0	-15	0	-18	0	-20
	T4	0	-6	0	-7	0	-8	0	-9	0	-10	0	-11	0	-13	0	-15
	T2	0	-4	0	-4	0	-5	0	-5	0	-7	0	-8	0	-8	0	-10
Isolated outer diameter	T5-T4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	T2	0	-4	0	-4	0	-5	0	-5	0	-7	0	-8	0	-8	0	-10
Outer diameter out of round[4]	T5	7		9		10		11		13		15		18		20	
	T4	6		7		8		9		10		11		13		15	
	T2	4		4		5		5		7		8		8		10	
Outer diameter taper	T5	4		5		5		6		7		8		9		10	
	T4	3		3.5		4		5		5		6		7		8	
	T2	2		2		2.5		2.5		3.5		4		4		5	
Radial runout	T5	7		8		10		11		13		15		18		20	
	T4	5		5		6		7		8		10		11		13	
	T2	2.5		4		5		5		5		7		7		8	
Outside cylindrical runout with reference side	T5	8		8		9		10		10		11		13		13	
	T4	4		4		5		5		5		7		8		10	
	T2	1.5		1.5		2.5		2.5		2.5		4		5		7	
Raceway runout with reference side	T5	8		10		11		13		14		15		18		20	
	T4	5		5		6		7		8		10		10		13	
	T2	2.5		4		5		5		5		7		7		8	

Inner and outer rings for nominal bore diameter d, from 18 to 305 mm inclusive

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included															
		18 to 30		30 to 50		50 to 80		80 to 120		120 to 150		150 to 180		180 to 250		250 to 305	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Width of single ball bearing	T5-T4-T2	0	-120	0	-120	0	-150	0	-200	0	-250	0	-250	0	-300	0	-350
Width of duplex pair[1]	T5-T4	0	-500	0	-500	0	-500	0	-750	0	-750	0	-750	0	-750	0	-750
Width variation	T5	5		5		6		7		8		8		10		13	
	T4	2.5		3		4		4		5		5		6		7	
	T2	1.3		1.5		1.5		2.5		2.5		4		5		6	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

SERIES A4 to A13 Tolerances in µm for d 13 to 80 mm

I Thin section ball bearings

Tolerance classes TA5 - TA4

Inner ring

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included									
		13 to 18		18 to 30		30 to 45		45 to 65		65 to 80	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Mean bore diameter	TA5	0	-5	0	-5	0	-7.5	0	-10	0	-10
	TA4	0	-5	0	-5	0	-5	0	-7.5	0	-7.5
Series A, AD, AF 4											
Isolated bore diameter	TA5	+2.5	-7.5	+5	-10	+7.5	-15	+10	-20	+15	-25
	TA4	0	-5	+2.5	-7.5	+5	-10	+7.5	-15	+11	-19
Series A, AA, AD, AF 6-7-8-9-10-11-13											
Isolated bore diameter	TA5	+2.5	-7.5	+2.5	-7.5	+2.5	-10	+2.5	-12.5	+5	-15
	TA4	0	-5	+1	-6	+2.5	-7.5	+2.5	-10	+3	-11
All series A											
Radial runout	TA5	5		5		8		10		10	
	TA4	2.5		4		4		5		5	
Bore runout with reference side	TA5	7.5		7.5		7.5		7.5		7.5	
	TA4	2.5		4		4		5		5	
Raceway runout with reference side	TA5	7.5		7.5		7.5		10		10	
	TA2	2.5		4		4		5		5	

Outer ring

Toleranced parameter	Tolerance class	Nominal outer diameter D in mm, from excluded to included							
		18 to 28		28 to 50		50 to 80		80 to 120	
		Max	Min	Max	Min	Max	Min	Max	Min
Mean outer diameter	TA5	0	-5	0	-10	0	-10	0	-12
	TA4	0	-5	0	-5	0	-7.5	0	-10
Series A, AD, AF 4 open ball bearings									
Isolated outer diameter	TA5	+2.5	-7.5	+7	-17	+10	-20	+15	-27
	TA4	0	-5	+5	-10	+7	-15	+10	-20
Series A, AA, AD, AF 6-7-8-9-10-11-13 open ball bearings									
Isolated outer diameter	TA5	+2.5	-7.5	+2.5	-12.5	+2.5	-12.5	+5	-17
	TA4	0	-5	+2.5	-7.5	+2.5	-10	+2.5	-12.5
Series A, AD, A4 shielded or sealed ball bearings									
Isolated outer diameter	TA5	+5	-10	+10	-20	+12	-22	+18	-30
	TA4	+2.5	-7.5	+7	-12	+10	-17	+12	-22
Series A, AA, AD 6-7-9-11-13 shielded or sealed ball bearings									
Isolated outer diameter	TA5	+5	-10	+5	-15	+5	-15	+7	-20
	TA4	+2.5	-7.5	+5	-10	+5	-12	+5	-15
All series A									
Radial runout	TA5	5		8		8		10	
	TA4	4		5		5		8	
Outside cylindrical surface runout with reference side	TA5	8		8		8		8	
	TA4	4		4		4		5	
Raceway runout with reference side	TA5	8		8		10		12	
	TA2	5		5		8		8	

Inner and outer rings

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included									
		13 to 18		18 to 30		30 to 45		45 to 65		65 to 80	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Width of single bearing	TA5	0	-25	0	-25	0	-125	0	-125	0	-125
	TA4	0	-25	0	-25	0	-25	0	-25	0	-25
Width of duplex pair[1]	TA5	0	-380	0	-380	0	-500	0	-500	0	-500
	TA4	0	-380	0	-380	0	-380	0	-380	0	-380
Width variation	TA5	5		5		5		5		8	
	TA4	2.5		2.5		2.5		4		4	

Please contact our Design & Engineering Department for reduced tolerances compared to standards.

1 For an assembly comprising several ball bearings, the tolerance is equal to half this value multiplied by the number of ball bearings.

B. TECHNICAL DEFINITION OF PRODUCTS

SERIES A8 to A24 Tolerances in µm for d 80 to 305 mm

I Thin section ball bearings

Tolerance classes TA5 - TA4

Inner ring

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included									
		80 to 120		120 to 150		150 to 180		180 to 254		254 to 305	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Mean bore diameter	TA5	0	-12	0	-13	0	-15	0	-18	0	-20
	TA4	0	-9	0	-10	0	-12	0	-15	0	-18
Radial runout	TA5	6		6		8		10		13	
	TA4	5		5		6		8		10	
Raceway runout with reference side	TA5	9		9		10		13		13	
	TA4	5		5		7		8		10	

Outer ring

Toleranced parameter	Tolerance class	Nominal outer diameter D in mm, from excluded to included											
		80 to 120		120 to 150		150 to 180		180 to 254		254 to 305		305 to 330	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Mean outer diameter	TA5	0	-12	0	-13	0	-15	0	-18	0	-20	0	-22
	TA4	0	-10	0	-10	0	-12	0	-15	0	-18	0	-20
Radial runout	TA5	10		10		13		15		18		20	
	TA4	5		6		8		10		11		13	
Raceway runout with reference side	TA5	11		13		14		15		18		18	
	TA4	5		7		8		10		10		13	

Inner and outer rings

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included									
		80 to 120		120 to 150		150 to 180		180 to 254		254 to 305	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Width of single bearing	TA5-TA4	0	-125	0	-125	0	-125	0	-125	0	-250
Width of duplex pair[1]	TA5-TA4	0	-500	0	-500	0	-500	0	-500	0	-500
Width variation	TA5	7		7		8		10		12	
	TA4	4		4		5		6		8	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

Tolerances in µm for 0 < d < 50 mm

I Non-thin section ball bearings - Only for information

Tolerance classes T0 - T6

Inner ring

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included							
		0 to 10		10 to 18		18 to 30		30 to 50	
		Max	Min	Max	Min	Max	Min	Max	Min
Mean bore diameter	T0	0	-8	0	-8	0	-10	0	-12
	T6	0	-5	0	-5	0	-8	0	-10
Radial bore diameter	T0	+2	-10	+2	-10	+3	-13	+3	-15
	T6	+2	-7	+2	-7	+2	-10	+2	-12
Radial runout	T0	8		10		13		15	
	T6	5		7		8		10	

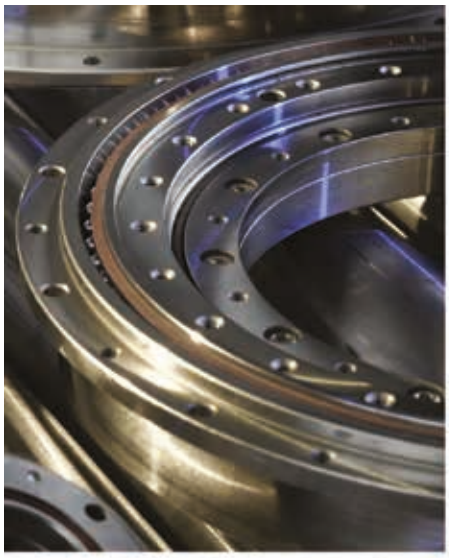
Outer ring

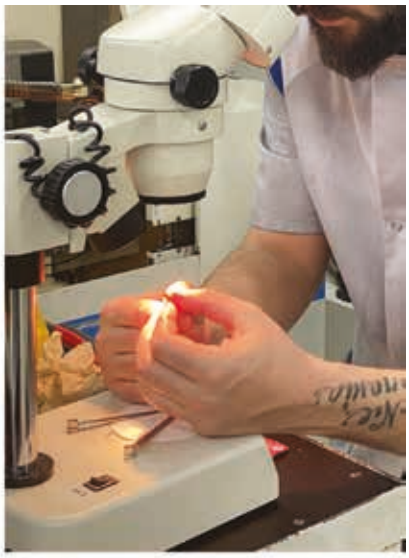
Toleranced parameter	Tolerance class	Nominal outer diameter D in mm, from excluded to included							
		0 to 18		18 to 30		30 to 50		50 to 80	
		Max	Min	Max	Min	Max	Min	Max	Min
Mean outer diameter	T0	0	-8	0	-9	0	-11	0	-13
	T6	0	-7	0	-8	0	-9	0	-11
Open ball bearings									
Isolated outer diameter	T0	+2	-10	+2	-11	+3	-14	+4	-17
	T6	+1	-8	+1	-9	+2	-11	+2	-13
Shielded or sealed ball bearings									
Isolated outer diameter	T0	+5	-13	+5	-14	+7	-18	+10	-23
	T6	+4	-11	+5	-13	+6	-15	+7	-18
All ball bearings types									
Radial runout	T0	15		15		20		25	
	T6	8		9		10		13	
Flange diameter	T0	-		-		-		-	
	T6			+125	-50				
Flange width	T0	-		-		-		-	
	T6			0	-50				

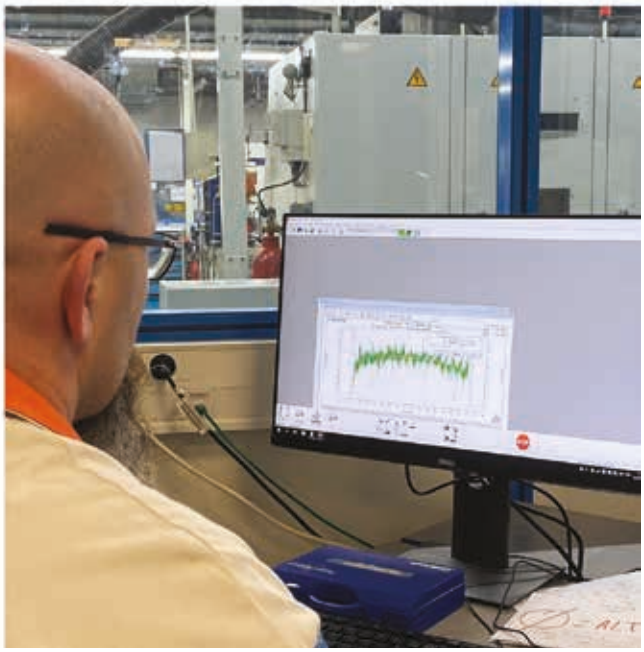
Inner and outer rings

Toleranced parameter	Tolerance class	Nominal bore diameter d in mm, from excluded to included									
		0 to 2.5		2.5 to 10		10 to 18		18 to 30		30 to 50	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Width of single bearing	T0-T6	0	-40	0	-120	0	-120	0	-120	0	-120
Width of duplex pair	T0-T6	-		0	-500	0	-500	0	-500	0	-500
Width variation	T0-T6	12		15		20		20		20	

Please contact our Design & Engineering Department for reduced tolerances compared to standards.





1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 8. RADIAL INTERNAL CLEARANCE OR CONTACT ANGLE

This terminology designates three types of parameters:

- Radial internal clearance,
- Contact angle,
- Axial internal clearance.

The definition of one of these parameters is sufficient to define the other two which are geometrically connected. The choice of these parameters is of primary importance to obtain the final mechanical performances of the ball bearing in terms of capacity, stiffness and friction torque.

1 I Radial internal clearance

The radial internal clearance in a ball bearing is the radial free space which exists between the raceways and the balls.
From a practical point of view, it is the radial relative and total displacement of a moving ring with respect to the other ring which is stationary.
Depending on the internal design (ball diameter, raceway radii), a variation in the radial internal clearance influences the contact angle and the axial clearance, and consequently load ratings, friction torque and stiffnesses. When properly chosen, all these parameters will improve the system's performances.

Particular attention must be paid to define the fits to avoid restricting the radial internal clearance during thermal stresses. In such cases, our Design & Engineering Department is available to help you calculate the effects and discuss the system's design to improve performances.

General remarks

- The definition of the radial internal clearance is generally applied to deep groove ball bearings. Angular contact ball bearings are generally defined by the contact angle's value.
- The radial internal clearance values are given under zero measuring loads.
- All deep groove ball bearings, as well as thin section ball bearings in all versions, are supplied with the normal radial internal clearance unless otherwise specified.
- The normal radial internal clearance is never indicated in a ball bearing's reference. E.g.: **WAY5ZZT5, WA1056HTA4**
- **For a coded and therefore specific radial internal clearance,** the digit which determines the code follows the tolerance classes **T** or **TA**. E.g.: **W623ZZT53, WA832RTA54** and is defined according to the tables below.
- **A radial internal clearance range which is not coded in the tables** must be fully expressed in µm after the letter J. This specific range shall be determined by common agreement between the user and ADR ; it may fulfil a technical purpose. E.g.: **W623ZZT4J310, WA12104RTA5J2040.**

Radial internal clearance codes and values

Table 1 - Deep groove ball bearings d ≤ 18 mm

Not for thin section ball bearings

Nominal bore diameter	Radial internal clearance codes, in µm											
	Small				Normal				Large			
d in mm	1		2		3		4		5		6	
from excluded to included	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
0 to 10	1	5	2	7	5	10	8	13	12	20	20	28
10 to 18	-	-	2	8	5	11	9	15	13	23	20	30

These values are adapted for instrument bearings. There are more radial internal clearance classes with narrower class ranges than those provided for in international standards in order to gain in behavioural repeatability. The radial internal clearance codes 1, 3 and 4 are not applicable to the tolerance classes T0 and T6.

Table 2 - Deep groove ball bearings, d 18 mm - 40 mm

Not for thin section ball bearings

Nominal bore diameter	Radial internal clearance codes, in µm									
d in mm	2		Normal		3		4		5	
from excluded to included	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
18 to 24	0	10	5	20	13	28	20	36	28	46
24 to 30	0	11	5	20	13	28	23	41	31	51
30 to 40	0	11	6	20	15	33	28	46	40	62

Table 3 - Ball bearing - metric series - series 619

Not for thin section ball bearings

Nominal bore diameter	Radial internal clearance codes, in µm									
d in mm	2		Normal		3		4		5	
from excluded to included	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
61900	6	15	17	30	32	49	53	73	78	102
61901										
61902	8	19	21	37	40	61	66	91	97	127
61903										
61904	9	22	25	44	48	73	79	109	117	152
61905										
61906										
61907	11	26	29	51	57	85	92	128	136	178
61908	12	30	34	59	65	98	106	146	156	203
61910										
61911	16	37	42	73	81	122	132	182	195	254
61913										
61920	25	59	68	117	130	195	212	291	312	406
61928	32	73	85	146	163	243	265	364	390	507
61934	38	88	102	175	195	292	318	437	468	608
61940										

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

Radial internal clearance codes and values

Table 4 - Thin section ball bearings

Series	Radial internal clearance codes, in µm									
	2		Normal		3		4		5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
A4 / AD4 / AF4	2	8	7	15	12	22	20	30	28	40
A6 / AA6 / AB6 / AD7. 8 .9 / AF7. 8. 9	3	12	10	22	18	33	30	45	42	60
A7. 8. 9. 11 .12 .13 / AA7.8.9.11.12.13 AB7.8.9.11.12.13 / AD10 / AF10	5	15	12	28	25	45	40	60	55	80
A10 / AA10 / AB10 / AD12 / AF12 / AM8	3	13	10	25	21	38	35	55	50	70
A16 / AA16 / AB16 / AM12 / ADM12	5	20	15	40	35	60	55	90	80	120
A24 / AA24 / AB24	10	30	25	55	50	90	85	130	115	170

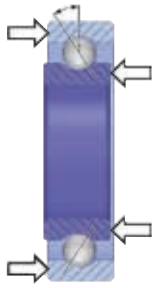
Table 5 - Thin section ball bearings – metric series – Series 618 / DM618

Basic ball bearing designation	Radial internal clearance codes, in µm									
	2		Normal		3		4		5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
61805 to 61808	3	10	8	20	17	30	28	45	40	60
61809 to 61810	3	13	10	25	21	38	35	55	50	70
61811 to 61812	5	15	12	28	25	45	40	60	55	80
61813 to 61816	5	20	13	33	30	55	50	80	70	105
61817 to 61820	5	25	20	43	40	70	60	100	90	130
61822 to 61824	8	30	25	50	45	85	80	120	105	160
61826 to 61828	10	35	30	60	50	100	90	145	125	190
61830 to 61832	10	40	30	65	60	115	105	165	145	215
61834 to 61836	12	45	35	75	70	130	120	185	165	245
61838 to 61844	15	50	40	85	75	145	135	210	180	275

Tables 4 and 5: these values are specific for our products. Depending on the internal design, they correspond to a contact angle range with a mean value of:

- **10°** for code 2,
- **15°** for normal code,
- **20°** for code 3,
- **25°** for code 4,
- **30°** for code 5.

2 I Contact angle



Under zero measuring load, the contact angle depends directly on the radial internal clearance for a given internal design. Angular contact ball bearings type B or H are delivered with a nominal contact angle with a tolerance assigned to it.

The normal contact angle values for angular contact ball bearings type **H** and **B** are: **15°± 2°**

For specific contact angles, the following codification is generally used: **A** + nominal angle followed by **N** + tolerance.

The nominal contact angle is expressed in degrees and its tolerance in (±) tenths of a degree.

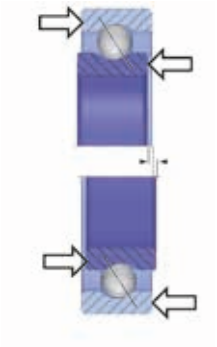
E.g.: **A20N25** (contact angle = 20° and tolerance ± 2.5°)

	Determination of contact angle according to codification			
	Nominal	Minimum	Maximum	Tolerance (±)
A20N25	20°	17.5°	22.5°	2.5°

Our Design & Engineering Department can supply you with the contact angle value for the radial internal clearances indicated in the previous tables.

Deep groove ball bearings may also be used to a certain extent like angular contact ball bearings to accommodate thrust loads. If a specific angle is requested, the codification is given by a radial internal clearance code. Our Design & Engineering Department can carry out the corresponding calculation.

3 I Axial clearance



Under zero measuring load, the axial clearance depends directly on the radial internal clearance for a given internal design. It is defined by the maximum axial displacement between the inner ring and the outer ring during alternate movements.

During assembly, the axial clearance is eliminated by the application of an axial load to the inner or outer rings depending on the mounting configuration.

Axial clearance is not directly codified. The radial internal clearance or contact angle code implicitly defines it. Our Design & Engineering Department can supply you with axial clearance values depending on the contact angle or the radial internal clearance.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 9. PRELOAD AND DUPLEX CONFIGURATIONS

The main purpose of the preload is to eliminate the ball bearing's internal clearances to guarantee high operating precision. The preload value directly affects the stiffness of the rotating system guaranteeing the load ratings and the ball bearing's service life. The preload is rigid, measured and controlled during the manufacturing process. ADR then guarantee the exact preload value of each pair.

1 I General

In a system comprising at least two ball bearings, angular contact ball bearings like deep groove ball bearings can receive an initial internal axial stress called preload. It is applied by a construction called **duplex configuration.**

Preload is applied to:

- eliminate the axial clearance as well as the radial internal clearance,
- reduce rotational noise,
- control the displacements of a preloaded pair subjected to outside loads thanks to the axial and radial stiffness of the system,
- prevent the raceways and balls from getting damaged due to either vibrations or high rotational accelerations,
- obtain a better distribution of loads on balls to allow increasing the load rating.

Duplex configuration mounting:

The duplex configuration is an assembly and a design which guarantee a preload value. This value is obtained by creating a determined free space between the inside faces of the outer rings for face-to-face configurations (designated **DX**), and of the inner rings for back-to-back configurations (designated **DO**). During the mounting operation, the abutment of the inside faces which will be locked into that position will provide the desired preload.

Preloads are corrected until the target value is obtained by reworking faces or changing ball size. Preloads are measured at each intermediate step and in the end phase. Each duplex configuration is delivered with its individual preload curve. On request.

Advantage of the controlled and measured duplex configuration:

The duplex configuration made by ADR offers the best technological means to **guarantee the precision** required to obtain the preload value.

This type of configuration guarantees a precisely determined preload value, that is known and identical on all rotating systems, thereby assuring uniformity, repeatability and operation control.

Systematic control at ADR of the preload **by measurement** guarantees a real known value for the given performances of your rotating system.

The mechanical behaviour of the system can therefore be **controlled and adjusted.**

In addition, controlling this preload value allows **realistic previsions** using our computational tools. By knowing and controlling this parameter, we can predict all characteristics, such as stiffness, friction torque, ball bearing life and behaviours in general.

2 I Main duplex configurations

DO = “BACK-TO-BACK”

The "opposed" duplex configuration is capable of accommodating combined and reversible radial internal and axial loads. The **“O”** arrangement of the ball bearings increases the angular stiffness of the assembly, as well as its resistance to moment loads.

DX = “FACE-TO-FACE”

The **“X”** duplex configuration is differentiated from the DO configuration by its lower angular stiffness. This solution better accommodates the misalignments of housings, while guaranteeing good axial and radial stiffnesses.

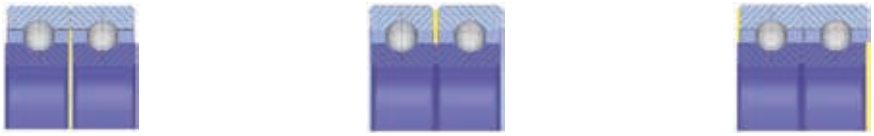
DT = “TANDEM”

The “Tandem” combination increases the resistance to thrust loads, but in only one direction. When radial loads are applied, the tandem assembly has to be axially preloaded. For preloading, the paired ball bearings in DT configuration (<<) must be associated with at least one other ball bearing in the opposite direction (>) shown in the TOT configuration <<> or other pairing coding detailed on page 49.

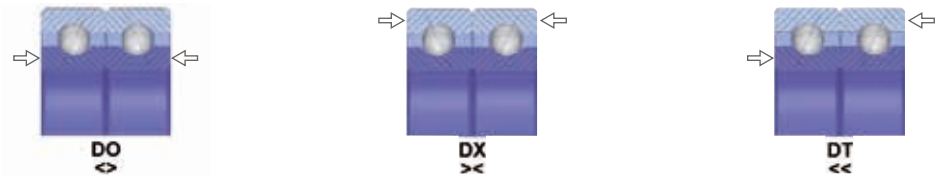
D = “UNIVERSAL DUPLEX CONFIGURATION”

The “Universal” duplex configuration is generally used to limit the number of duplex configurations for a pair of ball bearings. Both faces of each ball bearing are reworked in order to be able to obtain a DO, DX configuration according to the position of the chosen ball bearings.

Position of rings before preloading



Position of rings after preloading



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

Preload value

As standard

The duplex configuration symbol is followed by a nominal preload value expressed in Newtons along with a tolerance on the nominal preload of +/- 20%.

E.g.: **DO1500** (Back-to-Back configuration with a preload of 1500 ± 300 N)

E.g.: **DX250** (Face-to-Face configuration with a preload of 250 ± 50 N)

The preload value must be consistent with the load ratings of the paired ball bearings.

On specification (K...)

For applications which necessitate a high precision in stiffness or friction torque, a reduced preload tolerance can be determined in agreement with our Design & Engineering Department.

When the ball bearing reference includes a **"K"** specification for the various reasons explained on page 62, the preload value will not be fully indicated in the designation, but will be included in the **"K".** This value is reported in the technical definition of the product (TDP) sheet, which will be supplied to you during the ball bearing's codification.

On design (SP...)

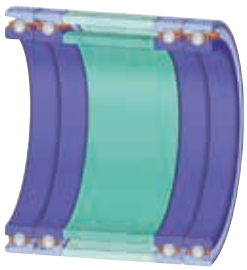
The configurations indicated above can be proposed with **spacers** either in the same material as the ball bearing to limit thermal impacts or in other materials depending on your applications.

The duplex or multiplex configurations can be associated with a **flanged** ball bearing to obtain an axial positioning of the ball bearings in the mounting.

A **screwed solid preload** is also proposed for super duplex ball bearings to facilitate the integration in the mounting, reduce overall dimensions, improve rigidity and positioning precision, reduce mounting times and gain in qualitative reliability.

Please contact our Design & Engineering Department to help you choose the best solution.

Multiplex of four ball bearings with spacers



Super duplex with flanged outer ring

Super duplex with screwed solid preload

Classification

Any pairing requires a classification of type C-type bores and outer diameters (see position 13 on page 55). Paired inner rings, as well as paired outer rings, will belong to the same class. This service is performed as standard on our pairs and is announced on our packages. This classification will allow you to increase fitting precision and minimise misalignments in your rotating systems, and therefore guarantee optimum performances.

Symbols indicating the position of the ball bearings

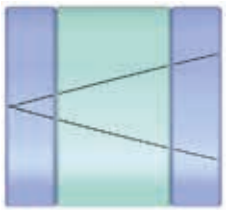
This marking is a visual aid to help you correctly and rapidly position the ball bearing assemblies during mounting phases.

The duplex configurations (**DO** and **DX**) and other multiplex configurations have a single 30° angle "V" symbol etched on the outer diameters of the ball bearings. This V symbol must be properly positioned when the set of ball bearings is mounted in the housing.

For tandem sets **DT,** the tip of the V shows the point where the thrust load is applied on the inner ring.

DO, DX, DT

DO, DX with Inner & Outer Spacers



DO Flanged ball bearing, Unflanged ball bearing

For the universal duplex configuration type **D,** each ball bearing is marked with a 30° angle V symbol. The tip of the V shows the point where the force is applied on the inner ring. The mounted configuration's marking will represent an **O** (<>) for a **DO** pair and an **X** (><) for a **DX** pair.

Symbols indicating the high points of radial runout

The alignment of the rings radial runouts reduces rotational eccentricities to a minimum, which can generate angular positioning errors and vibrations.

These markings are aligned throughout all the pairing operations in the production process at ADR. The alignment of these markings during mounting guarantees the repeatability of the measured performances in our clean rooms. The high points are symbolised by lines on the surfaces of the inner rings. The V symbol aligns the high points on the outer rings.

Preload measurement curves

All ball bearing pairs preloaded at ADR are systematically controlled to assure that the preload value conforms to the defined tolerance. For this control, we use devices equipped with high precision force and movement sensors. The curve of one in respect to the other one allows the identification of the preload point. On the next page, you will find an example of a preload control report.

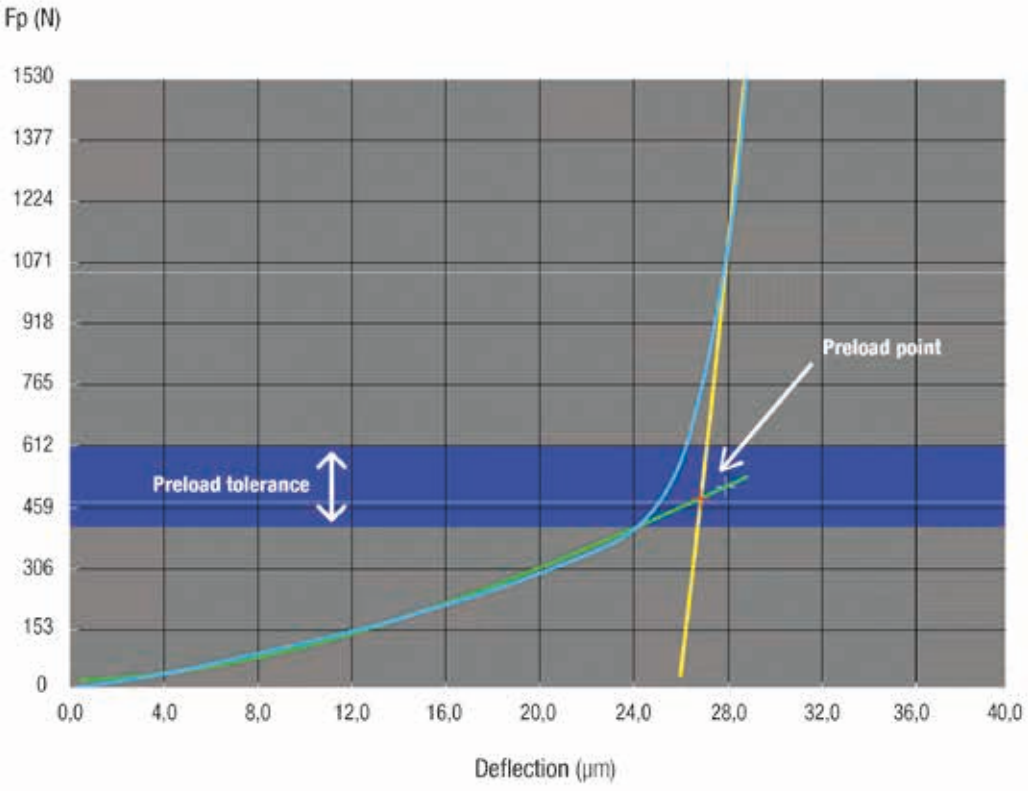
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

Example of a preload measurement

ADR ALCEN	ADR CP V3.5	
	CONTROL REPORT	DATE : 06-19-2020
	PRELOAD MEASUREMENT	VISA : CDU
Comments:		

REFERENCE : ----------			CONTROL CONDITIONS	
NUMERO OF : **192819B08**			Sensor Number	----------
			Sensor Limit (N)	10000
	Measured values	Tolerances	Tesa Number	D0404513
PRELOAD (N)	460	510 $^{610}_{410}$	Amplificator Number	D434897
DEFLECTION (µm)	26.5		Tooling Mass (N)	0
			Transducer Number	PT091



The first part of the curve represents the axial deflection of the ball bearing pair during axial loading before the pair's rings come into contact.

The graph shows a break in the curve at contact between the free rings **(preload point).**

The shaded area of the graph represents the preload tolerance to be respected where the preload point must appear.

4 I Possible duplex/multiplex configuration codifications

Code	Number of bearings	Usual designation	Symbols of contacts	Allowable outside loads	Moment of rigidity at switchover
D	2	Universal Duplex	<> ou ><		+ ou --
DO	2	Back-to-Back Duplex	<>		+
DX	2	Face-to-Face Duplex	><		- -
DT	2	Tandem Duplex	<<		- - -
TT	3	Triplex	<<<		- - -
TOT	3	Triplex	<>>		+
TXT	3	Triplex	>><		- -
QOT	4	Multiplex	<<>>		+ +
QXT	4	Multiplex	>>><		-
QOTT	4	Multiplex	<>>>		+
QXTT	4	Multiplex	>><<<		- -
POTT	5	Multiplex	<<>>>		+ +
PXTT	5	Multiplex	>>><<<		-
POQT	5	Multiplex	<>>>>		+ +
PXQT	5	Multiplex	><<<<		-
HOTT	6	Multiplex	<<<>>>		+ + +
HXTT	6	Multiplex	>>><<<		+
HOQT	6	Multiplex	<<>>>>		+ + +
HXQT	6	Multiplex	>><<<<		-

For any specific requests, please contact our Design & Engineering Department for assistance.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 10. VIBRATION LEVEL

The vibration level in a ball bearing is a measurable characteristic. The noise resulting from the rotation of a system of ball bearings depends as much on its usage context as on its intrinsic qualities. Our own standards guarantee for all qualities a low vibration level for a reference speed and a reference lubrication.
When the vibration level becomes a major characteristic, we can control each bearing according to various sensitivity criteria with the following codification.

As standard

W	**+ "3 digits"**	Vibration level on oiled ball bearing
WG	**+ "3 digits"**	Vibration level on greased ball bearing

The "3 digits" following the vibration level code correspond to the vibration ranges controlled on assembled ball bearings. These ranges are given, respectively, for 3 frequency bands based on internal standards. This type of control cannot be applied to large diameter ball bearings. Please consult us in such a case.

W201	Allowable reference vibration level.
W200	Reduced vibration level for ball bearings made of 100Cr6 steel only.
W100	Very low vibration level for tolerance classes minimum T5 and 100Cr6 steel only.
W099	Vibration level for high speed ball bearings.

On specification (K...)

When the vibration level becomes a critical characteristic, levels lower than those previously indicated may be supplied on a particular specification established in agreement with our Design & Engineering Department. For the same intrinsic quality of the ball bearing's parts, the selected lubricant may significantly influence the vibration level. Please consult us for recommendations. You will find below an example of vibration measurements such as those taken at ADR.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 11. SURFACE TREATMENT AND COATING

We propose a wide choice of surface treatments and coatings to meet specific requirements in specific environments. ADR will be able to help you make your choices according to your application.

P = PASSIVATION (On consultation of our Design & Engineering Department)

The "opposed" duplex configuration is capable of accommodating combined and reversible radial internal and axial loads. The **"O"** arrangement of the ball bearings increases the angular stiffness of the assembly, as well as its resistance to moment loads.

As standard

The purpose of the passivation treatment is to improve the corrosion resistance of stainless steels. It may prove useful when ball bearings are exposed directly to the exterior environment. Passivation is a specific process performed at ADR on rings and balls in stainless steel material only.

On specification (K...)

DLC (Diamond Like Carbon): the DLC coating comes in the form of a thin layer (a few microns) of amorphous carbon obtained by plasma deposit techniques such as PVD or PECVD. DLC possesses strong hardness (1,000 to 5,000 Vickers) and a friction coefficient that is generally very low (.1 to .2). These proprieties improve the wear resistance of metal surfaces, reducing the rubbing of contacts in motion and reinforcing corrosion resistance.

BALINIT® C: the BALINIT® C coating consists of WC/C layers having a hardness of 1,000 to 1,500HV.05 with a friction coefficient on dry steel of .1 – .2 and a maximum utilisation temperature of 300°C. BALINIT® C reduces adhesive wear (decreases the risk of seizure, sticking) thanks to its low friction coefficient and its good sliding properties. It resists heavy loads with reduced or dry lubrication, and is bio-compatible.

Kolsterising®: the treatment consists of changing the surface of the structure of austenitic stainless steels such as AISI 304 and 316. A large diffusion of carbon in the material realised in the gaseous phase and at low temperature confers major mechanical properties and strong hardness (1,000HV.05) on layers ranging from 20 to 30 µm. This coating significantly improves wear resistance and decreases the risk of seizure, while preserving the excellent corrosion resistance property of austenitic stainless steels.

Anti-migration coating: the anti-migration deposit is a fluorinated varnish which prevents the migration of oil outside the ball bearing. The anti-migration barrier is deposited on the adjacent faces of the ball bearing runway. The depositing areas of the treatment are to be defined with our Design & Engineering Department.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 12. TORQUE

This term designates two concepts:

- starting torque, that is, the torque necessary to start the ball bearing rotation,
- running torque, that is, the torque necessary to keep the ball bearing rotating.

These two important criteria condition the definition of the ball bearing.

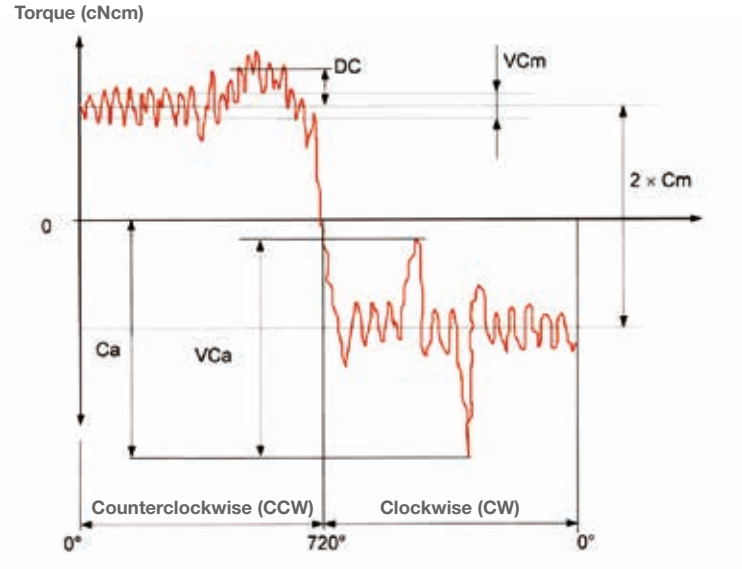
Friction torque characterises the efficiency and sensitivity of a ball bearing. It is a key parameter for precision ball bearings.
The torque measurement reference performed at ADR is based on the MIL-STD 206 B standard for small ball bearings.

DEFINITIONS

Starting torque (CD): torque necessary to start one ring rotating with respect to the other.

Running torque (Cm): torque necessary to keep a ring rotating at a specific speed and under a specific load. The measurement is taken at the vertical axis with an axial load for a single ball bearing or under a preload for paired bearings. The standard rotating speed is 2 revolutions per minute; the torque measurement is recorded in cN.cm over 4 revolutions, with 2 revolutions in each direction.

SCHEMATIC REPRESENTATION OF RUNNING TORQUE



Cm **Mean torque** during the entire measurement
Ca **Peak torque:** peak coupling point
VCa **Maximum hash width** of the running torque
VCm **Average hash width** of mean torque
DC **Torque derivation:** maximum deviation between the running mean over 600 points and the mean value (CR)

For information: the starting torque value can usually attain twice the running torque value.

As standard

–

reference running torque guaranteed. The reference running torque values are indicated in the tables in part 3 of the catalogue for ball bearings with a bore (d) less than or equal to 10 mm. For a specific definition, the running torque can be indicated to you on the Technical Definition of Product (TDP) sheet.

ML

maximum running torque guaranteed, less than 80 % of the reference torque.

MR

maximum running torque guaranteed, less than 80 % of the reference torque supplied with its individual record sheet.

The reference torque satisfies the following measurement conditions:

- Runing torque: measurement unit cN.cm
- Speed: 2 rpm
- Vertical axis
- Thrust load: .75 N for D ≤ 10 mm
  4 N for D > 10 mm
- Open or shielded ball bearings, made of 100Cr6 or X105CrMo17 (not valid for sealed ball bearings)
- With one- or two-piece pressed metal cage
- In tolerance class T5 or better (ISO 5)
- Radial internal clearance code 5 only
- Lubrication with light-duty oil for instruments, viscosity between 20 and 30 cSt at 20°C
- Control room temperature: 20 to 24°C

On specification (K...)

- For specific or non-specific designs, **friction torque values can be guaranteed by ADR** for all assemblies where the reference friction torque is not defined. Our Design & Engineering Department remains at your disposal to perform predictive calculations necessary to design your rotating systems.
- Likewise, for all designs, **the measurements of these torques** can be individually supplied on request.
- **An individual starting torque measurement** may be made on specification and will be handed over in a summary table at delivery.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

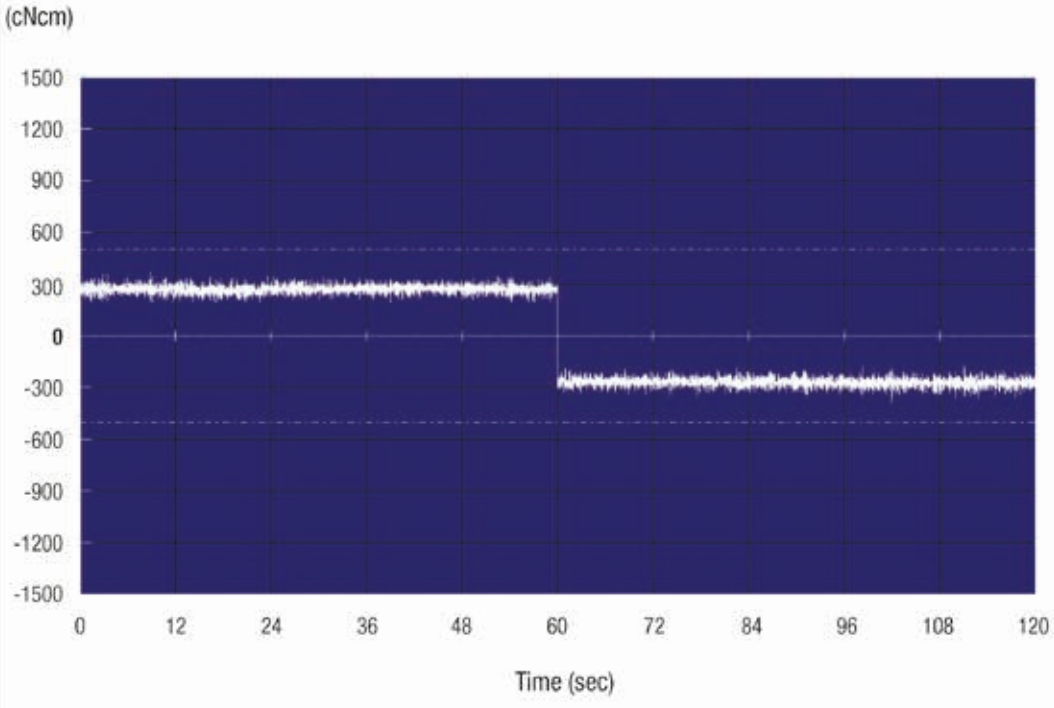
B. TECHNICAL DEFINITION OF PRODUCTS

Example of a control report of recorded running torques

ADR ALCEN	ADR BTT12 V4.4	
	CONTROL REPORT	DATE: 06-19-2020
	BEARING FRICTION TORQUE TRACE	VISA: NJA

Comments:

PRODUCT ORDER: **A18092**			EXPERIMENTAL CONDITIONS	
BEARING REFERENCE: ----------			Load (N)	1320
BEARING NUMBER: **53 2tr min**			Speed (rpm)	2
Torque (cNcm)	**Measured value**	**Tolerances**	Tool Radius (cm)	7.55
Mean Torque (Cm)	270.53	500.00	Tuning Mass (g)	500
Peak Torque (Ca)	389.80	-	Sensor n° :	J028
Maximum Hash Width (VCa)	215.44	-	Temperature (°C)	20
Average Hash Width (VCm)	46.23	-	RHL (%)	50
Torque Derivation (DC)	6.29	-		



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 13. CALIBRATION

To optimise rotating system performances, it is sometimes necessary to fit ball bearings very precisely with shafts and housings. The need to reduce geometric tolerances on ball bearings may then be expressed.
The calibration of ball bearing diameters is a possible response and this in order to define geometric tolerances more precisely.

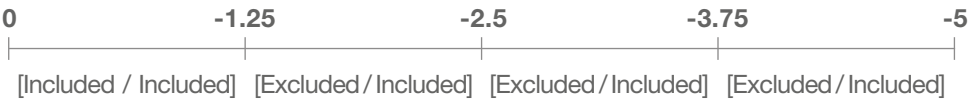
- **A calibration may be requested by measurement and marking in order to know the ball bearing's dimension more precisely and be able to fit it better.**
- **A calibration may be imposed in order to deliver ball bearings with reduced dimensional tolerances. Please consult our Design & Engineering Department to validate the feasibility.**

For precision ball bearings, the scope of the tolerance on bore and outer diameter can lead to a division into "classes" and so better control the fitting clearances with respect to shafts or housings.

DEFINITION

Calibration: operation which consists of dividing the tolerance into classes and marking the position of the dimension considered in this system.

E.g.:



Our codification system is based on the following principles:

1 | Requested calibration

a - Upon the order

- the letter C designates the calibration in the ball bearing reference (designation),
- the first digit designates for bore d the number of desired classes,
- the second digit designates for outer diameter D the number of desired classes,
- if one of the dimensions (d or D) is not requested to be calibrated, it is designated by a zero,
- if d and D are requested in two classes, the letter C is sufficient, the two digits 2 (C22) being implicit,
- the scope of a class is the total tolerance of the considered diameter divided by the number of desired classes. **Example:** For 4 classes with a bore tolerance of 5 µm, the scope of each class is 1.25 µm

Examples of codification for requested calibrations

Code	Number of classes	Code	Number of classes
C	2 classes on d and D (understood to be C22)	C04	4 classes on D only
C20	2 classes on d only	C24	2 classes on d and 4 classes on D
C40	4 classes on d only	C42	4 classes on d and 2 classes on D
C02	2 classes on D only	C44	4 classes on d and D

d: Bore diameter; D: Outer diameter

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

b - On delivery

On the packaging on the ball bearings, an anotation will be written accordingly as follows:

- the letters **CL** designate the calibration classes delivered.
- the **first digit** designates **the bore position** in the calibration system specified in the reference (designation).
- the **second digit** designates **the outer diameter position** in the calibration system specified in the reference (designation).
- the smallest digit always designates the class closest to the maximum bore or outer diameter.

Example: Requested calibration: C
Calibration into 2 classes
Tolerance scope: 5 µm for d and D

d \ D		0 -2.5 µm	-2.5 µm -5 µm
		1	2
0 -2.5 µm	1	CL11	CL12
-2.5 µm -5 µm	2	**CL21**	CL22

Example: Delivered calibration: **CL21**
Bore diameter Code 2, i.e., d -2.5 to -5 µm
Outer diameter Code 1, i.e., D 0 to -2.5 µm

Example of designation

On the order: **WA714ETA42DO100C44H47**
Bore tolerance (d): 0 -5 µm
Outer diameter tolerance (D): 0 -5 µm
The production is run and measured at 100 %.

At delivery: **WA714ETA42DO100C44H47**
The ball bearings are announced in the class to which they belong.
The delivered calibration is marked on the package label.

E.g.: CL23
Bore (d) between: -1.25 to -2.5 µm
Outer diameter (D) between: -2.5 to -3.75 µm

E.g.: CL11
Bore (d) between: 0 to -1.25 µm
Outer diameter (D) between: 0 to -1.25 µm

Example of package labels

2 I Imposed calibration on request

In this case, the ball bearing designation directly comprises the CL code and the class choice attached to the C calibration request. This codification means that the tolerance interval is reduced. It is important to consult the Design & Engineering Department to confirm the feasibility of the selected imposed calibration.

Example of a designation

On the order: **WAY5T5C44CL31**
Bore (d) between: -2.5 to -3.75 µm
Outer diameter (D) between: 0 to -1.25 µm
Only the ball bearings made in CL31 will be delivered.

3 I Remarks related to calibration

- Only bearings in tolerance classes T5 or better can be requested as calibrated on the order.
- A class scope less than the out of round or taper tolerances does not lead to any restriction on them, unless otherwise specified on the order and prior to manufacture.
- For bearings other than thin section ball bearings, the calibration is based on the minimum measured bore value and the maximum measured outer diameter value.
- For thin section ball bearing series, due to the large “out of round” values, the calibration is based on the mean measured bore value or the mean measured outer diameter value.
- For bearings requested as calibrated without any specific requirement, the delivered distribution may be of any value.
- For a number of classes other than 2, please consult our Design & Engineering Department.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

POSITION 14. LUBRICATION

Depending on the application, environment and system requirements, selecting the right lubricants is of primary importance. Knowledge about tribological phenomena is one of the key parameters of our know-how offered to you. We can propose appropriate solutions involving more than 300 lubricants (fluid or dry) which we use and whose limit dates we manage.

Generally, lubrication is aimed at avoiding contact between moving parts by using a lubricating substance which limits the deterioration of surfaces. For a ball bearing, the lubrication therefore reduces **the rolling friction** of the balls with rings and **the sliding friction** of the cages with balls and rings.
Selecting the right lubrication is therefore of primary importance to guarantee the proper operation of ball bearings. The lubrication method must take into consideration the operating and environmental conditions as viewed by the ball bearing (speed, temperature, loads, torque, etc.). We can supply upon request detailed indications according to your application's requirements.

The lubrication of a ball bearing is divided into two main lubrication types:

Fluid lubrication, which is divided into two lubricant families: oils and greases. These lubricants are extensively used for operating temperatures between -70°C and +250°C.

Oils are composed of a mineral or synthetic viscous fluid and additives. They are generally dedicated to applications necessitating very low friction torques or high rotational speeds. An impregnation process under vacuum performed at ADR allows porous cages to sufficiently absorb oil to increase ball bearing life.

Greases are composed of a soap or a gel poured in a mineral or synthetic oil. Their texture varies according to the soap and oil used and the manufacturing process. A large number of applications with ball bearings use greases due to their easy implementation. They assure good lubrication at moderate running speeds and protect ball bearing raceways from oxidation, particles or foreign liquids.

A controlled utilisation of these two types of fluid lubrications can be proposed to optimise the bearing's operation and resistance.

Dry lubrication concerns the use of solid coatings or self-lubricating cages. Below -70 °C or above +250 °C, conventional lubricants are often unreliable. So ADR proposes various dry lubrications adapted to specific contexts, such as high vacuum environments or high or low temperature applications. (Cf also position 11 – surface treatment and coating). For these extreme operating cases, please consult our Design & Engineering Department.

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As standard

- **Shielded ball bearings and sealed ball bearings:** when no specific indication is mentioned in the designation, the ball bearings are lubricated with grease, ADR code **G128** (Nycogrease GN10), regardless of the tolerance class.
- **Open ball bearings:** when no specific indication is mentioned in the designation, the ball bearings are lubricated with oil, ADR code **H47** (Klüber Isoflex PDP 38), regardless of the tolerance class (**H47** oil viscosity at + 20 °C : 25 mmÇ/s = 25 cSt)

The "digits" following the lubrication code correspond to the lubricants codified by ADR.
The data given in this table are an extract from our lubricant database.
The table next page indicates currently used oil codifications. This information is given as a guideline and may be subjected to change.

In codification

A wide range of lubricants is proposed to meet application requirements. Our Design & Engineering Department can help you choose the right lubrication and its codification. For preloaded assemblies type “DO”, “DX”, “AD”, etc., the amount of lubricant in mg is given per ball row.

1 I Oils

H--

H + “Digits” Designates the code of the oil used in the ball bearing **E.g.: H47.**

H + “Digits” + D Designates the code of the oil used which underwent a prior **degassing under vacuum** process, significantly reducing the evaporation of the oil from the ball bearing. This degassing also minimises lubricant migration and so the pollution of mechanical, electronic or optical units adjacent to the bearing. **E.g.: H47D.**

V + “Digits” Designates an **impregnation under vacuum of porous cage** process with the mentioned oil code. In this process, the cage is used as an oil tank to guarantee a continuous lubrication through the ball bearing’s life. This lubrication method is necessary for a large number of space applications and mechanisms requiring extremely long ball bearing lives without any servicing **E.g.: V47.**

H + “Digits” + L Designates the code of the oil used with a specific amount for the application’s requirements.
L + lower and higher values in mg. **E.g.: H47L510.**

Table of oils mainly proposed.
If nothing is specified, the standard lubrication will be H47. The same applies to grease G128.

ADR Code	Origin	Designation	Recommended temperatures in C°		Kinematic viscosity in cSt	Standards	
			Min	Max	At 40°C	MIL	NATO
H20	Shell	Aeroshell Fluid 12	-60	+150	16	PRF-6085	O-147
H23	Exxon - Esso	Turbo Oil 2389	-54	+175	12.53	PRF-7808L	O-148
H46	Dupont de Nemours	Krytox 143AB	-43	+232	78		
H47	**Kluber**	**Isoflex PDP 38**	**-65**	**+100**	**12**	**Correspond to PRF-6085**	**O-147**
H50	Kluber	Isoflex PDP 65	-50	+100	68		
H70	Mobil Oil	SHC 624	-40	+150	32		
H72	Dupont de Nemours	Krytox 143 AC	-35	+288	243		
H78	Castrol	Brayco 815Z	-65	+204	141		
H81	NYE Lubricants	NYE Synthetic Oil 173 (SRS 160)	-35	+125	351		
H83	Solvay Solexis	Fomblin Z 25	-65	+240	157		
H94	Exxon - Mobil	Spectrasyn 6	-45	+170	31		
H97	Dupont de Nemours	Krytox 143AA	-51	+177	32		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

2 I Greases

G--

G + "Digits" Designates the code of the grease used in the ball bearing. **E.g.: G128.**

GF + "Digits" Designates the code of the grease used and applied by **dilution – evaporation**. This method is used to spread the grease better in the ball bearing. **E.g.: GF128.**

G + "Digits" + P Designates the code of the grease used with a **full grease filling** (100% of the bearing's free volume). Completely filling a ball bearing with grease increases the protection of the ball bearing against external pollutions. Warning: this lubrication method may only be used for slow speeds. **E.g.: G128P.**

G + "Digits" + R Designates the code of the grease used with a reduced grease filling. For high rotational speeds, it is recommended to use a reduced grease filling to avoid intensive heating of the grease in the bearing. **E.g.: G128R.**

G + "Digits" + L Designates the code of the grease used with a specific amount for the application's requirements.
L + lower and higher values in mg. **E.g.: G128L512.**

Table of greases mainly proposed

If nothing is specified, the standard lubrication will be H47. The same applies to grease G128

ADR Code	Origin	Designation	Recommended temperatures in C°		Viscosity - Base Oil	Standards	
			Min	Max	40°C	MIL	NATO
G20[1]	Esso	Beacon 325	-54	121	11.8	G 3278A	G350
G31	Shell	Gadus S2 V100 2	-20	120	100	G 18709	
G39	Kluber	Isoflex super LDS 18	-50	120	15.5		
G63	Kluber	Isoflex LDS 18 speciale A	-50	120	15		
G66	Mobil oil	Mobilux EP2	-15	120	160		
G68	Nye lubricants	Rheolube 374C	-40	150	110 (38°C)	PRF-32014	
G74	Shell	Aeroshell grease 7	-60	130	10.3	PRF 23827C type II	G354
G81	Mobil oil	Mobil grease 28	-54	176	29.3	PRF-81322	G395
G85	Kluber	PDB 38 CX1000	-60	120	13		
G86	DuPont de Nemours	Krytox 240 AB	-40	232	77.8	PRF-27617	G398
G87	DuPont de Nemours	Krytox 240 AC	-34	288	243	PRF-27617	G399
G91	DuPont de Nemours	Krytox 240 AZ	-54	150	22.8		G397
G105	DuPont de Nemours	Krytox 283 AB	-40	232	85 (38°C)		
G112	NYE lubricants	Rheotemp 500	-54	175	51		
G121	Kluber	Asonic GLY 32	-50	140	25		
G128	**Nyco**	**Nycogrease GN 10**	**-73**	**121**	**13**	**PRF 23827C Type I**	**G354**
G133	Kluber	Barrierta I L _162	-45	200	160 (38°C)		
G141	Kluber	Isoflex PDL300A	-70	110	7.5		
G148	Castrol	Braycote 601EF	-80	204	148 (38°C)		
G150	Dow corning	Molykote M-77	-45	230	125 (25°C)		
G159	Kluber	Kluberalfa HX83-302	-60	240	300		
G160	Kluber	Kluberalfa YV 93-302	-60	200			
G161	Nye lubricants	Rheolube 2000	-45	125	110		
G164	Shell	Aeroshell grease 64	-73	121	14.2	G 21164D	G353
G166	Lubcon	Turmogrease highspeed L 252	-40	120	25		
G167	Shell	Aeroshell grease 22	-65	204	30.5	PRF-81322F Type II	G395
G185	Shell	Aeroshell grease 33	-73	121	14.2	PRF-23827C Type I	G354
G200	Nyco	Nyco grease GN148	-73	135	16	PRF-23827C Type I	G354

The "digits" following the lubrication code correspond to the lubricants codified by ADR.
The data given in this table are an extract from our lubricant database.
The table above indicates currently used grease codifications. This information is given as a guideline and may be subjected to change.
1 This grease will no longer be available after the end of 2021.

3 I Dry lubrication

LS2

ADR proposes a lubrication with an MoS_2 powder (molybdenum disulfide) deposited mechanically on the bearing balls and runways. This MoS_2 lubrication is generally used in high vacuum environments or high temperature applications.

On specification (K...)

MoS_2

The molybdenum disulfide coating (MoS_2) is deposited by PVD (Physical Vapor Deposition) on ball bearing runways. MoS_2 has a hexagonal laminar structure which is oriented parallel to the sliding direction under the effect of friction. It allows significant improvement of tribological performances, such as the friction coefficient, and resisting high load stresses. The MoS_2 coating's performances improve ball bearing life in severe environments such as space.

Silver deposit

Silver coatings are proposed for bearing cages or bearing runways. The silver deposit decreases the risk of seizure and is particularly effective for very high temperature applications.

WS_2

The tungsten disulfide coating (DICRONITE® DL5) in laminar form with a thickness less than .5µm has a very low friction coefficient which limits friction, abrasive wear and heating of contact surfaces. It can also be specially used in wide temperature ranges between -188°C and +538°C and in an extremely high vacuum environment.

If a different oil or grease is necessary, please do not hesitate to contact us so that we can propose a suitable solution from our 300 lubricant references. Otherwise, we can propose a custom choice specific to your needs.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

B. TECHNICAL DEFINITION OF PRODUCTS

POSITION 15. SPECIFICATION

Since we work on order and on specifications which we develop in tight collaboration with our customers, some characteristics are not coded as standard in our catalogue and so must be specially codified.

K = SPECIFICATION

K + digits (2 to 4 digits)
The specification is added in the following cases:

- when the requested characteristics cannot be coded in the designation (regardless of the position).

  Example: materials other than those codified (see position 1 on page 14 to 17), controls requested at delivery, treatments and coatings other than passivation, dimensional and geometric tolerances different from the tolerance tables (see position 7 on page 32 to 39), internal designs different from the rules used, etc.

  Z61802HQT5K4099 (in this example, the specification indicates, among others, the high speed steel grade used in the ball bearing).

- to simplify the designation when it exceeds 23 characters.

  Example: WA16104HTA54DO1200C20CL10G128R (30 characters)
  which is transformed into **WA16104HTA54DOK4330** (19 characters).

For any designation containing a specification number for one of the reasons described above, the positions 10 to 14 will be included in this specification to simplify the designation.

We will supply on request a Technical Definition of Product (TDP) sheet; it summarises all this information.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W		A725			N	TA4		DO						K2458
	F	R2	B				J1830					C42	G68	
W		SP11293				TA4								K2440
W		6201		ZZ		T4	6		W201	P	ML		H47	

3 ≡ BALL BEARING CHARACTERISTICS

LOAD RATING

The performance of instrument ball bearings is related not only to their precision, sensitivity (low torque) and silent operation, but also to their behaviour when sustaining loads of all types, whether radial, axial or combined, and applied dynamically or statically.

The load ratings are indicated in the ball bearing tables in chapter 5.

Basic dynamic radial load rating C: value of the radial load of constant strength and direction that can be theoretically sustained for a nominal ball bearing life of 1 million revolutions by taking, as a hypothesis, a rotating inner ring.

Basic static radial load rating C_o: value of the static radial load which will cause a total permanent deformation (ball and raceway) on the most heavily stressed ball/raceway contact (4 200 MPa) of approximately 0.0001 of the ball diameter.

In the case of an angular contact ball bearing with a single ball row, these two definitions involve the radial load which causes a purely radial displacement of the rings with respect to one another.

The basic dynamic radial load rating C should be multiplied by 1.62 for DO, DX and DT duplex configurations and by 2.16 for TOT and TT triplex configurations.

The minimum static radial load rating C_o should be multiplied by 2 for DO, DX and DT duplex configurations and by 3 for TOT, TT and TXT triplex configurations.

The minimum static thrust load rating C_{ax} should be multiplied by 2 for DT duplex configurations and by 3 for TT triplex configurations.

The minimum static thrust load rating is also given in the thin section ball bearing tables. It is calculated by reference for a contact angle of 15° and for the version with the minimum number of balls.

For instance, depending on the series, this value may be increased from 50% to 85% by increasing the contact angle and by changing the design within the limit of the groove depths.

BALL BEARING LIFE

Ball bearing life depends on the appropriate definition of the bearing with respect to the application and the environment. It also depends on the attention given by the user to precision, geometry and cleanliness of the mating parts and the mounting conditions. If lubrication is made for life in small quantity without renewal, the lubricant becomes of major importance with respect to the material and can significantly change the ball bearing life resulting from the conventional calculation thereafter based on the fatigue of the materials used to make the balls and rings.

A FEW DEFINITIONS REGARDING BALL BEARING LIFE

Life: for an individual ball bearing, the number of revolutions that one of its rings will make with respect to the other before the appearance of the first sign of fatigue of the material of one of the rings or one of the balls.

Reliability: for a group of ball bearings apparently identical and running under the same conditions, the percentage of these bearings expected to reach or exceed a given life. The reliability of an individual ball bearing is the probability of it reaching or exceeding a given life.

Nominal life (or basic rating life): for an individual ball bearing, or for a group of bearings apparently running identically under the same conditions, the life associated with a reliability of 90%. 50% of the ball bearings considered are expected to last five times longer.

Life formulas: the nominal life of a ball bearing, the basic dynamic radial load and the applied load are related by the formula:

Nominal life:

- in millions of revolutions $L_{10} = \left(\frac{C}{P}\right)^3$
- in number of operating hours $L_{10h} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3$

Symbols used in the formulas and table of this chapter

Symbols	Meaning
C	Basic dynamic radial load, in N
P	Equivalent dynamic radial load, in N
n	Rotational speed, in rpm
F_r	Radial component of the load, in N
F_a	Axial component of the load, in N
X	Radial coefficient of the ball bearing
Y	Axial coefficient of the ball bearing
P_o	Equivalent static radial load, in N
X_o	Radial coefficient of the ball bearing
Y_o	Axial coefficient of the ball bearing

EQUIVALENT LOAD RATINGS

Equivalent dynamic radial load:
A dynamic radial load that is constant in magnitude and direction under which the reached life would be the same as that with effectively applied loads. It is given by the formula:
$\mathbf{P = XF_r + YF_a}$

Equivalent static radial load:
A static radial load that would cause the same total permanent deformation on the most loaded contact as that obtained under effectively applied loads. It is given by the formula:
$\mathbf{P_o = X_oF_r + Y_oF_a}$ **(If $P_o < F_r$ take $P_o = F_r$)**

These equivalent load concepts allow making a first approximative calculation to validate a pre-sizing. For a more precise calculation, please contact our Design & Engineering Department.

Factors X and Y and Factors X_o and Y_o

In the table below, note that:

1 • For the DO or DX pairs, take $2F_a$ and the value Co of the pair.
2 • For the DO or DX pairs, X0 and Y0 are to be multiplied by 2.
3 • The values of X, Y and e to be retained for intermediate contact angles are obtained by linear interpolation.

Contact[3] angle	$\frac{F_a}{C_o}$[1]	e	Single ball bearing or DT pair				X_o[2]	Y_o[2]	DO or DX pairs			
			$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$				$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
			X	Y	X	Y			X	Y	X	Y
5°	.014	.23	1	0	.56	2.30	.6	.5	1	2.78	.78	3.74
	.028	.26				1.99				2.40		3.23
	.056	.30				1.71				2.07		2.78
	.085	.34				1.55				1.87		2.52
	.110	.36				1.45				1.75		2.36
	.170	.40				1.31				1.58		2.13
	.280	.45				1.15				1.39		1.87
	.420	.50				1.04				1.26		1.69
	.560	.52				1.00				1.21		1.63
10°	.014	.29	1	0	.46	1.88	.6	.5	1	2.18	.75	3.06
	.029	.32				1.71				1.98		2.78
	.057	.36				1.52				1.76		2.47
	.086	.38				1.41				1.63		2.29
	.110	.40				1.34				1.55		2.18
	.170	.44				1.23				1.42		2.00
	.290	.49				1.10				1.27		1.79
	.430	.54				1.01				1.17		1.64
	.570	.54				1.00				1.16		1.63
15°	.015	.38	1	0	.44	1.47	.5	.46	1	1.65	.72	2.39
	.029	.40				1.40				1.57		2.28
	.058	.43				1.30				1.46		2.11
	.087	.46				1.23				1.38		2.00
	.120	.47				1.19				1.34		1.93
	.170	.50				1.12				1.26		1.82
	.290	.55				1.02				1.14		1.66
	.440	.56				1.00				1.12		1.63
	.580	.56				1.00				1.12		1.63
20°	—	.57	1	0	.43	1.00	.5	.42	1	1.09	.70	1.63
25°	—	.68			.41	.87		.38		.92	.67	1.41
30°	—	.80			.39	.76		.33		.78	.63	1.24
35°	—	.95			.37	.66		.29		.66	.60	1.07

LIMITING SPEED

The limiting rotational speed of a ball bearing depends especially on its type, dimensions and the load it supports. Other factors such as lubrication method, cage type, and internal clearance values must, however, be taken into consideration.

Warning: the values given in the ball bearing tables are approximative. They apply to relatively lightly loaded ball bearings and for rotating inner rings. For utilisation speeds higher than those indicated in the tables, please consult our Design & Engineering Department.

4 ≡ MOUNTING STUDY

FITS

To define a correct fit, it is necessary to take into consideration:

- the quality of the selected ball bearing,
- the geometry of the shaft and housing, which must be matched to that of the bearing,
- the quality of surface finish of the shaft and housing seatings,
- the rotational speed of the moving part, the direction and the frequency of the applied loads,
- the materials from which the ball bearing's mating parts are made,
- the possible effects of temperature,
- the bearing's radial internal clearance, which can determine the fit or be determined by it.

Fitting recommendations

For light alloy housings, choose a tighter fit when thermal expansions are likely. When a sliding fit (clearance) is considered, it is advisable to insert a ground or broached steel liner between the housing and the ball bearing.

For these classes, the "fit" letter code is selected for both the shaft and the housing in the following order:

- TABLE 1: to obtain a code number for each main operating condition,
- TABLE 2: indicates the sets of codes corresponding to the most frequently used applications,
- TABLE 3: gives in conjunction with Table 2 the representative letter code for the recommended fit.

TABLE 1

Stationary shaft	1
Rotating shaft	2
Stationary housing	3
Rotating housing	4
Face-clamped inner ring	5
Unclamped inner ring	6
Tight ring (interference)	7
Sliding ring (clearance)	8
Slow speed	9
Moderate speed	10
High speed	11
Light load	12
Moderate load	13
Heavy load	14
Very low runout	15
High radial rigidity	16
Oscillations	17
Vibrations	18
Light-alloy housing	19

TABLE 2

Shaft
1.5.10.13
1.8.9.12
1.5.11.12.15.16
2.5.6.12
2.6.10.12.15.16
2.7.11.13.15.16
2.7.11.14.18

Housing
3.8.9.10.13
3.8.9.13.17
3.10.15.16
3.10.11.14
3.10.11.19
3.10.11.13
4.10.12.18
4.10.13.19
4.7.10.13.19

TABLE 3

A	B	C	D	E
•				
•				
	•			
	•			
		•		
			•	
			•	

A	B	C	D	E
•				
•				
	•			
		•		
		•		
			•	
			•	
			•	
				•

The following graphical representations show how to determine, according to the letter code obtained for the fit, the position of the tolerance to be allowed for the part associated with the ball bearing.

As a rule, the tolerance range of the associated part is:

- equal to the tolerance range of the corresponding ring for non-calibrated bearings,
- equal to the class range of the corresponding ring for calibrated bearings. The drawings refer to a calibration into two classes.

In each drawing the rectangle to the left symbolises the tolerance of the bearing ring, which can be read in the tables on pages 32 to 39, **Position 7.**

The letter "m" indicates the middle of this tolerance and the arrows + or – the direction of the variations with respect to the nominal dimension.

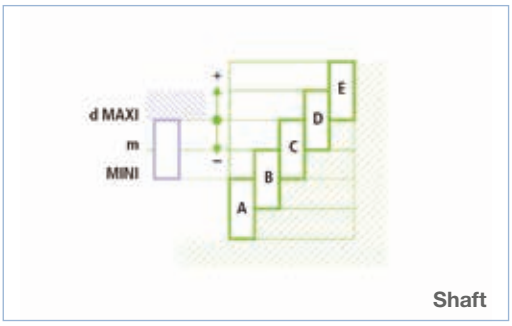
The stepped rectangles to the right symbolise the magnitude and position of the dimension variations corresponding to each fit letter code. A simple calculation defines the nominal dimension and the tolerance of the associated part. Note that the alphabetical progression of the letter codes goes from a loose to tight fit in the resulting fit direction.

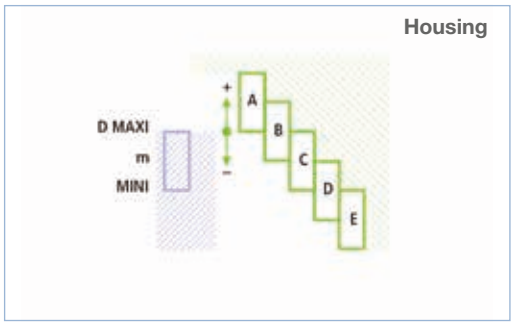
For calibrated ball bearings, the resulting fit is estimated between light areas or shaded areas depending on the type of calibration.

For tolerance classes TA5 – TA4, thin section series from A4 to A24,

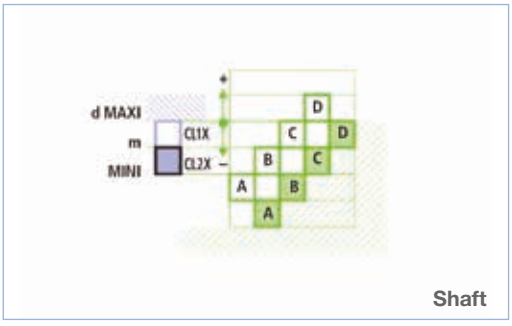
Considering the high flexibility of these series, fits should be studied for each specific case (particularly for preloaded ball bearing pairs). Please consult our Design & Engineering Department.

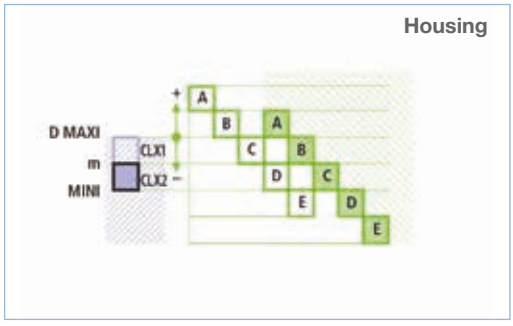
Non-calibrated ball bearings





Calibrated ball bearings





MOUNTING RECOMMENDATIONS

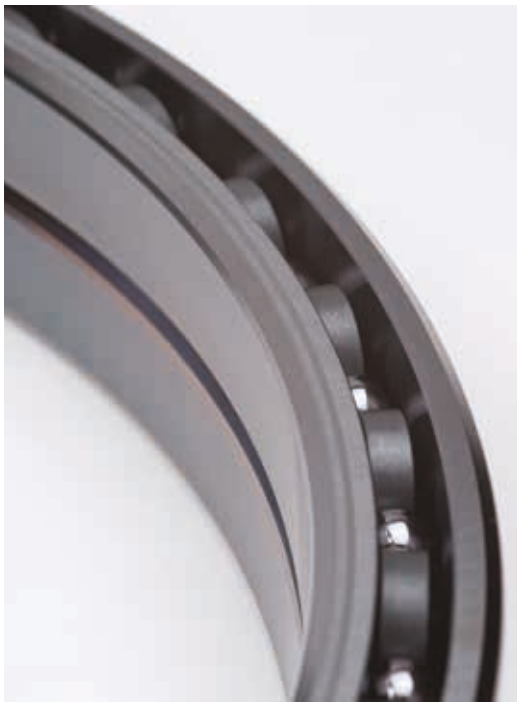
Study

The study of a system involving miniature or thin section ball bearings should be carried out carefully.
In most cases, the rings are very thin and the faces are therefore very narrow, so are the faces to diameter corners.
The size and accuracy of the mating parts must be matched to those of the ball bearing.

The following precautions should be taken:

- the connecting radius of the shaft or housing shoulder fillet must be less than or equal to the value r given in all the ball bearing tables. This value must be complied with to assure a correct seating of ball bearing's ring face. If there is an undercut (where dimensions allow), care should be taken that its maximum dimension on the shoulder face ensures satisfactory seating.
- the maximum shaft shoulder diameter must be equal to or slightly less than ball bearing dimension d1 or d2.
- the minimum housing shoulder diameter must be equal to or slightly greater than ball bearing dimension D1.
- the shaft and housing seatings should be aligned in order to avoid any misalignment which might harm the sensitivity and vibration level.

The values d1, d2 and D1 are used to determine shaft or housing shoulders and are given in the ball bearing tables (chapter 5).



Mounting

Mounting must be carried out carefully, with the following precautions to be taken:

- shaft and housing must be free of burrs and be carefully cleaned before mounting
- ball bearings should not be removed from their packages until the instant they are to be mounted
- In cases where interference fits are required, care should be taken to apply the force only to the ring involved; under no circumstances should the static mounting load be applied through the balls
- Whenever possible, ball bearings should be mounted under laminar flow or, at least, in clean areas exclusively reserved for this purpose
- magnetic fields should be avoided or neutralised in the areas reserved for mounting.

Mounting DO-DX duplex configurations.

Bringing the rings together and clamping them can be a delicate operation, because of the small cross sections of the ball bearings in this catalogue, particularly thin section ball bearings.

The procedure used will decide whether the geometry, dimensions and low torque will be conserved or not.

Clamping order: the rings which are the farthest apart should be clamped first (inner rings for DO, outer rings for DX).

Clamping method: whenever clamping is accomplished by peripheral screws, a mounting fixture can be devised to bring the separated rings together, with their faces parallel.

For example, this can be obtained with a temporary device incorporating a central screw. After this screw is locked in position, the peripheral screws may then be adjusted in the correct order, with a minimum risk of distortion. The temporary device is then withdrawn. The contacting rings (outer if DO, inner if DX) may then be secured. If those rings are fixed by peripheral screws, the previous method may also be considered.

In any case, whether rings are secured by screws, bolts or threaded rings, it is expressly recommended to use a torque wrench or screwdriver.

When applying the preload, please take care to rotate the ball bearing all along the tightening process.

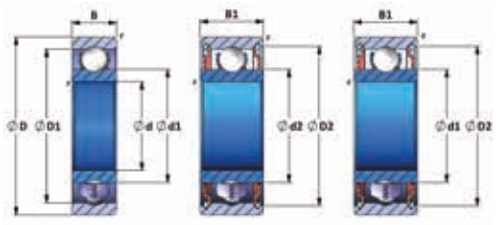
5 ≡ BALL BEARING TABLES

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM 1 TO 6 MM

1 I Metric series

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7



Basic designation open bearing	Open	Protection		Dimensions in mm								
		Protected	Sealed									
		Z or ZZ	RS or -2RS	d	D	B	B1	d1	d2[2]	D1	D2	r[1]
AX1	✓			1	3	1	-	1.67	-	2.43	-	.08
AX1.5	✓	✓		1.5	4	1.2	2	2.2	-	3.3	3.45	.1
X1.5	✓	✓		1.5	5	1.7	2.6	2.5	-	4	4.2	.15
619/1.5	✓	✓		1.5	5	2	2	2.97	-	4.1	4.3	.1
BX2	✓	✓		2	5	1.5	2.3	2.97	-	4.1	4.3	.1
X2	✓			2	6	2	-	3.25	-	4.75	-	.15
619/2	✓	✓		2	6	2.3	2.3	3.25	-	4.75	5.05	.15
AX2	✓	✓		2	6	2.3	3	3.25	-	4.75	5.05	.15
AX2.5	✓	✓		2.5	6	1.8	2.6	3.5	-	5	5.2	.15
X2.5	✓	✓		2.5	7	2.5	3	4	-	5.5	5.8	.15
60/2.5	✓	✓		2.5	8	2.8	2.8	4.6	-	6.4	6.7	.15
AX3	✓	✓		3	7	2	3	4.25	-	5.75	6.05	.15
X3	✓	✓		3	8	2.5	3	4.6	-	6.4	6.7	.15
619/3	✓			3	8	3	-	4.35	-	6.55	-	.15
639/3		✓		3	8	-	4	4.35	-	6.55	7.05	.15
623	✓	✓	✓	3	10	4	4	5.15	4.6	7.55	8.1	.15
AX4	✓	✓		4	9	2.5	3.5	5.2	-	7.48	7.9	.15
638/4		✓		4	9	-	4	5.2	-	7.48	7.9	.15
X4	✓	✓		4	10	3	4	5.95	-	8.35	8.75	.15
AY4	✓	✓	✓	4	11	4	4	5.9	5.35	9	9.7	.15
604	✓	✓		4	12	4	4	6.45	5.9	9.55	10.25	.2
624	✓	✓	✓	4	13	5	5	6.6	5.9	10.4	11.25	.2
634	✓	✓	✓	4	16	5	5	8.3	7.5	12.7	13.55	.3
X5	✓	✓		5	11	3	4	6.8	-	9.2	9.75	.15
638/5		✓		5	11	-	5	6.8	-	9.2	9.75	.15
AY5	✓	✓	✓	5	13	4	4	7.65	6.95	10.75	11.45	.2
625	✓	✓	✓	5	16	5	5	8.3	7.5	12.7	13.55	.3
635	✓	✓	✓	5	19	6	6	10	9.3	15	15.9	.3
X6	✓	✓		6	12	3	4	7.8	-	10.2	10.75	.15
AX6	✓	✓		6	13	3.5	4.5	7.9	-	11.1	11.65	.15
628/6		✓	✓	6	13	-	5	7.9	(7.22)	11.1	11.65	.15
AY6	✓	✓	✓	6	15	5	5	8.6	7.9	12.4	13.25	.2
626	✓	✓	✓	6	19	6	6	10	9.3	15	15.9	.3

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Depending on certain dimensions, the availability of the separator will be validated.

Comments

→ The torque value and speed limit hereunder are only for opened or shielded (Z or ZZ) ball bearings.
→ The axial load for running torque measurement is .75 N for D ≤ 10 mm and is 4N for D > 10 mm.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

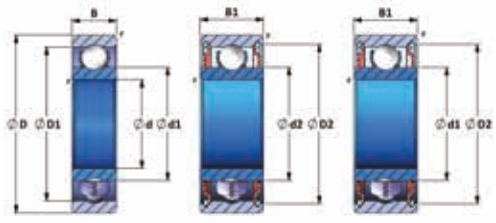
Basic load rating N				Running torque cN.cm		Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static			—	R		
Dyn.		Stat.							
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	.75 N	4 N	+grease (rpm)		g	
65	52	18	1.5	.02	-	95,000	-	.03	AX1
136	109	38	33	.025	-	90,000	-	.07	AX1.5
181	145	48	27	.025	-	78,000	-	.16	X1.5
154	123	49	37	.025	-	80,000	-	.24	619/1.5
154	123	49	37	.025	-	80,000	130,000	.13	BX2
212	169	64	33	.04	-	75,000	120,000	.26	X2
212	169	64	33	.04	-	75,000	120,000	.3	619/2
212	169	64	33	.04	-	75,000	120,000	.3	AX2
236	188	77	39	.04	-	70,000	110,000	.21	AX2.5
257	206	91	45	.04	-	67,000	100,000	.47	X2.5
325	260	113	58	.04	-	63,000	95,000	.7	60/2.5
256	205	93	45	.04	-	67,000	100,000	.34	AX3
325	260	113	58	.04	-	63,000	95,000	.59	X3
484	387	155	96	.04	-	63,000	75,000	.64	619/3
484	387	155	96	.04	-	63,000	75,000	.84	639/3
500	400	156	111	.055	-	60,000	90,000	1.58	623
547	438	192	152	.055	-	60,000	90,000	.7	AX4
547	438	192	152	.055	-	60,000	90,000	.81	638/4
550	440	201	112	.04	-	53,000	80,000	1.06	X4
735	588	252	111	-	.3	53,000	80,000	1.69	AY4
821	657	303	130	-	.3	50,000	75,000	2.18	604
1,012	809	375	143	-	.3	48,000	70,000	3.11	624
1,150	921	414	243	-	.37	43,000	63,000	5.4	634
648	518	269	145	-	.2	50,000	75,000	1.22	X5
648	518	269	145	-	.2	50,000	75,000	1.89	638/5
902	712	365	149	-	.3	48,000	70,000	2.47	AY5
1,150	921	414	243	-	.37	43,000	63,000	4.99	625
1,920	1,530	773	378	-	.45	36,000	53,000	8.98	635
640	512	278	146	-	.21	48,000	70,000	1.36	X6
901	721	369	108	-	.3	45,000	67,000	1.88	AX6
901	721	369	108	-	.3	45,000	67,000	2.49	628/6
1,250	1,000	518	204	-	.37	43,000	63,000	3.89	AY6
1,920	1,530	773	378	-	.45	36,000	53,000	8.38	626

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM 7 TO 17 MM

1 I Metric series

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7



Basic designation open bearing	Open	Protection		Dimensions in mm								
		Protected	Sealed									
	—	Z or ZZ	RS or -2RS	d	D	B	B1	d1	d2[2]	D1	D2	r[1]
AX7	✓	✓		7	14	3.5	5	8.9	-	12.1	12.55	.15
X7	✓			7	14	4	-	8.9	-	12.1	-	.15
628/7	✓			7	14	5	-	8.9	-	12.1	-	.15
AY7	✓	✓	✓	7	17	5	5	9.8	9.1	14.2	15.05	.3
607	✓	✓		7	19	6	6	10.5	9.8	15.5	16.4	.3
627	✓	✓	✓	7	22	7	7	11.5	10.5	17.9	19	.3
X8	✓	✓	✓	8	16	4	5	10.1	(9.45)	13.9	14.55	.2
638/8	✓	✓	✓	8	16	6	6	10.1	(9.45)	13.9	14.55	.2
AY8	✓	✓	✓	8	19	6	6	11.1	10.4	16.1	17.1	.3
608	✓	✓	✓	8	22	7	7	11.5	10.5	17.9	19	.3
X9	✓	✓		9	17	4	5	11.1	-	14.9	15.55	.2
638/9		✓		9	17	-	6	11.1	-	14.9	15.55	.2
AY9	✓	✓	✓	9	20	6	6	12	11.3	17	18	.3
609	✓	✓		9	24	7	7	13.7	12.4	19.9	21	.3
629	✓	✓	✓	9	26	8	8	14	(12.7)	21.1	22.4	.6
X10	✓	✓	✓	10	19	5	5	12.6	(11.8)	16.4	17.25	.3
63800	✓	✓	✓	10	19	7	7	12.6	(11.8)	16.4	17.25	.3
AY10	✓	✓	✓	10	22	6	6	13.05	12.35	18.05	18.95	.3
6000	✓	✓	✓	10	26	8	8	14	(12.7)	21.1	22.4	.3
6200	✓	✓	✓	10	30	9	9	17.15	(15.15)	22.85	24.05	.6
6300	✓			10	35	11	-	17.7	-	26.8	-	.6
61801	✓	✓	✓	12	21	5	5	15	14.1	18.2	18.95	.3
AY12	✓	✓	✓	12	24	6	6	15.5	14.8	20.5	21.4	.3
6001	✓	✓	✓	12	28	8	8	17.15	(15.15)	22.85	24.15	.3
6201	✓	✓	✓	12	32	10	10	18.26	17.2	25.7	27.34	.6
6301	✓			12	37	12	-	19.5	-	29.7	-	1
61802	✓	✓		15	24	5	5	17.9	-	21.1	21.95	.3
AY15	✓	✓	✓	15	28	7	7	18.4	17.4	24.6	25.7	.3
6002	✓	✓	✓	15	32	9	9	20.2	(18.2)	26.7	27.8	.3
6202	✓	✓		15	35	11	11	21.51	-	29	30.35	.6
6302	✓			15	42	13	-	23.7	21	33.65	-	1
61803	✓	✓		17	26	5	5	20.2	-	23.2	23.95	.3
AY17	✓	✓	✓	17	30	7	7	20.4	19.4	26.6	27.7	.3
Y17	✓	✓	✓	17	32	8	8	20.4	19.4	26.6	27.7	.3
6003	✓	✓		17	35	10	10	22.8	21.5	29.2	30.1	.3
6203	✓			17	40	12	-	24.5	-	32.7	-	.6
6303	✓			17	47	14	-	26.5	-	37.6	-	1

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Depending on certain dimensions, the availability of the separator will be validated.

Comments

→ The torque value and speed limit hereunder are only for opened or shielded (Z or ZZ) ball bearings.
→ The axial load for running torque measurement is 4N.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

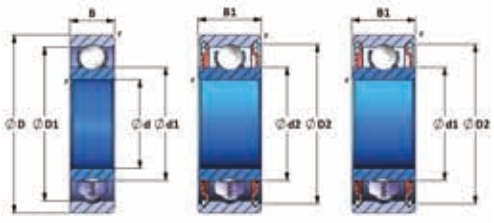
Basic load rating N				Running torque cN.cm	Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static		—	R		
Dyn.		Stat.						
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	4 N	+grease (rpm)		g	
968	774	428	122	.37	43,000	63,000	2.04	AX7
968	774	428	122	.37	43,000	63,000	2.32	X7
968	774	428	122	.37	43,000	63,000	2.77	628/7
1,510	1,210	614	245	.42	38,000	56,000	4.9	AY7
1,920	1,540	786	379	.45	36,000	53,000	7.72	607
2,850	2,280	1,170	487	.58	32,000	48,000	13	627
1,350	1,080	610	232	.37	38,000	56,000	3.09	X8
1,350	1,080	610	232	.37	38,000	56,000	4.31	638/8
1,930	1,540	800	380	.45	34,000	50,000	7.05	AY8
2,850	2,280	1,170	487	.58	32,000	48,000	12.1	608
1,440	1,150	693	259	.48	36,000	53,000	3.35	X9
1,440	1,150	693	259	.48	36,000	53,000	4.69	638/9
2,110	1,690	937	436	.45	32,000	48,000	7.63	AY9
2,890	2,310	1,240	604	.58	28,000	43,000	14.5	609
3,950	3,160	1,690	1,380	.6	28,000	43,000	18.8	629
1,510	1,210	784	286	.5	32,000	48,000	5.4	X10
1,510	1,210	784	286	.5	32,000	48,000	8.43	63800
2,110	1,690	959	438	.48	30,000	45,000	9.72	AY10
3,950	3,160	1,690	1,380	.65	28,000	42,000	19	6000
5,810	4,640	3,230	1,820	-	25,000	37,000	33	6200
10,300	8,240	5,380	2,120	-	-	33,000	53	6300
1,490	1,190	716	818	-	30,000	45,000	6.15	61801
2,410	1,930	1,240	541	-	26,000	40,000	10.4	AY12
5,800	4,640	3,220	1,800	-	24,000	36,000	22	6001
7,900	6,320	4,250	2,090	-	22,000	34,000	37	6201
11,500	9,240	5,860	3,180	-	-	30,000	58	6301
1,610	1,290	872	1,330	-	24,000	36,000	7.26	61802
3,390	2,710	1,740	842	-	24,000	38,000	14.4	AY15
6,200	4,960	3,490	1,100	-	21,000	33,000	30	6002
8,040	6,430	4,530	3,030	-	-	30,000	44	6202
13,600	10,800	7,860	3,480	-	-	26,000	83	6302
1,730	1,390	1,020	1,080	-	24,000	35,000	8.03	61803
3,600	2,880	1,970	940	-	22,000	36,000	15.7	AY17
3,600	2,880	1,970	940	-	22,000	36,000	24	Y17
6,550	5,240	3,800	1,430	-	-	28,000	40	6003
7,200	5,760	3,100	4,750	-	-	26,000	65	6203
15,700	12,600	9,140	4,570	-	-	23,000	115	6303

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM 20 TO 40 MM

1 I Metric series

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7



Basic designation open bearing	Open	Protection		Dimensions in mm								
		Protected	Sealed									
	—	Z or ZZ	RS or -2RS	d	D	B	B1	d1	d2[2]	D1	D2	r[1]
61804	✓	✓		20	32	7	7	24	-	28.25	29.35	.3
AY20	✓	✓	✓	20	37	9	9	25.55	(24.3)	31.35	34.5	.3
6004	✓	✓		20	42	12	12	27.2	-	34.8	35.8	.6
6204	✓			20	47	14	-	28.5	-	38.45	-	1
6304	✓			20	52	15	-	30.3	-	42.1	-	1
AY22	✓	✓	✓	22	39	9	9	27.3	26	34	35.6	.3
Y22	✓	✓	✓	22	40	9	9	27.3	26	34	35.6	.3
AY25	✓	✓	✓	25	42	9	9	30.3	28.2	36.7	38	.3
6005	✓			25	47	12	-	32	-	40.3	-	.6
6205	✓			25	52	15	-	34.04	-	43.95	-	1
6305	✓			25	62	17	-	36.6	-	50.9	-	1
AY28	✓	✓		28	45	9	9	33.35	32	40	41.6	.3
AY30	✓	✓		30	47	9	9	35.3	34	42	43.6	.3
6006	✓			30	55	13	-	38.2	-	46.8	-	1
6206	✓			30	62	16	-	40.36	-	51.55	-	1
6306	✓			30	72	19	-	43.2	-	59.5	-	1
AY32	✓			32	52	10	-	38	-	46	-	.6
AY35	✓	✓		35	55	10	10	41	-	49	50	.6
6007	✓			35	62	14	-	43.75	-	53.25	-	1
6207	✓			35	72	17	-	46.9	-	60.6	-	1
6307	✓			35	80	21	-	49.5	-	66.1	-	1.5
AY40	✓	✓		40	62	12	12	47.7	44.6	54.5	58	.6
6008	✓			40	68	15	-	49.25	-	58.75	-	1
6208	✓			40	80	18	-	52.6	-	67.9	-	1
6308	✓			40	90	23	-	55.2	-	75.5	-	1.5

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Depending on certain dimensions, the availability of the separator will be validated.

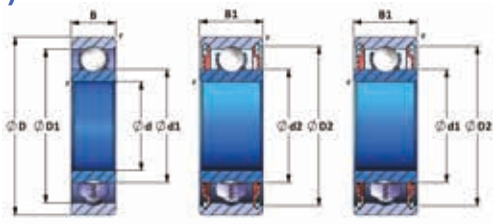
Comments

→ The torque value and speed limit hereunder are only for opened or shielded (Z or ZZ) ball bearings.
→ The axial load for running torque measurement is 4N.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

Basic load rating N				Running torque cN.cm	Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static					
Dyn.		Stat.			—	R		
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	4 N	+grease (rpm)		g	
2,720	2,170	1,550	1,350	-	19,000	25,000	18	61804
6,750	5,400	3,910	2,220	-	18,000	26,000	38	AY20
10,400	8,340	6,240	3,650	-	-	24,000	68	6004
14,900	11,900	9,010	3,960	-	-	22,000	105	6204
18,500	14,800	11,000	6,490	-	-	20,000	145	6304
7,170	5,730	4,500	526	-	16,000	24,000	40	AY22
7,170	5,730	4,500	526	-	16,000	24,000	45	Y22
6,990	5,590	4,330	1,620	-	15,000	22,000	45	AY25
11,600	9,310	7,400	3,730	-	-	20,000	77	6005
15,200	12,100	9,410	4,940	-	-	19,000	130	6205
24,500	19,600	15,200	7,850	-	-	17,000	225	6305
7,830	6,260	5,910	782	-	13,000	20,000	48	AY28
8,140	6,510	6,420	825	-	12,000	17,000	50	AY30
9,250	7,400	4,680	7,630	-	-	17,000	115	6006
15,400	12,300	7,840	13,600	-	-	16,000	200	6206
31,200	24,900	20,200	10,700	-	-	14,000	335	6306
9,360	7,480	6,820	1,970	-	11,000	17,000	70	AY32
9,720	7,780	7,440	2,130	-	10,000	16,000	75	AY35
13,200	10,500	7,980	12,900	-	-	15,000	150	6007
27,100	21,700	17,800	9,650	-	-	14,000	275	6207
28,700	23,000	16,600	28,300	-	-	13,000	450	6307
14,500	11,600	12,400	4,620	-	-	14,000	112	AY40
13,900	11,100	9,470	17,000	-	-	13,000	190	6008
32,600	26,000	21,900	9,410	-	-	12,000	350	6208
46,700	37,400	31,900	16,600	-	-	11,000	600	6308

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM .04 INCH (d 1.016 MM) TO .125 INCH (d 3.175 MM)



2 I Inch series

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7

Basic designation open bearing	Open	Protection		Dimensions *in inches* / in mm								
		Protected	Sealed									
	—	Z or ZZ	RS or -2RS	d	D	B	B1	d1	d2	D1	D2	r[1]
R09	✓			*.04*	*.125*	*.0469*	-	*.0657*	-	*.0957*	-	*.003*
				1.016	3.175	1.191	-	1.67	-	2.43	-	.075
X3/64	✓	✓		*.0469*	*.1562*	*.0625*	*.0937*	*.0764*	-	*.122*	*.128*	*.004*
				1.191	3.9675	1.588	2.38	1.94	-	3.1	3.25	.1
R1	✓	✓		*.055*	*.1875*	*.0781*	*.1094*	*.0925*	-	*.1496*	*.1575*	*.005*
				1.397	4.7625	1.984	2.779	2.35	-	3.8	4	.125
X5/64	✓	✓		*.0781*	*.25*	*.0937*	*.1406*	*.128*	-	*.187*	*.1988*	*.005*
				1.984	6.35	2.38	3.571	3.25	-	4.75	5.05	.125
AX3/32	✓	✓		*.0937*	*.1875*	*.0625*	*.0937*	*.1169*	-	*.1614*	*.1673*	*.004*
				2.38	4.7625	1.588	2.38	2.97	-	4.1	4.25	.1
SP4622		✓		*.0937*	*.2883*	-	*.0625*	*.1169*	-	*.1614*	*.189*	*.004*
				2.38	7.323	-	1.588	2.97	-	4.1	4.8	.1
X3/32	✓	✓		*.0937*	*.3125*	*.1094*	*.1406*	*.1713*	-	*.2579*	*.2776*	*.005*
				2.38	7.9375	2.779	3.571	4.35	-	6.55	7.05	.125
AX1/8SP7		✓		*.125*	*.25*	-	*.0937*	*.1575*	-	*.2165*	*.2244*	*.004*
				3.175	6.35	-	2.38	4	-	5.5	5.7	.1
AX1/8	✓	✓		*.125*	*.25*	*.0937*	*.1094*	*.1575*	-	*.2165*	*.2244*	*.004*
				3.175	6.35	2.38	2.779	4	-	5.5	5.7	.1
SP4962		✓		*.125*	*.3125*	-	*.1094*	*.1575*	-	*.2165*	*.2244*	*.005*
				3.175	7.9375	-	2.779	4	-	5.5	5.7	.125
X1/8	✓	✓		*.125*	*.3125*	*.1094*	*.1406*	*.1713*	-	*.2579*	*.2776*	*.005*
				3.175	7.9375	2.779	3.571	4.35	-	6.55	7.05	.125
SP3621		✓		*.125*	*.375*	-	*.1094*	*.1575*	-	*.2165*	*.2244*	*.005*
				3.175	9.525	-	2.779	4	-	5.5	5.7	.125
R2	✓	✓	✓	*.125*	*.375*	*.1562*	*.1562*	*.2028*	*.1811*	*.2972*	*.3189*	*.012*
				3.175	9.525	3.967	3.967	5.15	4.6	7.55	8.1	.3
SP3630		✓		*.125*	*.41*	-	*.0937*	*.1575*	-	*.2165*	*.2244*	*.005*
				3.175	10.414	-	2.38	4	-	5.5	5.7	.125
SP3557		✓		*.125*	*.41*	-	*.1094*	*.1811*	-	*.252*	*.2638*	*.005*
				3.175	10.414	-	2.779	4.6	-	6.4	6.7	.125
AX1/8SP5		✓		*.125*	*.425*	-	*.1094*	*.1575*	-	*.2165*	*.2244*	*.004*
				3.175	10.795	-	2.779	4	-	5.5	5.7	.1
SP5239		✓		*.125*	*.5*	-	*.1094*	*.1575*	-	*.2165*	*.2244*	*.004*
				3.175	12.7	-	2.779	4	-	5.5	5.7	.1
R2A	✓	✓		*.125*	*.5*	*.1719*	*.1719*	*.2028*	*.1811*	*.2972*	*.3189*	*.012*
				3.175	12.7	4.366	4.366	5.15	4.6	7.55	8.1	.3

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
Depending on certain dimensions, the availability of the separator will be validated.

Comments

→ The torque value and speed limit hereunder are only for opened or shielded (Z or ZZ) ball bearings.
→ The axial load for running torque measurement is .75 N for D ≤ 10 mm and is 4N for D > 10 mm.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

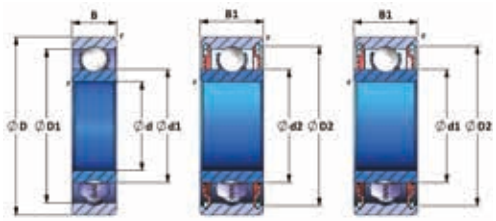
Basic load rating N				Running torque cN.cm		Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static			—	R		
Dyn.		Stat.							
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	.75 N	4 N	+grease (rpm)		g	
49	39	10	8	.02	-	95,000	-	.04	R09
97	77	21	35	.025	-	90,000	-	.12	X3/64
145	116	33	51	.04	-	85,000	-	.23	R1
156	125	37	59	.04	-	75,000	-	.54	X5/64
115	92	28	48	.025	-	80,000	-	.13	AX3/32
115	92	28	48	.025	-	80,000	-	.4	SP4622
351	281	89	127	.055	-	60,000	90,000	.8	X3/32
192	154	53	86	.04	-	67,000	100,000	.32	AX1/8SP7
192	154	53	86	.04	-	67,000	100,000	.3	AX1/8
192	154	53	86	.04	-	67,000	100,000	.7	SP4962
351	281	89	127	.055	-	63,000	95,000	.68	X1/8
192	154	53	86	.04	-	67,000	100,000	.97	SP3621
401	321	111	160	.055	-	60,000	90,000	1.16	R2
192	154	53	86	-	.155	67,000	100,000	1.25	SP3630
242	193	66	101	-	.155	63,000	95,000	1.37	SP3557
192	154	53	86	-	.155	67,000	100,000	1.6	AX1/8SP5
192	154	53	86	-	.155	67,000	100,000	2.36	SP5239
401	321	111	160	-	.2	60,000	90,000	3.15	R2A

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM .1562 INCH (d 3.967 MM) TO .5 INCH (d 12.7 MM)

2 I Inch series

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7



Basic designation open bearing	Open	Protection		Dimensions *in inches* / in mm								
		Protected	Sealed									
	—	Z or ZZ	RS or -2RS	d	D	B	B1	d1	d2[2]	D1	D2	r[1]
X5/32	✓	✓		*.1562*	*.3125*	*.1094*	*.125*	*.2197*	-	*.2795*	*.2874*	*.004*
				3.9675	7.9375	2.779	3.175	5.58	-	7.1	7.3	.1
AX3/16	✓	✓		*.1875*	*.3125*	*.1094*	*.125*	*.2197*	-	*.2795*	*.2874*	*.004*
				4.7625	7.9375	2.779	3.175	5.58	-	7.1	7.3	.1
X3/16	✓	✓		*.1875*	*.375*	*.125*	*.125*	*.2343*	-	*.3287*	*.3366*	*.005*
				4.7625	9.525	3.175	3.175	5.95	-	8.35	8.55	.125
X3/16SP5		✓		*.1875*	*.425*	-	*.125*	*.2343*	-	*.3287*	*.3366*	*.005*
				4.7625	10.795	-	3.175	5.95	-	8.35	8.55	.125
SP5154		✓		*.1875*	*.5*	-	*.1094*	*.2197*	-	*.2795*	*.3031*	*.004*
				4.7625	12.7	-	2.779	5.58	-	7.1	7.7	.1
SP2824		✓		*.1875*	*.5*	-	*.1562*	*.2677*	*.2343*	*.3622*	*.3839*	*.005*
				4.7625	12.7	-	3.967	6.8	5.95	9.2	9.75	.125
Y3/16	✓	✓	✓	*.1875*	*.5*	*.1562*	*.196*	*.2697*	*.2539*	*.4154*	*.435*	*.012*
				4.7625	12.7	3.967	4.978	6.85	6.45	10.55	11.05	.3
R3	✓	✓		*.1875*	*.5*	*.1562*	*.196*	*.2717*	*.2539*	*.4075*	*.435*	*.012*
				4.7625	12.7	3.967	4.978	6.9	6.45	10.35	11.05	.3
SP4041		✓		*.1875*	*.875*	-	*.196*	*.2697*	*.2539*	*.4154*	*.435*	*.012*
				4.7625	22.225	-	4.978	6.85	6.45	10.55	11.05	.3
X1/4	✓	✓		*.25*	*.375*	*.125*	*.125*	*.2835*	-	*.3425*	*.3504*	*.005*
				6.35	9.525	3.175	3.175	7.2	-	8.7	8.9	.125
R188	✓	✓		*.25*	*.5*	*.125*	*.1875*	*.311*	-	*.437*	*.4528*	*.005*
				6.35	12.7	3.175	4.762	7.9	-	11.1	11.5	.125
Y1/4	✓	✓	✓	*.25*	*.625*	*.196*	*.196*	*.3622*	*.3346*	*.5118*	*.5453*	*.012*
				6.35	15.875	4.978	4.978	9.2	8.5	13	13.85	.3
R4	✓	✓		*.25*	*.625*	*.196*	*.196*	*.374*	*.3346*	*.5*	*.5453*	*.012*
				6.35	15.875	4.978	4.978	9.5	8.5	12.7	13.85	.3
R4A	✓	✓	✓	*.25*	*.75*	*.2188*	*.2812*	*.3937*	*.3661*	*.5906*	*.626*	*.016*
				6.35	19.05	5.558	7.142	10	9.3	15	15.9	.4
SP5407	✓	✓		*.3125*	*.5*	*.1562*	*.1562*	*.3622*	-	*.4429*	*.4618*	*.005*
				7.937	12.7	3.967	3.967	9.2	-	11.25	11.73	.125
Y3/8	✓	✓	✓	*.375*	*.875*	*.2188*	*.2812*	*.5*	*.4685*	*.748*	*.7835*	*.016*
				9.525	22.225	5.557	7.142	12.7	11.9	19	19.9	.4
R8	✓	✓	✓	*.5*	*1.125*	*.25*	*.3125*	*.6752*	*.5965*	*.8996*	*.9508*	*.016*
				12.7	28.575	6.35	7.937	17.15	(15.15)	22.85	24.15	.4

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Depending on certain dimensions, the availability of the separator will be validated.

Comments

→ The torque value and speed limit hereunder are only for opened or shielded (Z or ZZ) ball bearings.
→ The axial load for running torque measurement is .75 N for D ≤ 10 mm and is 4N for D > 10 mm.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

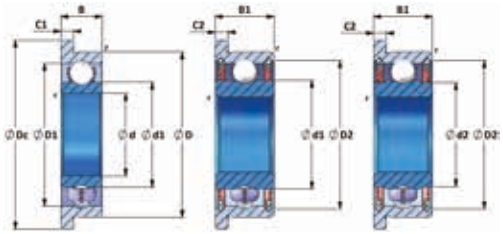
Basic load rating N				Running torque cN.cm		Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static			–	R		
Dyn.		Stat.							
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	.75 N	4 N	+grease (rpm)		g	
206	165	65	106	.04	-	60,000	90,000	.63	X5/32
206	165	65	106	.04	-	60,000	90,000	.47	AX3/16
445	356	133	193	.055	-	53,000	80,000	.78	X3/16
445	356	133	193	.055	-	53,000	80,000	1.28	X3/16SP5
206	165	65	106	-	.155	60,000	90,000	2.06	SP5154
484	387	155	228	-	.2.	50,000	75,000	2.33	SP2824
821	657	242	323	-	.3	48,000	70,000	2.69	Y3/16
821	657	242	323	-	.3	48,000	70,000	2.69	R3
821	657	242	323	-	.3	48,000	70,000	12.3	SP4041
229	183	83	136	.055	-	50,000	75,000	.58	X1/4
669	535	213	297	-	.3	45,000	67,000	2.08	R188
929	743	305	416	-	.365	40,000	60,000	4.43	Y1/4
1,270	1,020	527	592	-	.365	40,000	60,000	4.43	R4
1,400	1,120	445	578	-	.45	36,000	53,000	9.58	R4A
547	438	203	302	-	.35	45,000	67,000	1.7	SP5407
2,100	1,680	701	892	-	.58	28,000	43,000	9.36	Y3/8
6,320	5,050	3,220	1,350	-	.7	24,000	38,000	22.5	R8

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM 1.5 TO 6 MM

3 I Metric series with flanged outer ring

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7



Basic designation open bearing	Open	Protection	Dimensions in mm											
		Z or ZZ	d	D	Dc	B	C1	B1	C2	d1	d2[2]	D1	D2	r[1]
FAX1.5	✓	✓	1.5	4	5	1.2	2	2.2	-	2.2	-	3.3	3.45	.1
FX1.5	✓	✓	1.5	5	6.5	1.7	2.6	2.5	-	2.5	-	4	4.2	.15
F619/1.5	✓		1.5	5	6.5	2	2	2.97	-	2.97	-	4.1	4.3	.1
FBX2	✓	✓	2	5	6.1	1.5	2.3	2.97	-	2.97	-	4.1	4.3	.1
F619/2		✓	2	6	7.5	2.3	2.3	3.25	-	3.25	-	4.75	5.05	.15
FAX2	✓	✓	2	6	7.5	2.3	3	3.25	-	3.25	-	4.75	5.05	.15
FAX2.5	✓	✓	2.5	6	7.1	1.8	2.6	3.5	-	3.5	-	5	5.2	.15
FX2.5	✓	✓	2.5	7	8.5	2.5	3	4	-	4	-	5.5	5.8	.15
FAX3	✓	✓	3	7	8.1	2	3	4.25	-	4.25	-	5.75	6.05	.15
FX3	✓	✓	3	8	9.5	2.5	3	4.6	-	4.6	-	6.4	6.7	.15
F623	✓	✓	3	10	11.5	4	4	5.15	4.6	5.15	4.6	7.55	8.1	.15
FAX4	✓	✓	4	9	10.3	2.5	3.5	5.2	-	5.2	-	7.48	7.9	.15
F638/4		✓	4	9	10.3	-	4	5.2	-	5.2	-	7.48	7.9	.15
FX4	✓	✓	4	10	11.5	3	4	5.95	-	5.95	-	8.35	8.75	.15
FAY4	✓	✓	4	11	12.5	4	4	5.9	5.35	5.9	5.35	9	9.7	.15
F604		✓	4	12	14	4	4	6.45	5.9	6.45	5.9	9.55	10.25	.2
F624	✓	✓	4	13	15	5	5	6.6	5.9	6.6	5.9	10.4	11.25	.2
F634	✓	✓	4	16	18	5	5	8.3	7.5	8.3	7.5	12.7	13.55	.3
FX5	✓		5	11	12.5	3	4	6.8	-	6.8	-	9.2	9.75	.15
FBX5	✓	✓	5	11	12.5	-	-	4	1	6.8	-	9.2	9.75	.15
F638/5		✓	5	11	12.5	-	5	6.8	-	6.8	-	9.2	9.75	.15
FAY5	✓	✓	5	13	15	4	4	7.65	6.95	7.65	6.95	10.75	11.45	.2
F625	✓	✓	5	16	18	5	5	8.3	7.5	8.3	7.5	12.7	13.55	.3
F635	✓	✓	5	19	22	6	6	10	9.3	10	9.3	15	15.9	.3
FAX6	✓		6	13	15	3.5	4.5	7.9	-	7.9	-	11.1	11.65	.15
FBX6	✓	✓	6	13	15	-	-	4.5	1	7.8	-	10.2	11.15	.15
F628/6		✓	6	13	15	-	5	7.9	(7.22)	7.9	(7.22)	11.1	11.65	.15
FAY6	✓	✓	6	15	17	5	5	8.6	7.9	8.6	7.9	12.4	13.25	.2
F626	✓	✓	6	19	22	6	6	10	9.3	10	9.3	15	15.9	.3

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Depending on certain dimensions, the availability of the separator will be validated.

Comments

→ The torque value and speed limit hereunder are only for opened or shielded (Z or ZZ) ball bearings.
→ The axial load for running torque measurement is .75 N for D ≤ 10 mm and is 4N for D > 10 mm.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

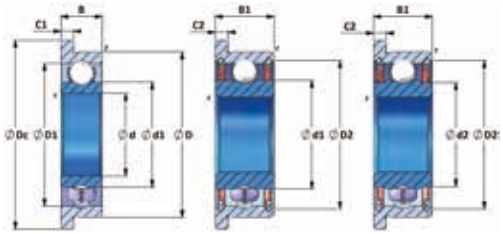
Basic load rating N				Running torque cN.cm		Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static			—	R		
Dyn.		Stat.							
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	.75 N	4 N	+grease (rpm)		g	
136	109	38	33	.025	-	90,000	-	.09	FAX1.5
181	145	48	27	.025	-	78,000	-	.22	FX1.5
154	123	49	37	.025	-	80,000	-	.31	F619/1.5
154	123	49	37	.025	-	80,000	130,000	.16	FBX2
212	169	64	33	.04	-	75,000	120,000	.38	F619/2
212	169	64	33	.04	-	75,000	120,000	.38	FAX2
236	188	77	39	.04	-	70,000	110,000	.26	FAX2.5
257	206	91	45	.04	-	67,000	100,000	.57	FX2.5
256	205	93	45	.04	-	67,000	100,000	.39	FAX3
325	260	113	58	.04	-	63,000	95,000	.7	FX3
500	400	156	111	.055	-	60,000	90,000	1.77	F623
547	438	192	152	.055	-	60,000	90,000	.79	FAX4
547	438	192	152	.055	-	60,000	90,000	1.13	F638/4
550	440	201	112	.04	-	53,000	80,000	1.17	FX4
735	588	252	111	-	.3	53,000	80,000	1.91	FAY4
821	657	303	130	-	.3	50,000	75,000	2.5	F604
1,012	809	375	143	-	.3	48,000	70,000	3.45	F624
1,150	921	414	243	-	.37	43,000	63,000	5.77	F634
648	518	269	145	-	.2	50,000	75,000	1.35	FX5
648	518	269	145	-	.2	50,000	75,000	1.76	FBX5
648	518	269	145	-	.2	50,000	75,000	2.11	F638/5
902	712	365	149	-	.3	48,000	70,000	2.81	FAY5
1,150	921	414	243	-	.37	43,000	63,000	5.24	F625
1,920	1,530	773	378	-	.45	36,000	53,000	10.2	F635
901	721	369	108	-	.3	45,000	67,000	2.22	FAX6
901	721	369	108	-	.3	45,000	67,000	2.64	FBX6
901	721	369	108	-	.3	45,000	67,000	2.87	F628/6
1,250	1,000	518	204	-	.37	43,000	63,000	4.36	FAY6
1,920	1,530	773	378	-	.45	36,000	53,000	9.51	F626

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM 7 TO 10 MM

3 I Metric series with flanged outer ring

Versions: Stainless pressed sheet-metal cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7



Basic designation open bearing	Open	Protection	Dimensions in mm											
		Z or ZZ	d	D	Dc	B	C1	B1	C2	d1	d2[2]	D1	D2	r[1]
FAX7	✔	✔	7	14	16	3.5	1	5	1.1	8.9	-	12.1	12.55	.15
FAY7	✔	✔	7	17	19	5	1.2	5	1.2	9.8	9.1	14.2	15.05	.3
F607	✔	✔	7	19	22	6	1.5	6	1.5	10.5	9.8	15.5	16.4	.3
F627	✔	✔	7	22	25	7	1.5	7	1.5	11.5	10.5	17.9	19	.3
FX8	✔	✔	8	16	18	4	1	-	-	10.1	(9.45)	13.9	14.55	.2
F638/8		✔	8	16	18	-	-	6	1.3	10.1	(9.45)	13.9	14.55	.2
FAY8	✔	✔	8	19	22	6	1.5	6	1.5	11.1	10.4	16.1	17.1	.3
F608	✔	✔	8	22	25	7	1.5	7	1.5	11.5	10.5	17.9	19	.3
FX9	✔		9	17	19	4	1	-	-	11.1	-	14.9	15.55	.2
F638/9		✔	9	17	19	-	-	6	1.3	11.1	-	14.9	15.55	.2
FAY9	✔	✔	9	20	23	6	1.5	6	1.5	12	11.3	17	18	.3
F609	✔	✔	9	24	27	7	1.5	7	1.5	13.7	12.4	19.9	21	.3
F629	✔	✔	9	26	28	8	2	8	2	14	(12.7)	21.1	22.4	.6
FX10	✔	✔	10	19	21	5	1	-	-	12.6	(11.8)	16.4	17.25	.3
F63800		✔	10	19	21	-	-	7	1.5	12.6	(11.8)	16.4	17.25	.3

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Depending on certain dimensions, the availability of the separator will be validated.

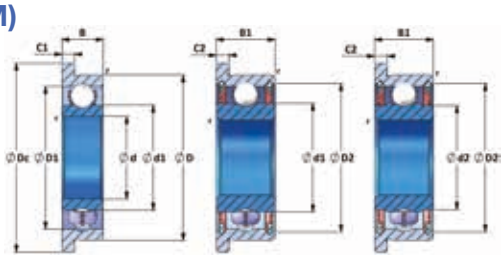
Comments

→ The axial load for running torque measurement is 4N.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

Basic load rating N				Running torque cN.cm	Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static		—	R		
Dyn.		Stat.						
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	4 N	+grease (rpm)		g	
968	774	428	122	.37	43,000	63,000	2.41	FAX7
1,510	1,210	614	245	.42	38,000	56,000	5.43	FAY7
1,920	1,540	786	379	.45	36,000	53,000	8.85	F607
2,850	2,280	1,170	487	.58	32,000	48,000	14.3	F627
1,350	1,080	610	232	.37	38,000	56,000	3.36	FX8
1,350	1,080	610	232	.37	38,000	56,000	4.85	F638/8
1,930	1,540	800	380	.45	34,000	50,000	8.18	FAY8
2,850	2,280	1,170	487	.58	32,000	48,000	13.4	F608
1,440	1,150	693	259	.48	36,000	53,000	3.79	FX9
1,440	1,150	693	259	.48	36,000	53,000	5.94	F638/9
2,110	1,690	937	436	.45	32,000	48,000	8.82	FAY9
2,890	2,310	1,240	604	.58	28,000	43,000	15.9	F609
3,950	3,160	1,690	1,380	.6	28,000	43,000	20.2	F629
1,510	1,210	784	286	.5	32,000	48,000	5.89	FX10
1,510	1,210	784	286	.5	32,000	48,000	7.86	F63800

A. DEEP GROOVE BALL BEARINGS

BORE DIAMETER d FROM .04 INCH (d 1.016 MM) TO .5 INCH (d 12.7 MM)



4 I Inch series with flanged outer ring

Versions: Stainless pressed sheet-metal
cage as standard: —
Crown-type cage: **R**
Tolerances: T5, T4, T2
Position 7

Basic designation open bearing	Open	Protection	Dimensions *in inches* / in mm											
	—	Z or ZZ	d	D	Dc	B	C1	B1	C2	r[1]	d1	d2[2]	D1	D2
FR09	✓		*.04*	*.125*	*.171*	*.0469*	*.013*	-	-	*.003*	*.066*	-	*.096*	-
			1.016	3.175	4.343	1.191	.33	-	-	.075	1.67	-	2.43	-
FX3/64	✓	✓	*.0469*	*.1562*	*.203*	*.0625*	*.013*	*.0937*	*.031*	*.004*	*.076*	-	*.122*	*.128*
			1.191	3.9675	5.156	1.588	.33	2.38	.787	.1	1.94	-	3.1	3.25
FR1	✓	✓	*.055*	*.1875*	*.234*	*.0781*	*.023*	*.1094*	*.031*	*.005*	*.093*	-	*.150*	*.158*
			1.397	4.7625	5.944	1.984	.584	2.779	.787	.125	2.35	-	3.8	4
FX5/64	✓	✓	*.0781*	*.25*	*.296*	*.0937*	*.023*	*.1406*	*.031*	*.005*	*.128*	-	*.187*	*.199*
			1.984	6.35	7.518	2.38	.584	3.571	.787	.125	3.25	-	4.75	5.05
FAX3/32	✓	✓	*.0937*	*.1875*	*.234*	*.0625*	*.018*	*.0937*	*.031*	*.004*	*.117*	-	*.161*	*.167*
			2.38	4.7625	5.944	1.588	.457	2.38	.787	.1	2.97	-	4.1	4.25
FX3/32	✓	✓	*.0937*	*.3125*	*.359*	*.1094*	*.023*	*.1406*	*.031*	*.005*	*.171*	-	*.258*	*.278*
			2.38	7.9375	9.119	2.779	.584	3.571	.787	.125	4.35	-	6.55	7.05
FAX1/8	✓	✓	*.125*	*.25*	*.296*	*.0937*	*.023*	*.1094*	*.031*	*.004*	*.158*	-	*.217*	*.224*
			3.175	6.35	7.518	2.38	.584	2.779	.787	.1	4	-	5.5	5.7
FX1/8	✓	✓	*.125*	*.3125*	*.359*	*.1094*	*.023*	*.1406*	*.031*	*.005*	*.171*	-	*.258*	*.278*
			3.175	7.9375	9.119	2.779	.584	3.571	.787	.125	4.35	-	6.55	7.05
FR2	✓	✓	*.125*	*.375*	*.44*	*.1562*	*.03*	*.1562*	*.03*	*.012*	*.203*	*.181*	*.297*	*.319*
			3.175	9.525	11.176	3.967	.762	3.967	.762	.3	5.15	4.6	7.55	8.1
FX5/32	✓	✓	*.1562*	*.3125*	*.359*	*.1094*	*.023*	*.125*	*.036*	*.004*	*.220*	-	*.280*	*.287*
			3.9675	7.9375	9.119	2.779	.584	3.175	.914	.1	5.58	-	7.1	7.3
FAX3/16	✓	✓	*.1875*	*.3125*	*.359*	*.1094*	*.023*	*.125*	*.036*	*.004*	*.220*	-	*.280*	*.287*
			4.7625	7.9375	9.119	2.779	.584	3.175	.914	.1	5.58	-	7.1	7.3
FX3/16	✓	✓	*.1875*	*.375*	*.422*	*.125*	*.023*	*.125*	*.031*	*.005*	*.234*	-	*.329*	*.337*
			4.7625	9.525	10.719	3.175	.584	3.175	.787	.125	5.95	-	8.35	8.55
FY3/16	✓	✓	*.1875*	*.5*	*.565*	*.196*	*.042*	*.196*	*.042*	*.012*	*.270*	*.254*	*.415*	*.435*
			4.7625	12.7	14.351	4.978	1.067	4.978	1.067	.3	6.85	6.45	10.55	11.05
FR3		✓	*.1875*	*.5*	*.565*	-	-	*.196*	*.042*	*.012*	*.272*	*.254*	*.408*	*.435*
			4.7625	12.7	14.351	-	-	4.978	1.067	.3	6.9	6.45	10.35	11.05
FX1/4	✓	✓	*.25*	*.375*	*.422*	*.125*	*.023*	*.125*	*.036*	*.005*	*.284*	-	*.343*	*.350*
			6.35	9.525	10.719	3.175	.584	3.175	.914	.125	7.2	-	8.7	8.9
FR188	✓	✓	*.25*	*.5*	*.547*	*.125*	*.023*	*.1875*	*.045*	*.005*	*.311*	-	*.437*	*.453*
			6.35	12.7	13.894	3.175	.584	4.762	1.143	.125	7.9	-	11.1	11.5
FY1/4	✓	✓	*.25*	*.625*	*.69*	*.196*	*.042*	*.196*	*.042*	*.012*	*.362*	*.335*	*.512*	*.545*
			6.35	15.875	17.526	4.978	1.067	4.978	1.067	.3	9.2	8.5	13	13.85
FR4		✓	*.25*	*.625*	*.69*	-	-	*.196*	*.042*	*.012*	*.374*	*.335*	*.500*	*.545*
			6.35	15.875	17.526	-	-	4.978	1.067	.3	9.5	8.5	12.7	13.85
FSP5407	✓	✓	*.3125*	*.5*	*.547*	*.1562*	*.031*	*.1562*	*.031*	*.005*	*.362*	-	*.443*	*.462*
			7.937	12.7	13.894	3.967	.787	3.967	.787	.125	9.2	-	11.25	11.73
FY3/8	✓	✓	*.3750*	*.875*	*.969*	*.2812*	*.062*	*.2812*	*.062*	*.016*	*.500*	*.469*	*.748*	*.784*
			9.525	22.225	24.612	7.142	1.575	7.142	1.575	.4	12.7	11.9	19	19.9
FR8	✓	✓	*.5*	*1.125*	*1.225*	*.25*	*.062*	*.3125*	*.062*	*.016*	*.675*	*.597*	*.900*	*.951*
			12.7	28.575	31.115	6.35	1.575	7.937	1.575	.4	17.15	(15.15)	22.85	24.15

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 The values in brackets () are only valid for sealed version RS or –2RS.

Comments

→ The axial load for running torque measurement is .75 N for D ≤ 10 mm and is 4N for D > 10 mm.
→ The mean mass corresponds to opened beating mass or shielded ball bearings if the opened version does not exist.

Basic load rating N				Running torque cN.cm		Speed limit Cage type:		Mean mass	Basic designation open bearing
Radial			Axial static			—	R		
Dyn.		Stat.							
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	.75 N	4 N	+grease (rpm)		g	
49	39	10	8	.02	-	95,000	-	.06	FR09
97	77	21	35	.025	-	90,000	-	.14	FX3/64
145	116	33	51	.04	-	85,000	-	.28	FR1
156	125	37	59	.04	-	75,000	-	.6	FX5/64
115	92	28	48	.025	-	80,000	-	.17	FAX3/32
351	281	89	127	.055	-	60,000	90,000	.87	FX3/32
192	154	53	86	.04	-	67,000	100,000	.36	FAX1/8
351	281	89	127	.055	-	63,000	95,000	.75	FX1/8
401	321	111	160	.055	-	60,000	90,000	1.32	FR2
206	165	65	106	.04	-	60,000	90,000	.7	FX5/32
206	165	65	106	.04	-	60,000	90,000	.54	FAX3/16
445	356	133	193	.055	-	53,000	80,000	.87	FX3/16
821	657	242	323	-	.3	48,000	70,000	2.96	FY3/16
821	657	242	323	-	.3	48,000	70,000	3.04	FR3
229	183	83	136	.055	-	50,000	75,000	.65	FX1/4
669	535	213	297	-	.3	45,000	67,000	2.19	FR188
929	743	305	416	-	.365	40,000	60,000	4.79	FY1/4
1,270	1,020	527	592	-	.365	40,000	60,000	4.82	FR4
547	438	203	302	-	.35	45,000	67,000	1.85	FSP5407
2,100	1,680	701	892	-	.58	28,000	43,000	11.7	FY3/8
6,320	5,050	3,220	1,350	-	.7	24,000	38,000	24	FR8

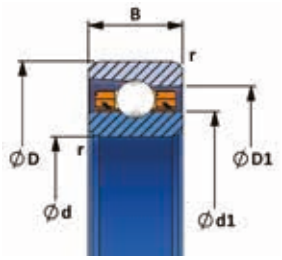
Depending on certain dimensions, the availability of the separator will be validated.

B. ANGULAR CONTACT BALL BEARINGS

BORE DIAMETER d FROM 5 TO 85 MM

1 I Metric series, type H - Rigid series

Versions: Type H with one-piece machined cage with cylindrical ball pockets
Tolerances: T5, T4, T2
Position 7



Basic designation	Dimensions in mm					
	d	D	B	d1	D1	r[1]
635H	5	19	6	11.1	15.05	.3
626H	6	19	6	10.6	14.55	.3
607H	7	19	6	11.1	15.05	.3
638/8H	8	16	6	10.1	13.9	.2
608H	8	22	7	12.45	17.65	.3
609H	9	24	7	13.95	19.15	.3
6000H	10	26	8	14.85	21.15	.3
6200H	10	30	9	16.8	23.6	.6
6001H	12	28	8	16.85	23.15	.3
6201H	12	32	10	18.3	26.4	.6
6002H	15	32	9	20.6	26.8	.3
6202H	15	35	11	21.51	29	.6
6203H	17	40	12	24.23	32.7	.6
6004H	20	42	12	27.2	34.8	.6
6205H	25	52	15	33.52	43.64	.6
6007H	35	62	14	43.75	53.25	.6
6008H	40	68	15	49.25	59.1	1
6009H	45	75	16	54.2	65.8	1
6010H	50	80	16	59.2	70.8	1
6210H	50	90	20	62.3	77.7	.6
6012H	60	95	18	70.8	84.2	1.1
6212H	60	110	22	75.4	94.6	.6
6017H	85	130	22	99.4	115.6	1.1

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

Comments

→ Nominal contact angle: 15° ± 2°.
→ Other nominal values or tolerances may be given upon request.

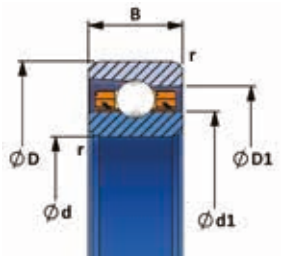
Basic load rating N				Speed limit in rpm (revolution per minute)		Mean mass	Basic designation
Radial			Axial static				
Dyn.		Stat.					
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	with grease	with oil	g	
1,960	1,570	752	1,390	69,000	100,000	8.79	**635H**
1,890	1,510	764	1,510	72,000	104,000	8.37	**626H**
1,960	1,570	752	1,390	69,000	100,000	7.9	**607H**
1,430	1,150	671	217	75,000	108,000	4	**638/8H**
2,900	2,320	1,130	2,080	60,000	86,000	12.3	**608H**
3,150	2,520	1,310	2,440	54,000	78,000	15	**609H**
4,030	3,220	1,620	2,990	50,000	72,000	18.8	**6000H**
5,280	4,220	2,170	3,980	44,000	64,000	30.5	**6200H**
4,380	3,500	1,900	3,530	45,000	65,000	21	**6001H**
7,500	6,000	3,780	2,750	40,000	58,000	35.1	**6201H**
4,700	3,760	2,260	4,260	38,000	55,000	29.5	**6002H**
7,310	5,850	3,290	6,090	35,000	51,000	44	**6202H**
8,210	6,570	3,830	7,110	31,000	45,000	64.1	**6203H**
8,370	6,690	4,360	8,220	29,000	41,000	67.6	**6004H**
14,600	11,700	9,120	8,890	23,000	33,000	126	**6205H**
14,900	11,900	9,840	18,800	18,000	26,000	154	**6007H**
16,400	13,100	12,200	22,300	16,000	24,000	187	**6008H**
21,500	17,200	15,100	29,000	15,000	21,000	236	**6009H**
22,100	17,700	16,300	31,400	13,000	20,000	252	**6010H**
33,600	26,900	22,900	43,600	12,000	18,000	465	**6210H**
29,100	23,300	22,400	43,000	11,000	16,000	399	**6012H**
-	40,300	37,600	72,600	10,000	15,000	797	**6212H**
-	38,400	44,000	93,000	8,000	12,000	897	**6017H**

B. ANGULAR CONTACT BALL BEARINGS

BORE DIAMETER d FROM 10 TO 200 MM

2 I Metric series, type H and N - 619 series

Versions: Type H with one-piece machined cage with cylindrical ball pockets
Type N with separating rings
Tolerances: T5, T4, T2
Position 7



Basic designation	Dimensions in mm					
	d	D	B	d1	D1	r[1]
61900H	10	22	6	14	18	.3
61901H	12	24	6	15.9	20.6	.3
61902H	15	28	7	18.95	24.07	.3
61903H	17	30	7	21	26	.3
61904H	20	37	9	25.55	31.35	.3
61905H	25	42	9	30.3	36.7	.3
61906H	30	47	9	35.3	42	.3
61907H	35	55	10	41.1	48.9	.3
61908H	40	62	12	46.7	55.3	.6
61910H	50	72	12	57.1	64.9	.6
61911H	55	80	13	62.7	72.3	1
61913H	65	90	13	73	82.1	1
61920H	100	140	20	112	128	1.1
61928H	140	190	24	155	175	1.5
61934H	170	230	28	188.6	211.4	2
61940H	200	280	38	229.35	250.85	2

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

Comments

→ Nominal contact angle: 15° ± 2°.
→ Other nominal values or tolerances may be given upon request.

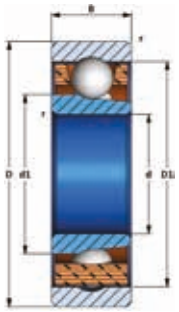
Basic load rating N				Speed limit in rpm (revolution per minute)		Mean mass	Basic designation
Radial			Axial static				
Dyn.		Stat.					
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	with grease	with oil	g	
2,260	1,810	1,070	2,060	56,000	81,000	10	**61900H**
2,510	2,010	1,330	1,410	49,000	71,000	10	**61901H**
3,580	2,860	1,890	3,640	41,000	60,000	15	**61902H**
3,550	2,840	1,940	3,760	38,000	55,000	16	**61903H**
5,460	4,370	3,260	6,340	31,000	45,000	36	**61904H**
6,090	4,870	4,120	7,550	26,000	38,000	41	**61905H**
6,170	4,930	4,490	5,500	23,000	33,000	47	**61906H**
8,140	6,510	6,120	8,570	20,000	28,000	72	**61907H**
10,300	8,300	7,980	13,600	17,000	25,000	106	**61908H**
11,400	9,130	10,000	19,800	14,000	21,000	130	**61910H**
18,000	14,400	16,100	31,700	13,000	19,000	171	**61911H**
17,500	14,000	16,400	32,500	11,000	16,000	198	**61913H**
43,400	34,700	45,600	90,100	7,000	10,000	745	**61920H**
68,400	54,700	80,900	160,400	5,000	7,000	1,561	**61928H**
85,500	68,400	100,000	198,300			2,668	**61934H**
94,700	75,700	128,000	254,800			6,506	**61940H**

B. ANGULAR CONTACT BALL BEARINGS

BORE DIAMETER d FROM 1.5 MM TO 50 MM

3 I Metric series, type B (separable)

Versions: Type B with one-piece machined cage, with stepped ball pockets
Tolerances: T5, T4, T2
Position 7



Basic designation	Dimensions in mm					
	d	D	B	d1	D1	r[1]
619/1.5B	1.5	5	2	2.58	3.92	.15
AX2B	2	6	2.3	3.33	4.67	.15
60/2.5B	2.5	8	2.8	4.4	6.65	.15
623B	3	10	4	5.2	7.45	.15
604B	4	12	4	6.6	9.4	.2
624B	4	13	5	6.75	10.2	.2
634B	4	16	5	7.65	12.35	.3
625B	5	16	5	7.65	12.35	.3
626B	6	19	6	10.15	14.85	.3
607B	7	19	6	10.65	15.35	.3
608B	8	22	7	12.15	17.85	.3
6000B	10	26	8	14.2	20.85	.3
6001B	12	28	8	16.7	23.35	.3
6002B	15	32	9	20.6	26.8	.3
6003B	17	35	10	22.8	29.2	.3
6006B	30	55	13	38.2	47.1	.6
6007B	35	62	14	43.75	53.25	.6
6210B	50	90	20	62	78.6	.6

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

Comments

→ Nominal contact angle: 15° ± 2°.
→ Other nominal values or tolerances may be given upon request.
→ Type B ball bearings d ≤ 8 mm may be supplied with a flange on the outer ring by indicating the F symbol in position 2 of the designation.

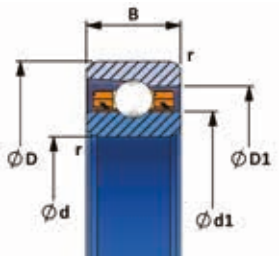
Basic load rating N				Speed limit in rpm (revolution per minute)		Mean mass	Basic designation
Radial			Axial static				
Dyn.		Stat.					
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	with grease	with oil	g	
131	105	28	45	276,000	400,000	.18	619/1.5B
156	125	37	61	225,000	325,000	.3	AX2B
349	279	89	145	162,000	234,000	.62	60/2.5B
398	318	110	181	141,000	204,000	1.53	623B
595	476	173	284	112,000	162,000	2.15	604B
728	582	202	330	105,000	152,000	3.04	624B
1,170	942	337	545	90,000	130,000	5.01	634B
1,170	942	337	545	90,000	130,000	4.7	625B
1,380	1,100	439	721	150,000	216,000	8.12	626B
1,390	1,110	446	735	69,000	100,000	7.59	607B
2,050	1,640	674	1,100	60,000	86,000	11.5	608B
2,830	2,260	959	1,560	51,000	74,000	18.8	6000B
3,420	2,730	1,300	2,140	45,000	65,000	20	6001B
4,700	3,760	2,260	4,260	38,000	55,000	29.2	6002B
3,950	3,160	1,730	2,890	34,000	50,000	38.2	6003B
12,700	10,200	8,850	15,300	21,000	30,000	115	6006B
16,700	13,400	12,400	22,100	18,000	26,000	156	6007B
37,500	30,000	27,400	33,400	12,000	18,000	439	6210B

B. ANGULAR CONTACT BALL BEARINGS

BORE DIAMETER d FROM .25 INCH (d 6.35 MM) TO .5 INCH (d 12.7 MM)

4 I Inch series, type H

Versions: Type H with one-piece machined cage
with cylindrical ball pockets
Tolerances: T5, T4, T2
Position 7



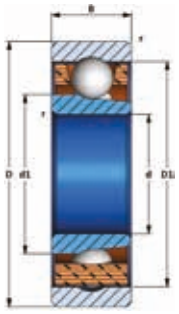
Basic designation	Dimensions *in inches* / in mm					
	d	D	B	d1	D1	r[1]
WR4H	*.25*	*.625*	*.196*	*.374*	*.5*	*.012*
	6.35	15.875	4.978	9.5	12.7	.3
WR8H	*.5*	*1.125*	*.3125*	*.7283*	*.8976*	*.016*
	12.7	28.575	7.937	18.5	22.8	.4

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

BORE DIAMETER d FROM .0781 INCH (d 1.984 MM) TO .25 INCH (d 6.35 MM)

5 I Inch series, type B (separable)

Versions: Type B with one-piece machined cage,
with stepped ball pockets
Tolerances: T5, T4, T2
Position 7



Basic designation	Dimensions *in inches* / in mm					
	d	D	B	d1	D1	r[1]
WX5/64B	*.0781*	*.25*	*.0937*	*.1311*	*.1839*	*.005*
	1.984	6.35	2.38	3.33	4.67	.125
WX3/32B	*.0937*	*.3125*	*.1094*	*.1732*	*.2618*	*.005*
	2.38	7.9375	2.779	4.4	6.65	.125
WX1/8B	*.125*	*.3125*	*.1094*	*.1732*	*.2618*	*.005*
	3.175	7.9375	2.779	4.4	6.65	.125
WR2B	*.125*	*.375*	*.1562*	*.2047*	*.2933*	*.012*
	3.175	9.525	3.967	5.2	7.45	.3
WY3/16B	*.1875*	*.5*	*.1562*	*.2756*	*.4114*	*.012*
	4.7625	12.7	3.967	7	10.45	.3
WY1/4B	*.25*	*.625*	*.196*	*.3681*	*.5039*	*.012*
	6.35	15.875	4.978	9.35	12.8	.3

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

Comments

→ Nominal contact angle: 15° ± 2°.
→ Other nominal values or tolerances may be given upon request.

Basic load rating N				Speed limit in rpm (revolution per minute)		Mean mass	Basic designation
Radial			Axial static				
Dyn.		Stat.					
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	with grease	with oil	g	
991	792	338	560	81,000	117,000	4.4	WR4H
2,410	1,930	1,170	1,960	43,000	62,000	19.4	WR8H

Comments

→ Nominal contact angle: 15° ± 2°.
→ Other nominal values or tolerances may be given upon request.
→ Type B ball bearings d ≤ 8 mm may be supplied with a flange on the outer ring by indicating the F symbol in position 2 of the designation.

Basic load rating N				Speed limit in rpm (revolution per minute)		Mean mass	Basic designation
Radial			Axial static				
Dyn.		Stat.					
$C_{(100C6)}$	$C_{(Z100CD17)}$	Co	Cax	with grease	with oil	g	
156	125	37	61	225,000	325,000	.37	WX5/64B
349	279	89	145	162,000	234,000	.61	WX3/32B
349	279	89	145	162,000	234,000	.54	WX1/8B
398	318	110	181	141,000	204,000	1.31	WR2B
812	650	239	391	102,000	148,000	2.14	WY3/16B
916	733	300	498	81,000	117,000	4.4	WY1/4B

C. THIN SECTION BALL BEARINGS

The variations available are listed on the tabular data for each series.
Z100CD17 (X105CrMo17) steel for all series. Tolerances TA5-TA4,
see Position 7 pages 32-39.

DESCRIPTION OF THE INTERNAL DESIGNS

1 I DESIGN E
Deep groove ball bearings for slow or oscillating motions with PTFE tube separators.

2 I DESIGN R
Deep groove ball bearings for moderate or high speeds, depending on dimensions: with crown-type cage, machined from phenolic resin. (Design shown in tables for series A and 618).

3 I DESIGN H
Angular contact ball bearings with a maximum load carrying capacity with crown-type cage, machined from phenolic resin, for all speeds.

4 I DESIGN N
Angular contact ball bearings with a maximum load carrying capacity with ring-shaped spacers, for slow speeds and low torque applications.

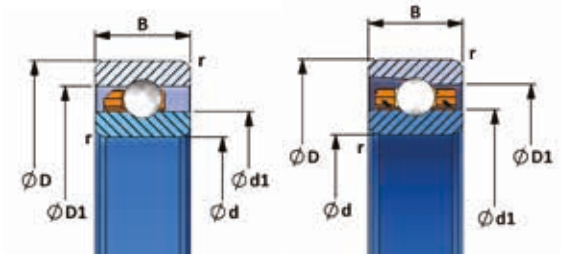
Variants
Variant LA: extended inner ring for all designs.
Variant EA: extended inner and outer rings for E and R designs in ZZ only.
For these two variants, the extended width(s) is (are) mentioned in each table for the series involved.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM .375 INCH (d 9.525 MM) TO 1.625 INCH (d 41.275 MM)

1 I Series A4 - Inch series

Constant ball diameter: 1/16 inch (1.588 mm)
Constant section
Versions E, R, H and N
Open ball bearing for all versions
Ball bearing with shields on versions E and R
Ball bearing with two shields on versions E
Width variant LA and EA: .1960"(4.978 mm)
Tolerances TA5, TA4
Position 7



Version R Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA406	*.375*	*.625*	*.1562*	*.4583*	*.5417*	*.01*	*R*	*630*	*440*	*470*	2.7
	9.525	15.875	3.967	11.64	13.76	.25	H	690	500	540	
WA408	*.5*	*.75*	*.1562*	*.5835*	*.6669*	*.01*	*R*	*680*	*520*	*580*	3.4
	12.7	19.05	3.967	14.82	16.94	.25	H	780	640	720	
WA410	*.625*	*.875*	*.1562*	*.7083*	*.7917*	*.01*	*R*	*720*	*600*	*690*	4
	15.875	22.225	3.967	17.99	20.11	.25	H	810	720	830	
WA412	*.75*	*1*	*.1562*	*.8335*	*.9169*	*.01*	*R*	*750*	*680*	*790*	4.7
	19.05	25.4	3.967	21.17	23.29	.25	H	900	890	1,040	
WA414	*.875*	*1.125*	*.1562*	*.9583*	*1.0417*	*.01*	*R*	*810*	*790*	*940*	5.4
	22.225	28.575	3.967	24.34	26.46	.25	H	900	940	1,110	
WA417	*1.0625*	*1.3125*	*.1562*	*1.1461*	*1.2295*	*.01*	*R*	*850*	*930*	*1,110*	6.4
	26.9875	33.3375	3.967	29.11	31.23	.25	H	960	1,100	1,320	
WA420	*1.25*	*1.5*	*.1562*	*1.3335*	*1.4169*	*.01*	*R*	*880*	*1,030*	*1,250*	7.4
	31.75	38.1	3.967	33.87	35.99	.25	H	1,010	1,270	1,530	
WA422	*1.375*	*1.625*	*.1562*	*1.4583*	*1.5417*	*.01*	*R*	*920*	*1,140*	*1,400*	8
	34.925	41.275	3.967	37.04	39.16	.25	H	1,040	1,370	1,680	
WA424	*1.5*	*1.75*	*.1562*	*1.5835*	*1.6669*	*.01*	*R*	*960*	*1,260*	*1,540*	8.7
	38.1	44.45	3.967	40.22	42.34	.25	H	1,070	1,480	1,820	
WA426	*1.625*	*1.875*	*.1562*	*1.7083*	*1.7917*	*.01*	*R*	*990*	*1,370*	*1,680*	9.4
	41.275	47.625	3.967	43.39	45.51	.25	H	1,100	1,590	1,960	

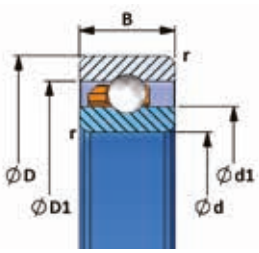
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

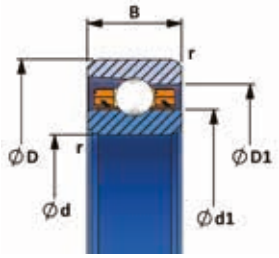
BORE DIAMETER d FROM .875 INCH (d 22.225 MM) TO 2.5 INCHES (d 63.5 MM)

1 I Series A6 - Inch series

Constant ball diameter: 3/32 inch (2.381 mm)
Constant section
Versions E, R, H and N
Open ball bearing only
Width variant LA and EA
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA614	*.875*	*1.25*	*.1875*	*1.0043*	*1.1205*	*.01*	*R*	*1,470*	*1,290*	*2,080*	11
	22.225	31.75	4.762	25.51	28.46	.25	H	1,860	1,840	2,950	
WA616	*1*	*1.375*	*.1875*	*1.1291*	*1.2453*	*.01*	*R*	*1,570*	*1,480*	*2,380*	12
	25.4	34.925	4.762	28.68	31.63	.25	H	1,930	2,020	3,250	
WA618	*1.125*	*1.5*	*.1875*	*1.2543*	*1.3705*	*.01*	*R*	*1,620*	*1,600*	*2,640*	14
	28.575	38.1	4.762	31.86	34.81	.25	H	2,000	2,210	3,630	
WA620	*1.25*	*1.625*	*.1875*	*1.3791*	*1.4953*	*.01*	*R*	*1,660*	*1,720*	*2,830*	15
	31.75	41.275	4.762	35.03	37.98	.25	H	2,020	2,320	3,810	
WA622	*1.375*	*1.75*	*.1875*	*1.5043*	*1.6205*	*.01*	*R*	*1,700*	*1,850*	*3,090*	16
	34.925	44.45	4.762	38.21	41.16	.25	H	2,080	2,510	4,190	
WA624	*1.5*	*1.875*	*.1875*	*1.6291*	*1.7453*	*.01*	*R*	*1,730*	*1,970*	*3,270*	17
	38.1	47.625	4.762	41.38	44.33	.25	H	2,140	2,690	4,470	
WA628	*1.75*	*2.125*	*.1875*	*1.8791*	*1.9953*	*.01*	*R*	*1,840*	*2,280*	*3,830*	20
	44.45	53.975	4.762	47.73	50.68	.25	H	2,210	3,000	5,030	
WA632	*2*	*2.375*	*.1875*	*2.1291*	*2.2453*	*.01*	*R*	*1,900*	*2,520*	*4,270*	22
	50.8	60.325	4.762	54.08	57.03	.25	H	2,340	3,430	5,800	
WA640	*2.5*	*2.875*	*.1875*	*2.6291*	*2.7453*	*.01*	*R*	*2,050*	*3,080*	*5,270*	27
	63.5	73.025	4.762	66.78	69.73	.25	H	2,510	4,170	7,140	

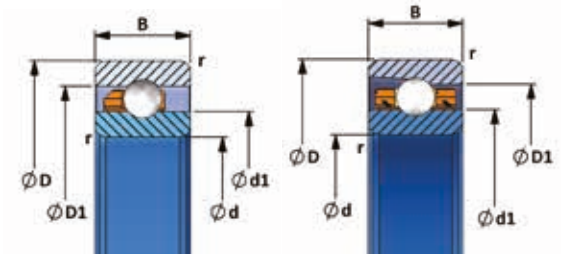
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM .625 INCH (d 15.875 MM) TO 2.5625 INCHES (d 65.0875 MM)

1 I Series A7 - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Versions E, R, H and N
Open ball bearing for all versions
Ball bearing with shields on versions E and R
Width variant LA and EA: .2812"(7.142 mm)
Tolerances: TA5, TA4
Position 7



Version R Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA710	*.625*	*1.0625*	*.25*	*.7661*	*.9217*	*.015*	*R*	*2,090*	*1,550*	*2,290*	12
	15.875	26.9875	6.35	19.46	23.41	.38	H	2,420	1,940	2,870	
WA712	*.75*	*1.1875*	*.25*	*.8909*	*1.0465*	*.015*	*R*	*2,240*	*1,780*	*2,690*	14
	19.05	30.1625	6.35	22.63	26.58	.38	H	2,650	2,290	3,460	
WA713	*.8125*	*1.25*	*.25*	*.9535*	*1.1091*	*.015*	*R*	*2,310*	*1,890*	*2,890*	15
	20.6375	31.75	6.35	24.22	28.17	.38	H	2,710	2,390	3,670	
WA714	*.875*	*1.3125*	*.25*	*1.0161*	*1.1717*	*.015*	*R*	*2,280*	*1,870*	*2,900*	16
	22.225	33.3375	6.35	25.81	29.76	.38	H	2,760	2,500	3,870	
WA717	*1.0625*	*1.5*	*.25*	*1.2035*	*1.3591*	*.015*	*R*	*2,470*	*2,210*	*3,500*	19
	26.9875	38.1	6.35	30.57	34.52	.38	H	2,990	2,950	4,670	
WA721	*1.3125*	*1.75*	*.25*	*1.4535*	*1.6091*	*.015*	*R*	*2,590*	*2,530*	*4,100*	22
	33.3375	44.45	6.35	36.92	40.87	.38	H	3,140	3,380	5,470	
WA725	*1.5625*	*2*	*.25*	*1.7035*	*1.8591*	*.015*	*R*	*2,710*	*2,860*	*4,710*	26
	39.6875	50.8	6.35	43.27	47.22	.38	H	3,420	4,050	6,670	
WA729	*1.8125*	*2.25*	*.25*	*1.9535*	*2.1091*	*.015*	*R*	*2,880*	*3,300*	*5,510*	30
	46.0375	57.15	6.35	49.62	53.57	.38	H	3,530	4,480	7,480	
WA733	*2.0625*	*2.5*	*.25*	*2.2035*	*2.3591*	*.015*	*R*	*2,970*	*3,630*	*6,110*	34
	52.3875	63.5	6.35	55.97	59.92	.38	H	3,640	4,920	8,280	
WA737	*2.3125*	*2.75*	*.25*	*2.4535*	*2.6091*	*.015*	*R*	*3,060*	*3,950*	*6,710*	37
	58.7375	69.85	6.35	62.32	66.27	.38	H	3,750	5,350	9,090	
WA741	*2.5625*	*3*	*.25*	*2.7035*	*2.8591*	*.015*	*R*	*3,200*	*4,400*	*7,520*	41
	65.0875	76.2	6.35	68.67	72.62	.38	H	3,890	5,900	10,000	

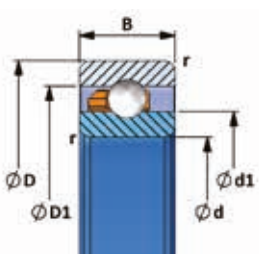
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

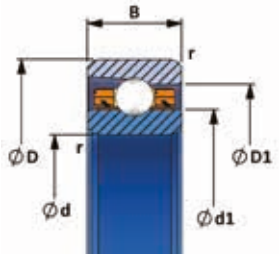
BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 7 INCHES (d 177.8 MM)

1 I Series A8 - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Versions E, R, H and N
Open ball bearing only
Width variant LA and EA
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA832	*2*	*2.5*	*.25*	*2.172*	*2.3275*	*.025*	*R*	*2,990*	*3,630*	*6,110*	40
	50.8	63.5	6.35	55.17	59.12	.635	H	3,660	4,920	8,280	
WA840	*2.5*	*3*	*.25*	*2.672*	*2.8275*	*.025*	*R*	*3,150*	*4,280*	*7,320*	48
	63.5	76.2	6.35	67.87	71.82	.635	H	3,860	5,790	9,890	
WA848	*3*	*3.5*	*.25*	*3.172*	*3.3275*	*.025*	*R*	*3,360*	*5,050*	*8,720*	57
	76.2	88.9	6.35	80.57	84.52	.635	H	4,090	6,780	11,600	
WA856	*3.5*	*4*	*.25*	*3.672*	*3.8275*	*.025*	*R*	*3,450*	*5,590*	*9,730*	66
	88.9	101.6	6.35	93.27	97.22	.635	H	4,290	7,760	13,500	
WA864	*4*	*4.5*	*.25*	*4.172*	*4.3275*	*.025*	*R*	*3,710*	*6,590*	*11,500*	75
	101.6	114.3	6.35	105.97	109.92	.635	H	4,480	8,750	15,300	
WA868	*4.25*	*4.75*	*.25*	*4.422*	*4.5775*	*.025*	*R*	*3,770*	*6,920*	*12,100*	79
	107.95	120.65	6.35	112.32	116.27	.635	H	4,550	9,190	16,100	
WA872	*4.5*	*5*	*.25*	*4.672*	*4.8275*	*.025*	*R*	*3,830*	*7,250*	*12,700*	83
	114.3	127	6.35	118.67	122.62	.635	H	4,620	9,620	16,900	
WA876	*4.75*	*5.25*	*.25*	*4.922*	*5.0775*	*.025*	*R*	*3,920*	*7,690*	*13,500*	88
	120.65	133.35	6.35	125.02	128.97	.635	H	4,730	10,100	17,900	
WA880	*5*	*5.5*	*.25*	*5.172*	*5.3275*	*.025*	*R*	*3,970*	*8,010*	*14,100*	92
	127	139.7	6.35	131.37	135.32	.635	H	4,790	10,600	18,700	
WA888	*5.5*	*6*	*.25*	*5.672*	*5.8275*	*.025*	*R*	*4,080*	*8,670*	*15,300*	101
	139.7	152.4	6.35	144.07	148.02	.635	H	4,950	11,600	20,500	
WA896	*6*	*6.5*	*.25*	*6.172*	*6.3275*	*.025*	*R*	*4,210*	*9,440*	*16,700*	109
	152.4	165.1	6.35	156.77	160.72	.635	H	5,100	12,500	22,300	
WA8104	*6.5*	*7*	*.25*	*6.672*	*6.8275*	*.025*	*R*	*4,340*	*10,200*	*18,100*	118
	165.1	177.8	6.35	169.47	173.42	.635	H	5,240	13,500	24,100	
WA8112	*7*	*7.5*	*.25*	*7.172*	*7.3275*	*.025*	*R*	*4,420*	*10,800*	*19,300*	127
	177.8	190.5	6.35	182.17	186.12	.635	H	5,380	14,500	25,900	

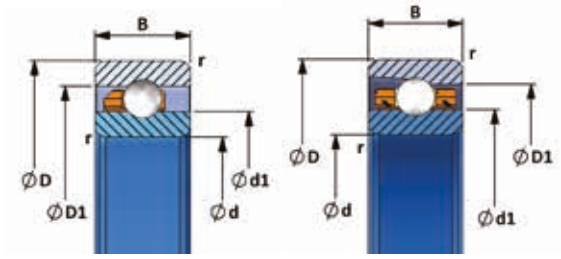
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2.0625 INCHES (d 52.3875 MM) TO 7 INCHES (d 177.8 MM)

1 I Series A9 - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Versions E, R, H and N
Open ball bearing for all versions
Ball bearing with shields on versions E and R
Width variant LA and EA: .2812"(7.142 mm)
Tolerances: TA5, TA4
Position 7



Version R Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA933	*2.0625*	*2.625*	*.25*	*2.2657*	*2.4212*	*.015*	*R*	*3,010*	*3,740*	*6,310*	49
	52.3875	66.675	6.35	57.55	61.5	.38	H	3,730	5,140	8,680	
WA937	*2.3125*	*2.875*	*.25*	*2.5157*	*2.6712*	*.015*	*R*	*3,160*	*4,180*	*7,110*	54
	58.7375	73.025	6.35	63.9	67.85	.38	H	3,820	5,580	9,480	
WA940	*2.5*	*3.0625*	*.25*	*2.7031*	*2.8587*	*.015*	*R*	*3,200*	*4,400*	*7,520*	58
	63.5	77.7875	6.35	68.66	72.61	.38	H	3,890	5,900	10,000	
WA948	*3*	*3.5625*	*.25*	*3.2031*	*3.3587*	*.015*	*R*	*3,350*	*5,050*	*8,720*	68
	76.2	90.4875	6.35	81.36	85.31	.38	H	4,120	6,890	11,800	
WA956	*3.5*	*4.0625*	*.25*	*3.7031*	*3.8587*	*.015*	*R*	*3,490*	*5,710*	*9,930*	79
	88.9	103.1875	6.35	94.06	98.01	.38	H	4,320	7,870	13,700	
WA964	*4*	*4.5625*	*.25*	*4.2031*	*4.3587*	*.015*	*R*	*3,660*	*6,470*	*11,300*	89
	101.6	115.8875	6.35	106.76	110.71	.38	H	4,470	8,750	15,300	
WA972	*4.5*	*5.0625*	*.25*	*4.7031*	*4.8587*	*.015*	*R*	*3,820*	*7,240*	*12,700*	100
	114.3	128.5875	6.35	119.46	123.41	.38	H	4,650	9,740	17,100	
WA980	*5*	*5.5625*	*.25*	*5.2031*	*5.3587*	*.015*	*R*	*3,930*	*7,900*	*13,900*	110
	127	141.2875	6.35	132.16	136.11	.38	H	4,820	10,700	18,900	
WA988	*5.5*	*6.0625*	*.25*	*5.7031*	*5.8587*	*.015*	*R*	*4,070*	*8,670*	*15,300*	120
	139.7	153.9875	6.35	144.86	148.81	.38	H	4,970	11,700	20,700	
WA996	*6*	*6.5625*	*.25*	*6.2031*	*6.3587*	*.015*	*R*	*4,170*	*9,330*	*16,500*	130
	152.4	166.6875	6.35	157.56	161.51	.38	H	5,120	12,700	22,500	
WA9104	*6.5*	*7.0625*	*.25*	*6.7031*	*6.8587*	*.015*	*R*	*4,300*	*10,100*	*17,900*	141
	165.1	179.3875	6.35	170.26	174.21	.38	H	5,260	13,600	24,300	
WA9112	*7*	*7.5625*	*.25*	*7.2031*	*7.3587*	*.015*	*R*	*4,390*	*10,700*	*19,100*	151
	177.8	192.0875	6.35	182.96	186.91	.38	H	5,400	14,670	26,100	

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 Capacity values for version N are close to version H.

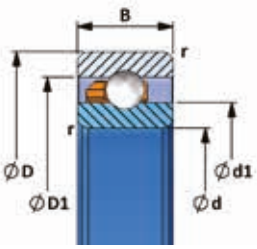
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

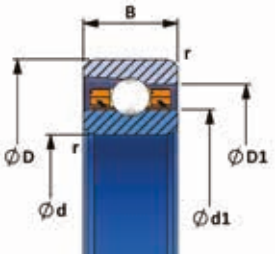
BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 8 INCHES (d 203.2 MM)

1 I Series A10 - Inch series

Constant ball diameter: 5/32 inch (3.969 mm)
Constant section
Versions E, R, H and N
Open ball bearing only
Width variant LA and EA
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA1032	*2*	*2.625*	*.3125*	*2.2154*	*2.4094*	*.04*	*R*	*4,630*	*5,870*	*6,350*	63
	50.8	66.675	7.937	56.27	61.2	1.015	H	5,540	7,720	8,120	
WA1040	*2.5*	*3.125*	*.3125*	*2.7154*	*2.9094*	*.04*	*R*	*5,070*	*7,390*	*7,900*	76
	63.5	79.375	7.937	68.97	73.9	1.015	H	5,970	9,490	9,870	
WA1048	*3*	*3.625*	*.3125*	*3.2154*	*3.4094*	*.04*	*R*	*5,250*	*8,430*	*8,940*	89
	76.2	92.075	7.937	81.67	86.6	1.015	H	6,440	11,500	11,800	
WA1056	*3.5*	*4.125*	*.3125*	*3.7154*	*3.9094*	*.04*	*R*	*5,600*	*9,940*	*10,400*	103
	88.9	104.775	7.937	94.37	99.3	1.015	H	6,780	13,200	13,600	
WA1064	*4*	*4.625*	*.3125*	*4.2154*	*4.4094*	*.04*	*R*	*5,920*	*11,400*	*12,000*	116
	101.6	117.475	7.937	107.07	112	1.015	H	7,090	15,000	15,300	
WA1068	*4.25*	*4.875*	*.3125*	*4.4654*	*4.6594*	*.04*	*R*	*5,990*	*11,900*	*12,500*	123
	107.95	123.825	7.937	113.42	118.35	1.015	H	7,270	16,000	16,400	
WA1072	*4.5*	*5.125*	*.3125*	*4.7154*	*4.9094*	*.04*	*R*	*6,140*	*12,700*	*13,300*	130
	114.3	130.175	7.937	119.77	124.7	1.015	H	7,440	17,000	17,400	
WA1076	*4.75*	*5.375*	*.3125*	*4.9654*	*5.1594*	*.04*	*R*	*6,280*	*13,500*	*14,100*	137
	120.65	136.525	7.937	126.12	131.05	1.015	H	7,540	17,800	18,100	
WA1080	*5*	*5.625*	*.3125*	*5.2154*	*5.4094*	*.04*	*R*	*6,410*	*14,200*	*14,800*	143
	127	142.875	7.937	132.47	137.4	1.015	H	7,700	18,800	19,100	
WA1088	*5.5*	*6.125*	*.3125*	*5.7154*	*5.9094*	*.04*	*R*	*6,600*	*15,500*	*16,100*	157
	139.7	155.575	7.937	145.17	150.1	1.015	H	7,950	20,600	20,900	
WA1096	*6*	*6.625*	*.3125*	*6.2154*	*6.4094*	*.04*	*R*	*6,770*	*16,800*	*17,400*	170
	152.4	168.275	7.937	157.87	162.8	1.015	H	8,180	22,300	22,600	
WA10104	*6.5*	*7.125*	*.3125*	*6.7154*	*6.9094*	*.04*	*R*	*7,010*	*18,300*	*19,000*	184
	165.1	180.975	7.937	170.57	175.5	1.015	H	8,400	24,100	24,300	
WA10112	*7*	*7.625*	*.3125*	*7.2154*	*7.4094*	*.04*	*R*	*7,230*	*19,800*	*20,500*	197
	177.8	193.675	7.937	183.27	188.2	1.015	H	8,670	26,100	26,300	
WA10120	*7.5*	*8.125*	*.3125*	*7.7154*	*7.9094*	*.04*	*R*	*7,320*	*20,800*	*21,600*	210
	190.5	206.375	7.937	195.97	200.9	1.015	H	8,870	27,900	28,100	
WA10128	*8*	*8.625*	*.3125*	*8.2154*	*8.4094*	*.04*	*R*	*7,470*	*22,100*	*22,900*	224
	203.2	219.075	7.937	208.67	213.6	1.015	H	9,070	29,700	29,800	

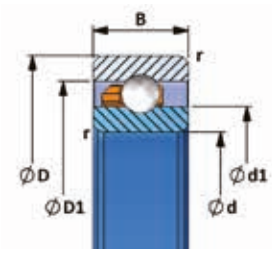
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

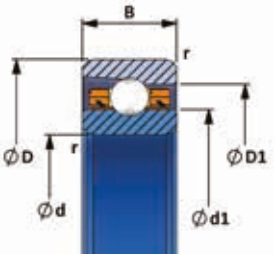
BORE DIAMETER d FROM 2.5625 INCHES (d 65.0875 MM) TO 6.8125 INCHES (d 173.0375 MM)

1 I Series A11 - Inch series

Constant ball diameter: 3/16 inch (4.762 mm)
Constant section
Versions E, R, H and N
Open ball bearing for all versions
Ball bearing with shields on versions E and R
Ball bearing with two shields on versions E
Width variant LA and EA: .3750"(9.525 mm)
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA1141	*2.5625*	*3.25*	*.3125*	*2.7896*	*3.0228*	*.015*	*R*	*6,520*	*8,840*	*9,650*	87
	65.0875	82.55	7.937	70.856	76.78	.38	H	8,110	12,200	13,300	
WA1145	*2.8125*	*3.5*	*.3125*	*3.0396*	*3.2728*	*.015*	*R*	*6,860*	*9,920*	*10,700*	94
	71.4375	88.9	7.937	77.206	83.13	.38	H	8,360	13,300	14,500	
WA1149	*3.0625*	*3.75*	*.3125*	*3.2896*	*3.5228*	*.015*	*R*	*7,030*	*10,600*	*11,500*	102
	77.7875	95.25	7.937	83.556	89.48	.38	H	8,610	14,400	15,600	
WA1153	*3.3125*	*4*	*.3125*	*3.5396*	*3.7728*	*.015*	*R*	*7,180*	*11,400*	*12,200*	109
	84.1375	101.6	7.937	89.906	95.83	.38	H	8,840	15,500	16,700	
WA1161	*3.8125*	*4.5*	*.3125*	*4.0396*	*4.2728*	*.015*	*R*	*7,480*	*12,800*	*13,700*	123
	96.8375	114.3	7.937	102.606	108.53	.38	H	9,260	17,700	18,900	
WA1169	*4.3125*	*5*	*.3125*	*4.5396*	*4.7728*	*.015*	*R*	*7,880*	*14,700*	*15,500*	138
	109.5375	127	7.937	115.306	121.23	.38	H	9,660	19,900	21,100	
WA1177	*4.8125*	*5.5*	*.3125*	*5.0396*	*5.2728*	*.015*	*R*	*8,130*	*16,100*	*17,000*	153
	122.2375	139.7	7.937	128.006	133.93	.38	H	9,920	21,800	23,000	
WA1185	*5.3125*	*6*	*.3125*	*5.5396*	*5.7728*	*.015*	*R*	*8,360*	*17,600*	*18,500*	168
	134.9375	152.4	7.937	140.706	146.63	.38	H	10,200	24,000	25,200	
WA1193	*5.8125*	*6.5*	*.3125*	*6.0396*	*6.2728*	*.015*	*R*	*8,690*	*19,400*	*20,300*	183
	147.6375	165.1	7.937	153.406	159.33	.38	H	10,600	26,200	27,400	
WA11101	*6.3125*	*7*	*.3125*	*6.5396*	*6.7728*	*.015*	*R*	*8,900*	*20,900*	*21,800*	197
	160.3375	177.8	7.937	166.106	172.03	.38	H	10,900	28,400	29,600	
WA11109	*6.8125*	*7.5*	*.3125*	*7.0396*	*7.2728*	*.015*	*R*	*9,110*	*22,400*	*23,300*	212
	173.0375	190.5	7.937	178.806	184.73	.38	H	11,200	30,600	31,800	

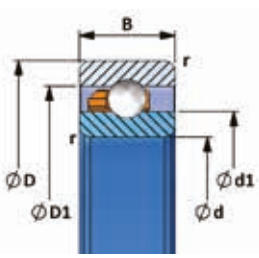
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

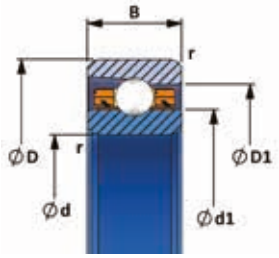
BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 10 INCHES (d 254 MM)

1 I Series A12 - Inch series

Constant ball diameter: 3/16 inch (4.762 mm)
Constant section
Versions E, R, H and N
Open ball bearing only
Width variant LA and EA
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA1264	*4*	*4.75*	*.375*	*4.2583*	*4.4917*	*.04*	*R*	*7,760*	*13,900*	*14,800*	172
	101.6	120.65	9.525	108.16	114.09	1.015	H	9,250	18,100	19,200	
WA1268	*4.25*	*5*	*.375*	*4.5083*	*4.7417*	*.04*	*R*	*7,890*	*14,700*	*15,500*	181
	107.95	127	9.525	114.51	120.44	1.015	H	9,450	19,200	20,300	
WA1272	*4.5*	*5.25*	*.375*	*4.7583*	*4.9917*	*.04*	*R*	*8,020*	*15,400*	*16,300*	191
	114.3	133.35	9.525	120.86	126.79	1.015	H	9,640	20,300	21,500	
WA1276	*4.75*	*5.5*	*.375*	*5.0083*	*5.2417*	*.04*	*R*	*8,140*	*16,100*	*17,000*	204
	120.65	139.7	9.525	127.21	133.14	1.015	H	9,830	21,400	22,600	
WA1280	*5*	*5.75*	*.375*	*5.2583*	*5.4917*	*.04*	*R*	*8,380*	*17,200*	*18,100*	211
	127	146.05	9.525	133.56	139.49	1.015	H	10,000	22,500	23,700	
WA1288	*5.5*	*6.25*	*.375*	*5.7583*	*5.9917*	*.04*	*R*	*8,600*	*18,700*	*19,600*	230
	139.7	158.75	9.525	146.26	152.19	1.015	H	10,300	24,700	25,900	
WA1296	*6*	*6.75*	*.375*	*6.2583*	*6.4917*	*.04*	*R*	*8,920*	*20,500*	*21,400*	250
	152.4	171.45	9.525	158.96	164.89	1.015	H	10,600	26,900	28,100	
WA12104	*6.5*	*7.25*	*.375*	*6.7583*	*6.9917*	*.04*	*R*	*9,120*	*22,000*	*22,900*	269
	165.1	184.15	9.525	171.66	177.59	1.015	H	10,900	29,100	30,300	
WA12112	*7*	*7.75*	*.375*	*7.2583*	*7.4917*	*.04*	*R*	*9,400*	*23,800*	*24,800*	289
	177.8	196.85	9.525	184.36	190.29	1.015	H	11,200	31,300	32,500	
WA12120	*7.5*	*8.25*	*.375*	*7.7583*	*7.9917*	*.04*	*R*	*9,580*	*25,300*	*26,200*	309
	190.5	209.55	9.525	197.06	202.99	1.015	H	11,500	33,500	34,700	
WA12128	*8*	*8.75*	*.375*	*8.2583*	*8.4917*	*.04*	*R*	*9,850*	*27,100*	*28,100*	328
	203.2	222.25	9.525	209.76	215.69	1.015	H	11,800	35,700	36,900	
WA12144	*9*	*9.75*	*.375*	*9.2583*	*9.4917*	*.04*	*R*	*10,100*	*30,100*	*31,000*	366
	228.6	247.65	9.525	235.16	241.09	1.015	H	12,300	40,100	41,400	
WA12160	*10*	*10.75*	*.375*	*10.2583*	*10.4917*	*.04*	*R*	*10,600*	*33,700*	*34,700*	406
	254	273.05	9.525	260.56	266.49	1.015	H	12,800	44,500	45,800	

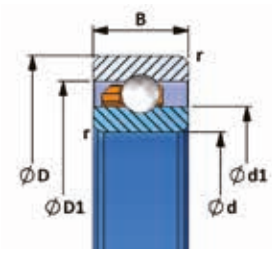
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

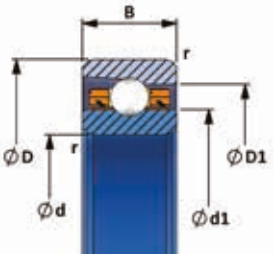
BORE DIAMETER d FROM 3.0625 INCHES (d 77.7875 MM) TO 10 INCHES (d 254 MM)

1 I Series A13 - Inch series

Constant ball diameter: 3/16 inch (4.762 mm)
Constant section
Versions E, R, H and N
Open ball bearing for all versions
Ball bearing with shields on versions E and R
Ball bearing with two shields on versions E
Width variant LA and EA: .3750"(9.525 mm)
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA1349	*3.0625*	*3.875*	*.3125*	*3.3521*	*3.5854*	*.015*	*R*	*7,140*	*11,000*	*11,800*	130
	77.7875	98.425	7.937	85.144	91.07	.38	H	8,560	14,400	15,500	
WA1356	*3.5*	*4.3125*	*.3125*	*3.7895*	*4.0228*	*.015*	*R*	*7,470*	*12,400*	*13,300*	147
	88.9	109.5375	7.937	96.254	102.18	.38	H	9,050	16,600	17,800	
WA1364	*4*	*4.8125*	*.3125*	*4.2895*	*4.5228*	*.015*	*R*	*7,750*	*13,900*	*14,800*	165
	101.6	122.2375	7.937	108.954	114.88	.38	H	9,470	18,800	20,000	
WA1372	*4.5*	*5.3125*	*.3125*	*4.7895*	*5.0228*	*.015*	*R*	*8,000*	*15,400*	*16,300*	184
	114.3	134.9375	7.937	121.654	127.58	.38	H	9,730	20,700	21,900	
WA1380	*5*	*5.8125*	*.3125*	*5.2895*	*5.5228*	*.015*	*R*	*8,250*	*16,900*	*17,800*	202
	127	147.6375	7.937	134.354	140.28	.38	H	10,100	22,900	24,100	
WA1388	*5.5*	*6.3125*	*.3125*	*5.7895*	*6.0228*	*.015*	*R*	*8,480*	*18,300*	*19,200*	221
	139.7	160.3375	7.937	147.054	152.98	.38	H	10,400	25,100	26,300	
WA1396	*6*	*6.8125*	*.3125*	*6.2895*	*6.5228*	*.015*	*R*	*8,700*	*19,800*	*20,700*	239
	152.4	173.0375	7.937	159.754	165.68	.38	H	10,700	27,300	28,500	
WA13104	*6.5*	*7.3125*	*.3125*	*6.7895*	*7.0228*	*.015*	*R*	*8,910*	*21,300*	*22,200*	258
	165.1	185.7375	7.937	172.454	178.38	.38	H	11,000	29,500	30,700	
WA13112	*7*	*7.8125*	*.3125*	*7.2895*	*7.5228*	*.015*	*R*	*9,110*	*22,800*	*23,600*	276
	177.8	198.4375	7.937	185.154	191.08	.38	H	11,300	31,700	32,900	
WA13120	*7.5*	*8.3125*	*.3125*	*7.7895*	*8.0228*	*.015*	*R*	*9,300*	*24,200*	*25,100*	295
	190.5	211.1375	7.937	197.854	203.78	.38	H	11,600	33,900	35,100	
WA13128	*8*	*8.8125*	*.3125*	*8.2895*	*8.5228*	*.015*	*R*	*9,490*	*25,700*	*26,600*	313
	203.2	223.8375	7.937	210.554	216.48	.38	H	11,800	36,100	37,300	
WA13144	*9*	*9.8125*	*.3125*	*9.2895*	*9.5228*	*.015*	*R*	*9,840*	*28,600*	*29,500*	350
	228.6	249.2375	7.937	235.954	241.88	.38	H	12,300	40,500	41,700	
WA13160	*10*	*10.8125*	*.3125*	*10.2895*	*10.5228*	*.015*	*R*	*10,100*	*31,600*	*32,500*	387
	254	274.6375	7.937	261.354	267.28	.38	H	12,800	44,900	46,100	

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 Capacity values for version N are close to version H.

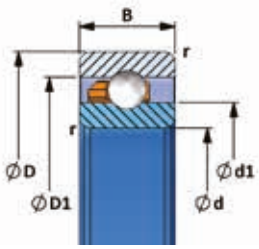
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

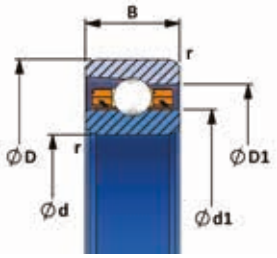
BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 12 INCHES (d 304.8 MM)

1 I Series A16 - Inch series

Constant ball diameter: 1/4 inch (6.35 mm)
Constant section
Versions R, H and N
Open ball bearing only
Tolerances: TA5, TA4
Position 7



Version R



Version H

Basic designation	Dimensions *in inches* / in mm						Version	Basic load rating N[2]			Mean mass[2]
								Radial		Axial static	
								Dyn.	Stat.		
	d	D	B	d1	D1	r[1]		C	Co	Cax	g
WA1664	*4*	*5*	*.5*	*4.3445*	*4.6555*	*.06*	*R*	*11,800*	*18,900*	*20,300*	312
	101.6	127	12.7	110.35	118.25	1.525	H	14,200	25,000	26,900	
WA1668	*4.25*	*5.25*	*.5*	*4.5945*	*4.9055*	*.06*	*R*	*11,850*	*19,600*	*21,000*	329
	107.95	133.35	12.7	116.7	124.6	1.525	H	14,400	26,300	28,200	
WA1672	*4.5*	*5.5*	*.5*	*4.8445*	*5.1555*	*.06*	*R*	*12,200*	*20,900*	*22,300*	346
	114.3	139.7	12.7	123.05	130.95	1.525	H	14,900	28,200	30,100	
WA1676	*4.75*	*5.75*	*.5*	*5.0945*	*5.4055*	*.06*	*R*	*12,500*	*22,200*	*23,600*	364
	120.65	146.05	12.7	129.4	137.3	1.525	H	15,100	29,600	31,400	
WA1680	*5*	*6*	*.5*	*5.3445*	*5.6555*	*.06*	*R*	*12,550*	*22,800*	*24,200*	380
	127	152.4	12.7	135.75	143.65	1.525	H	15,300	30,900	32,700	
WA1688	*5.5*	*6.5*	*.5*	*5.8445*	*6.1555*	*.06*	*R*	*13,100*	*25,400*	*26,800*	415
	139.7	165.1	12.7	148.45	156.35	1.525	H	15,900	34,000	36,000	
WA1696	*6*	*7*	*.5*	*6.3445*	*6.6555*	*.06*	*R*	*13,400*	*27,400*	*28,800*	450
	152.4	177.8	12.7	161.15	169.05	1.525	H	16,300	36,700	38,600	
WA16104	*6.5*	*7.5*	*.5*	*6.8445*	*7.1555*	*.06*	*R*	*13,700*	*29,300*	*30,700*	484
	165.1	190.5	12.7	173.85	181.75	1.525	H	16,700	39,300	41,200	
WA16112	*7*	*8*	*.5*	*7.3445*	*7.6555*	*.06*	*R*	*14,200*	*31,900*	*33,300*	519
	177.8	203.2	12.7	186.55	194.45	1.525	H	17,000	42,000	43,800	
WA16120	*7.5*	*8.5*	*.5*	*7.8445*	*8.1555*	*.06*	*R*	*14,500*	*33,900*	*35,300*	553
	190.5	215.9	12.7	199.25	207.15	1.525	H	17,500	45,200	47,000	
WA16128	*8*	*9*	*.5*	*8.3445*	*8.6555*	*.06*	*R*	*14,700*	*35,900*	*37,200*	587
	203.2	228.6	12.7	211.95	219.85	1.525	H	17,900	47,800	49,600	
WA16144	*9*	*10*	*.5*	*9.3445*	*9.6555*	*.06*	*R*	*15,400*	*40,400*	*41,800*	657
	228.6	254	12.7	237.35	245.25	1.525	H	18,600	53,700	55,500	
WA16160	*10*	*11*	*.5*	*10.3445*	*10.6555*	*.06*	*R*	*16,000*	*45,000*	*46,300*	726
	254	279.4	12.7	262.75	270.65	1.525	H	19,300	59,500	61,300	
WA16176	*11*	*12*	*.5*	*11.3445*	*11.6555*	*.06*	*R*	*16,500*	*48,900*	*50,200*	794
	279.4	304.8	12.7	288.15	296.05	1.525	H	19,900	64,800	66,500	
WA16192	*12*	*13*	*.5*	*12.3445*	*12.6555*	*.06*	*R*	*16,900*	*52,800*	*54,100*	863
	304.8	330.2	12.7	313.55	321.45	1.525	H	20,500	70,600	72,400	

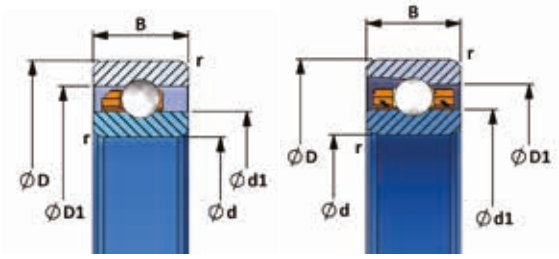
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 12 INCHES (d 304.8 MM)

1 I Series A24 - Inch series

Constant ball diameter: 3/8 inch (9.525 mm)
Constant section
Versions R, H and N
Open ball bearing only
Tolerances: TA5, TA4
Position 7



Version R Version H

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WA2464	*4*	*5.5*	*.75*	*4.5169*	*4.9831*	*.075*	*21,400*	*29,400*	*32,600*	746
	101.6	139.7	19.05	114.73	126.57	1.905	26,300	40,100	44,500	
WA2468	*4.25*	*5.75*	*.75*	*4.7669*	*5.2331*	*.075*	*21,700*	*30,900*	*34,100*	784
	107.95	146.05	19.05	121.08	132.92	1.905	27,100	43,000	47,500	
WA2472	*4.5*	*6*	*.75*	*5.0169*	*5.4831*	*.075*	*22,700*	*33,700*	*37,100*	826
	114.3	152.4	19.05	127.43	139.27	1.905	27,300	44,500	49,000	
WA2476	*4.75*	*6.25*	*.75*	*5.2669*	*5.7331*	*.075*	*23,000*	*35,200*	*38,600*	865
	120.65	158.75	19.05	133.78	145.62	1.905	28,100	47,400	52,000	
WA2480	*5*	*6.5*	*.75*	*5.5169*	*5.9831*	*.075*	*23,300*	*36,700*	*40,200*	904
	127	165.1	19.05	140.13	151.97	1.905	28,300	48,900	53,600	
WA2488	*5.5*	*7*	*.75*	*6.0169*	*6.4831*	*.075*	*23,900*	*39,600*	*43,200*	981
	139.7	177.8	19.05	152.83	164.67	1.905	29,200	53,300	58,100	
WA2496	*6*	*7.5*	*.75*	*6.5169*	*6.9831*	*.075*	*25,000*	*44,000*	*47,800*	1,070
	152.4	190.5	19.05	165.53	177.37	1.905	30,000	57,700	62,700	
WA24104	*6.5*	*8*	*.75*	*7.0169*	*7.4831*	*.075*	*25,600*	*46,900*	*50,700*	1,140
	165.1	203.2	19.05	178.23	190.07	1.905	30,800	62,200	67,200	
WA24112	*7*	*8.5*	*.75*	*7.5169*	*7.9831*	*.075*	*26,100*	*49,900*	*53,700*	1,220
	177.8	215.9	19.05	190.93	202.77	1.905	31,600	66,600	71,600	
WA24120	*7.5*	*9*	*.75*	*8.0169*	*8.4831*	*.075*	*27,000*	*54,300*	*58,100*	1,300
	190.5	228.6	19.05	203.63	215.47	1.905	32,300	71,000	76,100	
WA24128	*8*	*9.5*	*.75*	*8.5169*	*8.9831*	*.075*	*27,500*	*57,200*	*61,100*	1,380
	203.2	241.3	19.05	216.33	228.17	1.905	33,000	75,400	80,500	
WA24144	*9*	*10.5*	*.75*	*9.5169*	*9.9831*	*.075*	*28,700*	*64,500*	*68,500*	1,540
	228.6	266.7	19.05	241.73	253.57	1.905	34,300	84,200	89,400	
WA24160	*10*	*11.5*	*.75*	*10.5169*	*10.9831*	*.075*	*29,500*	*70,400*	*74,400*	1,690
	254	292.1	19.05	267.13	278.97	1.905	35,900	94,400	99,700	
WA24176	*11*	*12.5*	*.75*	*11.5169*	*11.9831*	*.075*	*30,700*	*77,800*	*81,800*	1,850
	279.4	317.5	19.05	292.53	304.37	1.905	37,000	103,200	108,600	
WA24192	*12*	*13.5*	*.75*	*11.5169*	*11.9831*	*.075*	*30,700*	*77,800*	*81,800*	1,950
	304.8	342.9	19.05	317.92	329.77	1.905	37,500	109,200	113,100	

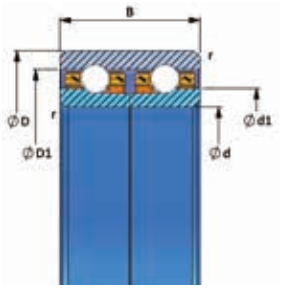
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM .5 INCH (d 12.7 MM) TO 1.625 INCH (d 41.275 MM)

2 I Series AD4, super duplex - Inch series

Constant ball diameter: 1/16 inch (1.588 mm)
Constant section
Version H
Duplex configuration back-to-back
Preload value upon request
Tolerances: TA5, TA4
Position 7



AD and AF versions

Identical table in size and capacity for the super duplex AD series preloaded back-to-back (DO) (see p21 for more information)

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
AD408	*.5*	*.75*	*.3125*	*.5835*	*.6669*	*.01*	1,280	1,290	740	6.7
	12.7	19.05	7.937	14.82	16.94	.25				
AD412	*.75*	*1*	*.3125*	*.8335*	*.9169*	*.01*	1,470	1,780	1,040	9.4
	19.05	25.4	7.937	21.17	23.29	.25				
AD420	*1.25*	*1.5*	*.3125*	*1.3335*	*1.4169*	*.01*	1,640	2,540	1,530	15
	31.75	38.1	7.937	33.87	35.99	.25				
AD424	*1.5*	*1.75*	*.3125*	*1.5835*	*1.6669*	*.01*	1,740	2,970	1,820	18
	38.1	44.45	7.937	40.22	42.34	.25				
AD426	*1.625*	*1.875*	*.3125*	*1.7083*	*1.7917*	*.01*	1,790	3,190	1,960	19
	41.275	47.625	7.937	43.39	45.51	.25				

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

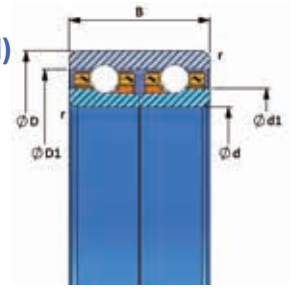
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM .6250 INCH (d 15.875 MM) TO 2.5625 INCHES (d 65.0875 MM)

2 I Series AD7, super duplex - Inch series

Constant ball diameter: 3/32 inch (2.381 mm)
Constant section
Versions H and B
Duplex configuration back-to-back
Preload value upon request
Tolerances: TA5, TA4
Position 7



AD and AF versions

Identical table in size and capacity for the super duplex AD series preloaded back-to-back (DO) (see p21 for more information)

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAD710	*.625*	*1.0625*	*.375*	*.7661*	*.8827*	*.015*	2,200	2,100	1,620	21
	15.875	26.9875	9.525	19.46	22.42	.38				
WAD712	*.75*	*1.1875*	*.375*	*.8909*	*1.0075*	*.015*	2,300	2,340	1,840	24
	19.05	30.1625	9.525	22.63	25.59	.38				
WAD713	*.8125*	*1.25*	*.375*	*.9535*	*1.0701*	*.015*	2,340	2,460	1,950	25
	20.6375	31.75	9.525	24.22	27.18	.38				
WAD714	*.875*	*1.3125*	*.375*	*1.0161*	*1.1327*	*.015*	2,390	2,590	2,070	27
	22.225	33.3375	9.525	25.81	28.77	.38				
WAD717	*1.0625*	*1.5*	*.375*	*1.2035*	*1.3201*	*.015*	2,510	2,950	2,400	31
	26.9875	38.1	9.525	30.57	33.53	.38				
WAD721	*1.3125*	*1.75*	*.375*	*1.4535*	*1.5701*	*.015*	2,720	3,570	2,960	37
	33.3375	44.45	9.525	36.92	39.88	.38				
WAD725	*1.5625*	*2*	*.375*	*1.7035*	*1.8201*	*.015*	2,840	4,060	3,410	43
	39.6875	50.8	9.525	43.27	46.23	.38				
WAD729	*1.8125*	*2.25*	*.375*	*1.9535*	*2.0701*	*.015*	3,010	4,680	3,970	49
	46.0375	57.15	9.525	49.62	52.58	.38				
WAD733	*2.0625*	*2.5*	*.375*	*2.2035*	*2.3201*	*.015*	3,850	7,110	6,080	57
	52.3875	63.5	9.525	55.97	58.93	.38				
WAD737	*2.3125*	*2.75*	*.375*	*2.4535*	*2.5701*	*.015*	3,990	7,850	6,750	63
	58.7375	69.85	9.525	62.32	65.28	.38				
WAD741	*2.5625*	*3*	*.375*	*2.7035*	*2.8201*	*.015*	4,130	8,590	7,420	69
	65.0875	76.2	9.525	68.67	71.63	.38				

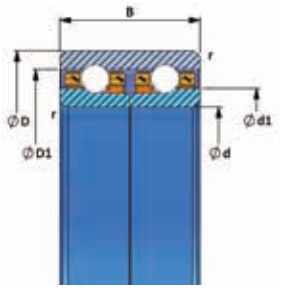
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 7 INCHES (d 177.8 MM)

2 I Series AD8, super duplex - Inch series

Constant ball diameter: 3/32 inch (2.381 mm)
Constant section
Version H
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AD and AF versions

Identical table in size and capacity for the super duplex AD series preloaded back-to-back (DO) (see p21 for more information)

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAD832	*2*	*2.5*	*.375*	*2.1913*	*2.3083*	*.015*	3,810	6,980	5,790	66
	50.8	63.5	9.525	55.66	58.63	.38				
WAD840	*2.5*	*3*	*.375*	*2.6913*	*2.8083*	*.015*	4,090	8,460	7,090	80
	63.5	76.2	9.525	68.36	71.33	.38				
WAD848	*3*	*3.5*	*.375*	*3.1913*	*3.3083*	*.015*	4,340	9,940	8,400	95
	76.2	88.9	9.525	81.06	84.03	.38				
WAD856	*3.5*	*4*	*.375*	*3.6913*	*3.8083*	*.015*	4,560	11,400	9,700	110
	88.9	101.6	9.525	93.76	96.73	.38				
WAD864	*4*	*4.5*	*.375*	*4.1913*	*4.3083*	*.015*	4,740	12,700	10,800	124
	101.6	114.3	9.525	106.46	109.43	.38				
WAD868	*4.25*	*4.75*	*.375*	*4.4413*	*4.5583*	*.015*	4,840	13,500	11,500	131
	107.95	120.65	9.525	112.81	115.78	.38				
WAD872	*4.5*	*5*	*.375*	*4.6913*	*4.8083*	*.015*	4,930	14,200	12,200	139
	114.3	127	9.525	119.16	122.13	.38				
WAD876	*4.75*	*5.25*	*.375*	*4.9413*	*5.0583*	*.015*	5,020	14,900	12,800	146
	120.65	133.35	9.525	125.51	128.48	.38				
WAD880	*5*	*5.5*	*.375*	*5.1913*	*5.3083*	*.015*	5,110	15,700	13,500	153
	127	139.7	9.525	131.86	134.83	.38				
WAD888	*5.5*	*6*	*.375*	*5.6913*	*5.8083*	*.015*	5,280	17,200	14,800	168
	139.7	152.4	9.525	144.56	147.53	.38				
WAD896	*6*	*6.5*	*.375*	*6.1913*	*6.3083*	*.015*	5,450	18,600	16,100	183
	152.4	165.1	9.525	157.26	160.23	.38				
WAD8104	*6.5*	*7*	*.375*	*6.6913*	*6.8083*	*.015*	5,600	20,100	17,400	197
	165.1	177.8	9.525	169.96	172.93	.38				
WAD8112	*7*	*7.5*	*.375*	*7.1913*	*7.3083*	*.015*	5,720	21,500	18,600	212
	177.8	190.5	9.525	182.66	185.63	.38				

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

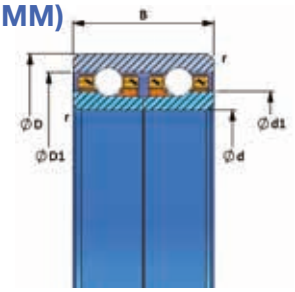
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2.0625 INCHES (d 52.3875 MM) TO 7 INCHES (d 177.8 MM)

2 I Series AD9, super duplex - Inch series

Constant ball diameter: 3/32 inch (2.381 mm)
Constant section
Versions H and B
Duplex configuration back-to-back
Preload value upon request
Tolerances: TA5, TA4
Position 7



AD and AF versions

Identical table in size and capacity for the super duplex AD series preloaded back-to-back (DO) (see p21 for more information)

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAD933	*2.0625*	*2.625*	*.375*	*2.2657*	*2.3823*	*.015*	3,140	5,290	4,530	79
	52.3875	66.675	9.525	57.55	60.51	.38				
WAD937	*2.3125*	*2.875*	*.375*	*2.5157*	*2.6323*	*.015*	3,280	5,910	5,090	87
	58.7375	73.025	9.525	63.9	66.86	.38				
WAD940	*2.5*	*3.0625*	*.375*	*2.7031*	*2.8197*	*.015*	4,130	8,590	7,420	95
	63.5	77.7875	9.525	68.66	71.62	.38				
WAD948	*3*	*3.5625*	*.375*	*3.2031*	*3.3197*	*.015*	4,370	10,000	8,760	112
	76.2	90.4875	9.525	81.36	84.32	.38				
WAD956	*3.5*	*4.0625*	*.375*	*3.7031*	*3.8197*	*.015*	4,560	11,400	10,000	129
	88.9	103.1875	9.525	94.06	97.02	.38				
WAD964	*4*	*4.5625*	*.375*	*4.2031*	*4.3197*	*.015*	4,770	12,800	11,300	146
	101.6	115.8875	9.525	106.76	109.72	.38				
WAD972	*4.5*	*5.0625*	*.375*	*4.7031*	*4.8197*	*.015*	4,960	14,300	12,600	163
	114.3	128.5875	9.525	119.46	122.42	.38				
WAD980	*5*	*5.5625*	*.375*	*5.2031*	*5.3197*	*.015*	5,140	15,800	14,000	180
	127	141.2875	9.525	132.16	135.12	.38				
WAD988	*5.5*	*6.0625*	*.375*	*5.7031*	*5.8197*	*.015*	5,310	17,300	15,300	197
	139.7	153.9875	9.525	144.86	147.82	.38				
WAD996	*6*	*6.5625*	*.375*	*6.2031*	*6.3197*	*.015*	5,470	18,800	16,700	214
	152.4	166.6875	9.525	157.56	160.52	.38				
WAD9104	*6.5*	*7.0625*	*.375*	*6.7031*	*6.8197*	*.015*	5,600	20,100	17,900	230
	165.1	179.3875	9.525	170.26	173.22	.38				
WAD9112	*7*	*7.5625*	*.375*	*7.2031*	*7.3197*	*.015*	5,740	21,600	19,200	247
	177.8	192.0875	9.525	182.96	185.92	.38				

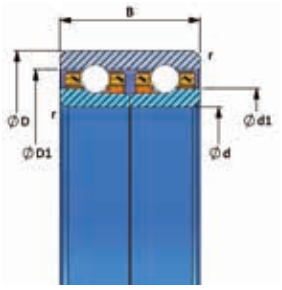
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 8 INCHES (d 203.2 MM)

2 I Series AD10, super duplex - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Version H
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AD and AF versions

Identical table in size and capacity for the super duplex AD series preloaded back-to-back (DO) (see p21 for more information)

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAD1032	*2*	*2.625*	*.5*	*2.2346*	*2.3906*	*.025*	5,890	9,830	8,230	110
	50.8	66.675	12.7	56.76	60.72	.635				
WAD1040	*2.5*	*3.125*	*.5*	*2.7346*	*2.8906*	*.025*	6,310	11,800	10,000	134
	63.5	79.375	12.7	69.46	73.42	.635				
WAD1048	*3*	*3.625*	*.5*	*3.2346*	*3.3906*	*.025*	6,670	13,700	11,800	157
	76.2	92.075	12.7	82.16	86.12	.635				
WAD1056	*3.5*	*4.125*	*.5*	*3.7346*	*3.8906*	*.025*	7,010	15,700	13,600	181
	88.9	104.775	12.7	94.86	98.82	.635				
WAD1064	*4*	*4.625*	*.5*	*4.2346*	*4.3906*	*.025*	7,250	17,500	15,200	205
	101.6	117.475	12.7	107.56	111.52	.635				
WAD1068	*4.25*	*4.875*	*.5*	*4.4846*	*4.6406*	*.025*	7,430	18,600	16,200	217
	107.95	123.825	12.7	113.91	117.87	.635				
WAD1072	*4.5*	*5.125*	*.5*	*4.7346*	*4.8906*	*.025*	7,540	19,400	17,000	229
	114.3	130.175	12.7	120.26	124.22	.635				
WAD1076	*4.75*	*5.375*	*.5*	*4.9846*	*5.1406*	*.025*	7,710	20,500	18,000	241
	120.65	136.525	12.7	126.61	130.57	.635				
WAD1080	*5*	*5.625*	*.5*	*5.2346*	*5.3906*	*.025*	7,810	21,400	18,800	252
	127	142.875	12.7	132.96	136.92	.635				
WAD1088	*5.5*	*6.125*	*.5*	*5.7346*	*5.8906*	*.025*	8,070	23,400	20,600	276
	139.7	155.575	12.7	145.66	149.62	.635				
WAD1096	*6*	*6.625*	*.5*	*6.2346*	*6.3906*	*.025*	8,310	25,400	22,300	300
	152.4	168.275	12.7	158.36	162.32	.635				
WAD10104	*6.5*	*7.125*	*.5*	*6.7346*	*6.8906*	*.025*	8,540	27,300	24,100	324
	165.1	180.975	12.7	171.06	175.02	.635				
WAD10112	*7*	*7.625*	*.5*	*7.2346*	*7.3906*	*.025*	8,760	29,300	25,900	348
	177.8	193.675	12.7	183.76	187.72	.635				
WAD10120	*7.5*	*8.125*	*.5*	*7.7346*	*7.8906*	*.025*	8,970	31,330	27,770	372
	190.5	206.375	12.7	196.46	200.42	.635				
WAD10128	*8*	*8.625*	*.5*	*8.2346*	*8.3906*	*.025*	9,140	33,080	29,370	395
	203.2	219.075	12.7	209.16	213.12	.635				

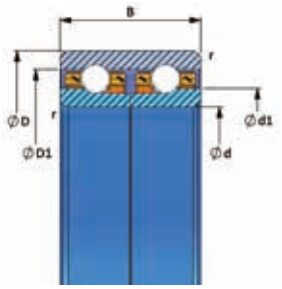
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 10 INCHES (d 254 MM)

2 I Series AD12, super duplex - Inch series

Constant ball diameter: 5/32 inch (3.969 mm)
Constant section
Version H
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AD and AF versions

Identical table in size and capacity for the super duplex AD series preloaded back-to-back (DO) (see p21 for more information)

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAD1264	*4*	*4.75*	*.625*	*4.278*	*4.472*	*.04*	11,600	30,700	16,100	305
	101.6	120.65	15.875	108.66	113.59	1.015				
WAD1268	*4.25*	*5*	*.625*	*4.528*	*4.722*	*.04*	11,900	32,700	17,100	323
	107.95	127	15.875	115.01	119.94	1.015				
WAD1272	*4.5*	*5.25*	*.625*	*4.778*	*4.972*	*.04*	12,100	34,300	17,900	340
	114.3	133.35	15.875	121.36	126.29	1.015				
WAD1276	*4.75*	*5.5*	*.625*	*5.028*	*5.222*	*.04*	12,300	36,300	18,900	358
	120.65	139.7	15.875	127.71	132.64	1.015				
WAD1280	*5*	*5.75*	*.625*	*5.278*	*5.472*	*.04*	12,500	37,800	19,700	375
	127	146.05	15.875	134.06	138.99	1.015				
WAD1288	*5.5*	*6.25*	*.625*	*5.778*	*5.972*	*.04*	12,900	41,400	21,400	410
	139.7	158.75	15.875	146.76	151.69	1.015				
WAD1296	*6*	*6.75*	*.625*	*6.278*	*6.472*	*.04*	13,300	45,000	23,200	445
	152.4	171.45	15.875	159.46	164.39	1.015				
WAD12104	*6.5*	*7.25*	*.625*	*6.778*	*6.972*	*.04*	13,700	49,000	25,200	480
	165.1	184.15	15.875	172.16	177.09	1.015				
WAD12112	*7*	*7.75*	*.625*	*7.278*	*7.472*	*.04*	14,100	52,600	27,000	515
	177.8	196.85	15.875	184.86	189.79	1.015				
WAD12120	*7.5*	*8.25*	*.625*	*7.778*	*7.972*	*.04*	14,400	56,100	28,800	550
	190.5	209.55	15.875	197.56	202.49	1.015				
WAD12128	*8*	*8.75*	*.625*	*8.278*	*8.472*	*.04*	14,700	59,700	30,600	585
	203.2	222.25	15.875	210.26	215.19	1.015				
WAD12144	*9*	*9.75*	*.625*	*9.278*	*9.472*	*.04*	15,300	66,800	34,100	655
	228.6	247.65	15.875	235.66	240.59	1.015				
WAD12160	*10*	*10.75*	*.625*	*10.278*	*10.472*	*.04*	15,900	74,000	37,700	725
	254	273.05	15.875	261.06	265.99	1.015				

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

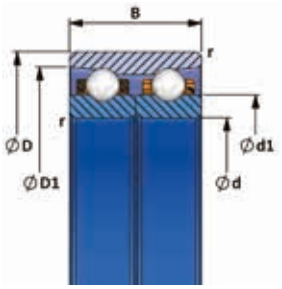
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM .875 INCH (d 22.225 MM) TO 2.5 INCHES (d 63.5 MM)

2 I Series AA6, super duplex - Inch series

Constant ball diameter: 3/32 inch (2.381 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA614	*.875*	*1.25*	*.375*	*1.0043*	*1.1665*	*.01*	3,030	3,680	2,950	21
	22.225	31.75	9.525	25.51	29.63	.25				
WAA616	*1*	*1.375*	*.375*	*1.1291*	*1.2913*	*.01*	3,150	4,050	3,250	24
	25.4	34.925	9.525	28.68	32.8	.25				
WAA618	*1.125*	*1.5*	*.375*	*1.2543*	*1.4161*	*.01*	3,250	4,420	3,630	26
	28.575	38.1	9.525	31.86	35.97	.25				
WAA620	*1.25*	*1.625*	*.375*	*1.3791*	*1.5409*	*.01*	3,290	4,650	3,810	29
	31.75	41.275	9.525	35.03	39.14	.25				
WAA622	*1.375*	*1.75*	*.375*	*1.5043*	*1.6657*	*.01*	3,380	5,020	4,190	31
	34.925	44.45	9.525	38.21	42.31	.25				
WAA624	*1.5*	*1.875*	*.375*	*1.6291*	*1.7906*	*.01*	3,470	5,390	4,470	33
	38.1	47.625	9.525	41.38	45.48	.25				
WAA628	*1.75*	*2.125*	*.375*	*1.8791*	*2.0402*	*.01*	3,590	6,000	5,030	38
	44.45	53.975	9.525	47.73	51.82	.25				
WAA632	*2*	*2.375*	*.375*	*2.1291*	*2.2898*	*.01*	3,800	6,860	5,800	44
	50.8	60.325	9.525	54.08	58.16	.25				
WAA640	*2.5*	*2.875*	*.375*	*2.6291*	*2.789*	*.01*	4,080	8,340	7,140	53
	63.5	73.025	9.525	66.78	70.84	.25				

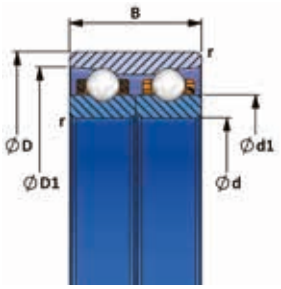
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM .625 INCH (d 15.875 MM) TO 2.5625 INCHES (d 65.0875 MM)

2 I Series AA7, super duplex - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA710	*.625*	*1.0625*	*.5*	*.7661*	*.9843*	*.015*	3,940	3,890	2,870	25
	15.875	26.9875	12.7	19.46	25	.38				
WAA712	*.75*	*1.1875*	*.5*	*.8909*	*1.1091*	*.015*	4,310	4,580	3,460	28
	19.05	30.1625	12.7	22.63	28.17	.38				
WAA713	*.8125*	*1.25*	*.5*	*.9535*	*1.1713*	*.015*	4,410	4,790	3,670	30
	20.6375	31.75	12.7	24.22	29.75	.38				
WAA714	*.875*	*1.3125*	*.5*	*1.0161*	*1.2339*	*.015*	4,490	5,010	3,870	32
	22.225	33.3375	12.7	25.81	31.34	.38				
WAA717	*1.0625*	*1.5*	*.5*	*1.2035*	*1.4209*	*.015*	4,860	5,900	4,670	37
	26.9875	38.1	12.7	30.57	36.09	.38				
WAA721	*1.3125*	*1.75*	*.5*	*1.4535*	*1.6705*	*.015*	5,110	6,760	5,470	45
	33.3375	44.45	12.7	36.92	42.43	.38				
WAA725	*1.5625*	*2*	*.5*	*1.7035*	*1.9201*	*.015*	5,550	8,100	6,670	52
	39.6875	50.8	12.7	43.27	48.77	.38				
WAA729	*1.8125*	*2.25*	*.5*	*1.9535*	*2.1697*	*.015*	5,740	8,970	7,480	60
	46.0375	57.15	12.7	49.62	55.11	.38				
WAA733	*2.0625*	*2.5*	*.5*	*2.2035*	*2.4193*	*.015*	5,920	9,840	8,280	67
	52.3875	63.5	12.7	55.97	61.45	.38				
WAA737	*2.3125*	*2.75*	*.5*	*2.4535*	*2.6689*	*.015*	6,090	10,700	9,090	74
	58.7375	69.85	12.7	62.32	67.79	.38				
WAA741	*2.5625*	*3*	*.5*	*2.7035*	*2.9185*	*.015*	6,330	11,800	10,000	81
	65.0875	76.2	12.7	68.67	74.13	.38				

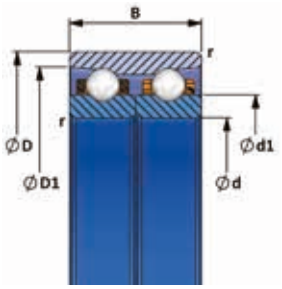
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 7 INCHES (d 177.8 MM)

2 I Series AA8, super duplex - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA832	*2*	*2.5*	*.5*	*2.172*	*2.3878*	*.025*	5,950	9,840	8,280	79
	50.8	63.5	12.7	55.17	60.65	.635				
WAA840	*2.5*	*3*	*.5*	*2.672*	*2.8866*	*.025*	6,270	11,500	9,890	96
	63.5	76.2	12.7	67.87	73.32	.635				
WAA848	*3*	*3.5*	*.5*	*3.172*	*3.3858*	*.025*	6,640	13,500	11,600	114
	76.2	88.9	12.7	80.57	86	.635				
WAA856	*3.5*	*4*	*.5*	*3.672*	*3.885*	*.025*	6,980	15,500	13,500	132
	88.9	101.6	12.7	93.27	98.68	.635				
WAA864	*4*	*4.5*	*.5*	*4.172*	*4.3843*	*.025*	7,290	17,500	15,300	149
	101.6	114.3	12.7	105.97	111.36	.635				
WAA868	*4.25*	*4.75*	*.5*	*4.422*	*4.6339*	*.025*	7,400	18,300	16,100	158
	107.95	120.65	12.7	112.32	117.7	.635				
WAA872	*4.5*	*5*	*.5*	*4.672*	*4.8835*	*.025*	7,510	19,200	16,900	167
	114.3	127	12.7	118.67	124.04	.635				
WAA876	*4.75*	*5.25*	*.5*	*4.922*	*5.1331*	*.025*	7,680	20,300	17,900	176
	120.65	133.35	12.7	125.02	130.38	.635				
WAA880	*5*	*5.5*	*.5*	*5.172*	*5.3827*	*.025*	7,790	21,200	18,700	184
	127	139.7	12.7	131.37	136.72	.635				
WAA888	*5.5*	*6*	*.5*	*5.672*	*5.8819*	*.025*	8,050	23,200	20,500	202
	139.7	152.4	12.7	144.07	149.4	.635				
WAA896	*6*	*6.5*	*.5*	*6.172*	*6.3811*	*.025*	8,290	25,100	22,300	220
	152.4	165.1	12.7	156.77	162.08	.635				
WAA8104	*6.5*	*7*	*.5*	*6.672*	*6.8799*	*.025*	8,520	27,100	24,100	238
	165.1	177.8	12.7	169.47	174.75	.635				
WAA8112	*7*	*7.5*	*.5*	*7.172*	*7.3791*	*.025*	8,740	29,100	25,900	255
	177.8	190.5	12.7	182.17	187.43	.635				

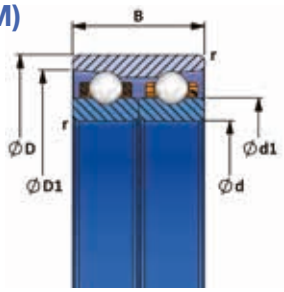
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2.0625 INCHES (d 52.3875 MM) TO 7 INCHES (d 177.8 MM)

2 I Series AA9, super duplex - Inch series

Constant ball diameter: 1/8 inch (3.175 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA933	*2.0625*	*2.625*	*.5*	*2.2657*	*2.4811*	*.015*	6,050	10,200	8,680	98
	52.3875	66.675	12.7	57.55	63.02	.38				
WAA937	*2.3125*	*2.875*	*.5*	*2.5157*	*2.7307*	*.015*	6,210	11,100	9,480	108
	58.7375	73.025	12.7	63.9	69.36	.38				
WAA940	*2.5*	*3.0625*	*.5*	*2.7031*	*2.9181*	*.015*	6,330	11,800	10,000	116
	63.5	77.7875	12.7	68.66	74.12	.38				
WAA948	*3*	*3.5625*	*.5*	*3.2031*	*3.4173*	*.015*	6,690	13,700	11,800	137
	76.2	90.4875	12.7	81.36	86.8	.38				
WAA956	*3.5*	*4.0625*	*.5*	*3.7031*	*3.9165*	*.015*	7,030	15,700	13,700	157
	88.9	103.1875	12.7	94.06	99.48	.38				
WAA964	*4*	*4.5625*	*.5*	*4.2031*	*4.4154*	*.015*	7,270	17,500	15,300	178
	101.6	115.8875	12.7	106.76	112.15	.38				
WAA972	*4.5*	*5.0625*	*.5*	*4.7031*	*4.9146*	*.015*	7,560	19,400	17,100	199
	114.3	128.5875	12.7	119.46	124.83	.38				
WAA980	*5*	*5.5625*	*.5*	*5.2031*	*5.4138*	*.015*	7,830	21,400	18,900	220
	127	141.2875	12.7	132.16	137.51	.38				
WAA988	*5.5*	*6.0625*	*.5*	*5.7031*	*5.913*	*.015*	8,080	23,400	20,700	241
	139.7	153.9875	12.7	144.86	150.19	.38				
WAA996	*6*	*6.5625*	*.5*	*6.2031*	*6.4122*	*.015*	8,330	25,400	22,500	262
	152.4	166.6875	12.7	157.56	162.87	.38				
WAA9104	*6.5*	*7.0625*	*.5*	*6.7031*	*6.9114*	*.015*	8,560	27,300	24,300	283
	165.1	179.3875	12.7	170.26	175.55	.38				
WAA9112	*7*	*7.5625*	*.5*	*7.2031*	*7.4106*	*.015*	8,770	29,300	26,100	304
	177.8	192.0875	12.7	182.96	188.23	.38				

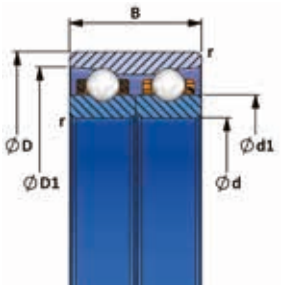
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 8 INCHES (d 203.2 MM)

2 I Series AA10, super duplex - Inch series

Constant ball diameter: 5/32 inch (3.969 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA1032	*2*	*2.625*	*.625*	*2.2154*	*2.4819*	*.04*	9,050	15,500	8,380	124
	50.8	66.675	15.875	56.27	63.04	1.015				
WAA1040	*2.5*	*3.125*	*.625*	*2.7154*	*2.9811*	*.04*	9,760	19,000	10,100	151
	63.5	79.375	15.875	68.97	75.72	1.015				
WAA1048	*3*	*3.625*	*.625*	*3.2154*	*3.4799*	*.04*	10,500	23,100	12,200	179
	76.2	92.075	15.875	81.67	88.39	1.015				
WAA1056	*3.5*	*4.125*	*.625*	*3.7154*	*3.9791*	*.04*	11,000	26,600	14,000	206
	88.9	104.775	15.875	94.37	101.07	1.015				
WAA1064	*4*	*4.625*	*.625*	*4.2154*	*4.4783*	*.04*	11,500	30,200	15,800	233
	101.6	117.475	15.875	107.07	113.75	1.015				
WAA1068	*4.25*	*4.875*	*.625*	*4.4654*	*4.728*	*.04*	11,800	32,200	16,900	247
	107.95	123.825	15.875	113.42	120.09	1.015				
WAA1072	*4.5*	*5.125*	*.625*	*4.7154*	*4.9776*	*.04*	12,100	34,300	17,900	260
	114.3	130.175	15.875	119.77	126.43	1.015				
WAA1076	*4.75*	*5.375*	*.625*	*4.9654*	*5.2272*	*.04*	12,300	35,800	18,700	274
	120.65	136.525	15.875	126.12	132.77	1.015				
WAA1080	*5*	*5.625*	*.625*	*5.2154*	*5.4701*	*.04*	12,500	37,800	19,700	288
	127	142.875	15.875	132.47	138.94	1.015				
WAA1088	*5.5*	*6.125*	*.625*	*5.7154*	*5.9756*	*.04*	12,900	41,400	21,500	315
	139.7	155.575	15.875	145.17	151.78	1.015				
WAA1096	*6*	*6.625*	*.625*	*6.2154*	*6.4748*	*.04*	13,300	44,900	23,400	342
	152.4	168.275	15.875	157.87	164.46	1.015				
WAA10104	*6.5*	*7.125*	*.625*	*6.7154*	*6.974*	*.04*	13,700	48,500	25,200	369
	165.1	180.975	15.875	170.57	177.14	1.015				
WAA10112	*7*	*7.625*	*.625*	*7.2154*	*7.4732*	*.04*	14,100	52,600	27,200	397
	177.8	193.675	15.875	183.27	189.82	1.015				
WAA10120	*7.5*	*8.125*	*.625*	*7.7154*	*7.9724*	*.04*	14,500	56,100	29,100	424
	190.5	206.375	15.875	195.97	202.5	1.015				
WAA10128	*8*	*8.625*	*.625*	*8.2154*	*8.4717*	*.04*	14,800	59,700	30,900	452
	203.2	219.075	15.875	208.67	215.18	1.015				

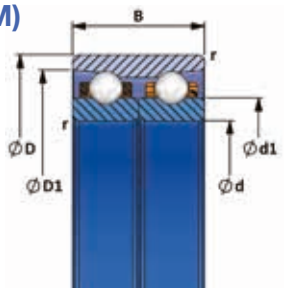
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2.5625 INCHES (d 65.0875 MM) TO 6.8125 INCHES (d 173.0375 MM)

2 I Series AA11, super duplex - Inch series

Constant ball diameter: 3/16 inch (4.762 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA1141	*2.5625*	*3.25*	*.625*	*2.7896*	*3.1102*	*.015*	13,100	24,500	13,300	173
	65.0875	82.55	15.875	70.856	79	.38				
WAA1145	*2.8125*	*3.5*	*.625*	*3.0396*	*3.3598*	*.015*	13,500	26,700	14,500	188
	71.4375	88.9	15.875	77.206	85.34	.38				
WAA1149	*3.0625*	*3.75*	*.625*	*3.2896*	*3.6094*	*.015*	13,900	28,900	15,600	203
	77.7875	95.25	15.875	83.556	91.68	.38				
WAA1153	*3.3125*	*4*	*.625*	*3.5396*	*3.8591*	*.015*	14,300	31,100	16,700	217
	84.1375	101.6	15.875	89.906	98.02	.38				
WAA1161	*3.8125*	*4.5*	*.625*	*4.0396*	*4.3583*	*.015*	15,000	35,500	18,900	248
	96.8375	114.3	15.875	102.606	110.7	.38				
WAA1169	*4.3125*	*5*	*.625*	*4.5396*	*4.8575*	*.015*	15,600	39,900	21,100	277
	109.5375	127	15.875	115.306	123.38	.38				
WAA1177	*4.8125*	*5.5*	*.625*	*5.0396*	*5.3563*	*.015*	16,100	43,600	23,000	307
	122.2375	139.7	15.875	128.006	136.05	.38				
WAA1185	*5.3125*	*6*	*.625*	*5.5396*	*5.8555*	*.015*	16,600	48,000	25,200	337
	134.9375	152.4	15.875	140.706	148.73	.38				
WAA1193	*5.8125*	*6.5*	*.625*	*6.0396*	*6.3465*	*.015*	17,200	52,400	27,400	368
	147.6375	165.1	15.875	153.406	161.2	.38				
WAA11101	*6.3125*	*7*	*.625*	*6.5396*	*6.8539*	*.015*	17,700	56,800	29,600	397
	160.3375	177.8	15.875	166.106	174.09	.38				
WAA11109	*6.8125*	*7.5*	*.625*	*7.0396*	*7.3531*	*.015*	18,200	61,200	31,800	427
	173.0375	190.5	15.875	178.806	186.77	.38				

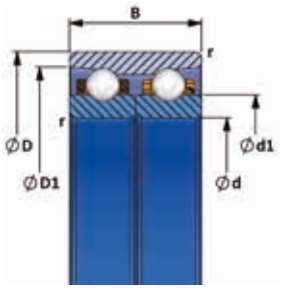
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 10 INCHES (d 254 MM)

2 I Series AA12, super duplex - Inch series

Constant ball diameter: 3/16 inch (4.762 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA1264	*4*	*4.75*	*.75*	*4.2583*	*4.5819*	*.04*	15,000	36,300	19,200	338
	101.6	120.65	19.05	108.16	116.38	1.015				
WAA1268	*4.25*	*5*	*.75*	*4.5083*	*4.8315*	*.04*	15,300	38,500	20,300	358
	107.95	127	19.05	114.51	122.72	1.015				
WAA1272	*4.5*	*5.25*	*.75*	*4.7583*	*5.0811*	*.04*	15,600	40,700	21,500	377
	114.3	133.35	19.05	120.86	129.06	1.015				
WAA1276	*4.75*	*5.5*	*.75*	*5.0083*	*5.3307*	*.04*	15,900	42,900	22,600	397
	120.65	139.7	19.05	127.21	135.4	1.015				
WAA1280	*5*	*5.75*	*.75*	*5.2583*	*5.5803*	*.04*	16,200	45,100	23,700	417
	127	146.05	19.05	133.56	141.74	1.015				
WAA1288	*5.5*	*6.25*	*.75*	*5.7583*	*6.0795*	*.04*	16,800	49,500	25,900	456
	139.7	158.75	19.05	146.26	154.42	1.015				
WAA1296	*6*	*6.75*	*.75*	*6.2583*	*6.5783*	*.04*	17,300	53,900	28,100	495
	152.4	171.45	19.05	158.96	167.09	1.015				
WAA12104	*6.5*	*7.25*	*.75*	*6.7583*	*7.078*	*.04*	17,800	58,300	30,300	534
	165.1	184.15	19.05	171.66	179.78	1.015				
WAA12112	*7*	*7.75*	*.75*	*7.2583*	*7.5669*	*.04*	18,300	62,700	32,500	575
	177.8	196.85	19.05	184.36	192.2	1.015				
WAA12120	*7.5*	*8.25*	*.75*	*7.7583*	*8.076*	*.04*	18,700	67,100	34,700	613
	190.5	209.55	19.05	197.06	205.13	1.015				
WAA12128	*8*	*8.75*	*.75*	*8.2583*	*8.5752*	*.04*	19,200	71,500	36,900	652
	203.2	222.25	19.05	209.76	217.81	1.015				
WAA12144	*9*	*9.75*	*.75*	*9.2583*	*9.5736*	*.04*	20,000	80,300	41,400	730
	228.6	247.65	19.05	235.16	243.17	1.015				
WAA12160	*10*	*10.75*	*.75*	*10.2583*	*10.572*	*.04*	20,800	89,100	45,800	810
	254	273.05	19.05	260.56	268.53	1.015				

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

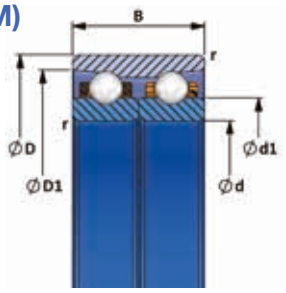
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 3.0625 INCHES (d 77.7875 MM) TO 10 INCHES (d 254 MM)

2 I Series AA13, super duplex - Inch series

Constant ball diameter: 3/16 inch (4.762 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA1349	*3.0625*	*3.875*	*.625*	*3.3521*	*3.672*	*.015*	13,900	28,000	15,500	260
	77.7875	98.425	15.875	85.144	93.27	.38				
WAA1356	*3.5*	*4.3125*	*.625*	*3.7895*	*4.1087*	*.015*	14,700	33,300	17,800	293
	88.9	109.5375	15.875	96.254	104.36	.38				
WAA1364	*4*	*4.8125*	*.625*	*4.2895*	*4.6079*	*.015*	15,300	37,700	20,000	331
	101.6	122.2375	15.875	108.954	117.04	.38				
WAA1372	*4.5*	*5.3125*	*.625*	*4.7895*	*5.1067*	*.015*	15,800	41,400	21,900	369
	114.3	134.9375	15.875	121.654	129.71	.38				
WAA1380	*5*	*5.8125*	*.625*	*5.2895*	*5.6059*	*.015*	16,400	45,800	24,100	405
	127	147.6375	15.875	134.354	142.39	.38				
WAA1388	*5.5*	*6.3125*	*.625*	*5.7895*	*6.1051*	*.015*	16,900	50,200	26,300	443
	139.7	160.3375	15.875	147.054	155.07	.38				
WAA1396	*6*	*6.8125*	*.625*	*6.2895*	*6.6043*	*.015*	17,400	54,600	28,500	481
	152.4	173.0375	15.875	159.754	167.75	.38				
WAA13104	*6.5*	*7.3125*	*.625*	*6.7895*	*7.1035*	*.015*	17,900	59,000	30,700	519
	165.1	185.7375	15.875	172.454	180.43	.38				
WAA13112	*7*	*7.8125*	*.625*	*7.2895*	*7.6028*	*.015*	18,400	63,400	32,900	556
	177.8	198.4375	15.875	185.154	193.11	.38				
WAA13120	*7.5*	*8.3125*	*.625*	*7.7895*	*8.102*	*.015*	18,800	67,800	35,100	594
	190.5	211.1375	15.875	197.854	205.79	.38				
WAA13128	*8*	*8.8125*	*.625*	*8.2895*	*8.6012*	*.015*	19,300	72,200	37,300	632
	203.2	223.8375	15.875	210.554	218.47	.38				
WAA13144	*9*	*9.8125*	*.625*	*9.2895*	*9.5992*	*.015*	20,100	81,000	41,700	708
	228.6	249.2375	15.875	235.954	243.82	.38				
WAA13160	*10*	*10.8125*	*.625*	*10.2895*	*10.5976*	*.015*	20,900	89,800	46,100	784
	254	274.6375	15.875	261.354	269.18	.38				

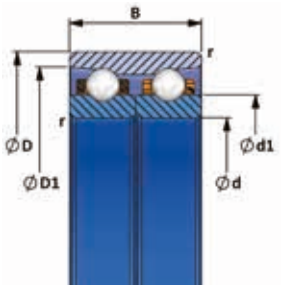
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 12 INCHES (d 304.8 MM)

2 I Series AA16, super duplex - Inch series

Constant ball diameter: 1/4 inch (6.35 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA1664	*4*	*5*	*1*	*4.3445*	*4.7787*	*.06*	23,100	50,000	26,900	620
	101.6	127	25.4	110.35	121.38	1.525				
WAA1668	*4.25*	*5.25*	*1*	*4.5945*	*5.0283*	*.06*	23,500	52,700	28,200	654
	107.95	133.35	25.4	116.7	127.72	1.525				
WAA1672	*4.5*	*5.5*	*1*	*4.8445*	*5.278*	*.06*	24,200	56,500	30,100	690
	114.3	139.7	25.4	123.05	134.06	1.525				
WAA1676	*4.75*	*5.75*	*1*	*5.0945*	*5.5276*	*.06*	24,600	59,200	31,400	724
	120.65	146.05	25.4	129.4	140.4	1.525				
WAA1680	*5*	*6*	*1*	*5.3445*	*5.7772*	*.06*	24,900	61,800	32,700	758
	127	152.4	25.4	135.75	146.74	1.525				
WAA1688	*5.5*	*6.5*	*1*	*5.8445*	*6.2764*	*.06*	25,900	68,300	36,000	828
	139.7	165.1	25.4	148.45	159.42	1.525				
WAA1696	*6*	*7*	*1*	*6.3445*	*6.7752*	*.06*	26,500	73,500	38,600	897
	152.4	177.8	25.4	161.15	172.09	1.525				
WAA16104	*6.5*	*7.5*	*1*	*6.8445*	*7.2744*	*.06*	27,100	78,700	41,200	965
	165.1	190.5	25.4	173.85	184.77	1.525				
WAA16112	*7*	*8*	*1*	*7.3445*	*7.7736*	*.06*	27,700	84,000	43,800	1,040
	177.8	203.2	25.4	186.55	197.45	1.525				
WAA16120	*7.5*	*8.5*	*1*	*7.8445*	*8.2728*	*.06*	28,500	90,500	47,000	1,110
	190.5	215.9	25.4	199.25	210.13	1.525				
WAA16128	*8*	*9*	*1*	*8.3445*	*8.772*	*.06*	29,000	95,700	49,600	1,180
	203.2	228.6	25.4	211.95	222.81	1.525				
WAA16144	*9*	*10*	*1*	*9.3445*	*9.7701*	*.06*	30,300	10,7,400	55,500	1,320
	228.6	254	25.4	237.35	248.16	1.525				
WAA16160	*10*	*11*	*1*	*10.3445*	*10.7685*	*.06*	31,400	11,9,100	61,300	1,460
	254	279.4	25.4	262.75	273.52	1.525				
WAA16176	*11*	*12*	*1*	*11.3445*	*11.7669*	*.06*	32,300	12,9,600	66,500	1,600
	279.4	304.8	25.4	288.15	298.88	1.525				
WAA16192	*12*	*13*	*1*	*12.3445*	*12.7654*	*.06*	33,400	14,1,300	72,400	1,740
	304.8	330.2	25.4	313.55	324.24	1.525				

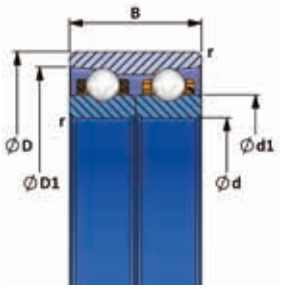
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 12 INCHES (d 304.8 MM)

2 I Series AA24, super duplex - Inch series

Constant ball diameter: 3/8 inch (9.525 mm)
Constant section
Versions H and N
Duplex configuration back-to-back
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



AA and AB versions

Basic designation	Dimensions *in inches* / in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAA2464	*4*	*5.5*	*1.5*	*4.5169*	*5.1728*	*.075*	42,700	80,200	44,500	1,490
	101.6	139.7	38.1	114.73	131.39	1.905				
WAA2468	*4.25*	*5.75*	*1.5*	*4.7669*	*5.4224*	*.075*	44,100	86,000	47,500	1,570
	107.95	146.05	38.1	121.08	137.73	1.905				
WAA2472	*4.5*	*6*	*1.5*	*5.0169*	*5.672*	*.075*	44,400	89,100	49,000	1,640
	114.3	152.4	38.1	127.43	144.07	1.905				
WAA2476	*4.75*	*6.25*	*1.5*	*5.2669*	*5.9217*	*.075*	45,600	94,800	52,000	1,720
	120.65	158.75	38.1	133.78	150.41	1.905				
WAA2480	*5*	*6.5*	*1.5*	*5.5169*	*6.1709*	*.075*	46,000	97,900	53,600	1,800
	127	165.1	38.1	140.13	156.74	1.905				
WAA2488	*5.5*	*7*	*1.5*	*6.0169*	*6.6701*	*.075*	47,400	106,700	58,100	1,960
	139.7	177.8	38.1	152.83	169.42	1.905				
WAA2496	*6*	*7.5*	*1.5*	*6.5169*	*7.1693*	*.075*	48,800	115,500	62,700	2,110
	152.4	190.5	38.1	165.53	182.1	1.905				
WAA24104	*6.5*	*8*	*1.5*	*7.0169*	*7.6681*	*.075*	50,100	124,400	67,200	2,270
	165.1	203.2	38.1	178.23	194.77	1.905				
WAA24112	*7*	*8.5*	*1.5*	*7.5169*	*8.1673*	*.075*	51,300	133,200	71,600	2,430
	177.8	215.9	38.1	190.93	207.45	1.905				
WAA24120	*7.5*	*9*	*1.5*	*8.0169*	*8.6665*	*.075*	52,500	142,000	76,100	2,580
	190.5	228.6	38.1	203.63	220.13	1.905				
WAA24128	*8*	*9.5*	*1.5*	*8.5169*	*9.1657*	*.075*	53,600	150,800	80,500	2,740
	203.2	241.3	38.1	216.33	232.81	1.905				
WAA24144	*9*	*10.5*	*1.5*	*9.5169*	*10.1638*	*.075*	55,800	168,400	89,400	3,050
	228.6	266.7	38.1	241.73	258.16	1.905				
WAA24160	*10*	*11.5*	*1.5*	*10.5169*	*11.1622*	*.075*	58,400	188,900	99,700	3,370
	254	292.1	38.1	267.13	283.52	1.905				
WAA24176	*11*	*12.5*	*1.5*	*11.5169*	*12.1606*	*.075*	60,200	206,500	108,600	3,690
	279.4	317.5	38.1	292.53	308.88	1.905				
WAA24192	*12*	*13.5*	*1.5*	*11.5169*	*12.9831*	*.075*	60,200	206,500	108,600	3,980
	304.8	342.9	38.1	317.92	329.77	1.905				

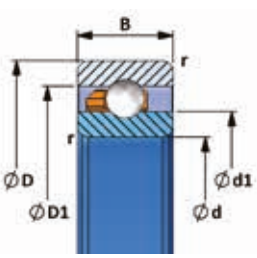
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

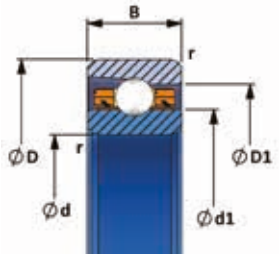
BORE DIAMETER d FROM 10 TO 220 MM

3 I Series 618 - Metric series

Deep grooves in stainless steel sheet up to 61804
Deep grooves with crown-type cage - **R**
Angular contact with one-piece machined cage, with cylindrical ball pockets: **H**
Open ball bearing as standard
Variable sections and balls Ø
Tolerances: T5, T4, T2
Position 7



Version R



Version H

Basic designation	Dimensions in mm								Version	Basic load rating N[2]			Mean mass[2]
										Radial		Axial static	
										Dyn.	Stat.		
	d	D	B	d1	d2	D1	D2	r[1]		C	Co	Cax	g
W61800 Same as X10	10	19	5	12.6	13	16.4	16	.3	R	1,210	830	280	5.4
									H	1,060	640	1,250	
W61801[3]	12	21	5	15	15	18.2	18.2	.3	R	1,190	750	810	6.15
									H	1,320	880	1,750	
W61802[3]	15	24	5	17.9	17.9	21.1	21.1	.3	R	1,290	920	1,330	7.26
									H	1,510	1,240	1,930	
W61803[3]	17	26	5	20.2	20.2	23.2	23.2	.3	R	1,390	1,080	1,080	8.03
									H	1,450	1,250	2,350	
W61804[3]	20	32	7	24	24	28.25	28.25	.3	R	2,170	1,640	1,800	18
									H	2,720	2,400	3,100	
W61805	25	37	7	29	29	33	33	.3	R	2,540	2,300	2,450	22
									H	3,150	3,170	3,420	
W61806	30	42	7	34	34	38	38	.3	R	2,750	2,780	2,920	26
									H	3,400	3,820	4,060	
W61807	35	47	7	39	39	43	43	.3	R	2,850	3,120	3,240	30
									H	3,550	4,320	4,550	
W61808	40	52	7	44	44	48	48	.3	R	3,030	3,600	3,710	34
									H	3,680	4,810	5,030	
W61809	45	58	7	49	49	54	54	.3	R	4,390	5,110	5,300	40
									H	5,280	6,740	6,990	
W61810	50	65	7	55	55	60	60	.3	R	4,530	5,630	5,800	52
									H	5,500	7,530	7,860	
W61811	55	72	9	60.5	60.5	66.5	66.5	.3	R	6,070	7,390	7,720	83
									H	7,470	10,000	10,500	
W61812	60	78	10	66	66	72	72	.3	R	6,300	8,120	8,440	110
									H	7,630	10,800	11,300	
W61813	65	85	10	71.6	71.6	78.4	78.4	.6	R	7,990	10,000	11,800	130
									H	9,830	13,700	16,200	
W61814	70	90	10	76.6	76.6	83.4	83.4	.6	R	8,330	11,000	12,900	140
									H	10,000	14,700	17,300	
W61815	75	95	10	81.6	81.6	88.4	88.4	.6	R	8,420	11,500	13,500	145
									H	10,300	15,700	18,400	

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 Capacity values for version N are close to version H.
Please contact our Design & Engineering Department for more details
3 References which can be offered in protected version Z or ZZ.

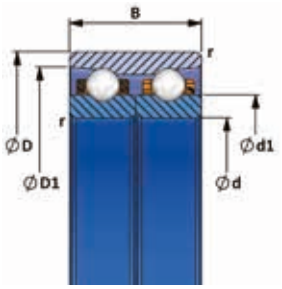
Basic designation	Dimensions in mm								Version	Basic load rating N[2]			Mean mass[2]
										Radial		Axial static	
										Dyn.	Stat.		
	d	D	B	d1	d2	D1	D2	r[1]		C	Co	Cax	g
W61816	80	100	10	86.6	86.6	93.4	93.4	.6	R	8,730	12,500	14,600	155
									H	10,500	16,700	19,500	
W61817	85	110	13	93.1	93.1	101.9	101.9	1.1	R	12,800	17,400	19,700	270
									H	15,400	22,700	26,100	
W61818	90	115	13	98.1	98.1	106.9	106.9	1.1	R	13,000	18,200	20,600	285
									H	15,800	24,300	27,900	
W61819	95	120	13	103.1	103.1	111.9	111.9	1.1	R	13,600	19,800	22,300	280
									H	16,300	26,000	29,600	
W61820	100	125	13	108.1	108.1	116.9	116.9	1.1	R	13,400	19,900	22,300	315
									H	16,400	26,800	30,500	
W61822	110	140	16	119.7	119.7	130.3	130.3	1.1	R	18,800	27,200	32,700	600
									H	22,800	36,400	44,000	
W61824	120	150	16	129.7	129.7	140.3	140.3	1.1	R	19,400	29,700	35,500	650
									H	23,200	38,900	46,900	
W61826	130	165	18	141.2	141.2	153.8	153.8	1.1	R	25,300	38,000	44,600	930
									H	30,800	50,800	60,200	
W61828	140	175	18	151.2	151.2	163.8	163.8	1.1	R	25,600	39,800	46,500	990
									H	31,500	54,300	64,000	
W61830	150	190	20	162.7	162.7	177.3	177.3	1.1	R	32,900	50,700	59,400	1,300
									H	39,900	67,600	78,800	
W61832	160	200	20	172.7	172.7	187.3	187.3	1.1	R	34,200	55,200	64,400	1,450
									H	40,900	72,200	83,900	
W61834	170	215	22	184.2	184.2	200.8	200.8	1.1	R	40,100	62,400	71,900	1,900
									H	50,000	86,900	100,000	
W61836	180	225	22	194.2	194.2	210.8	210.8	1.1	R	41,800	68,200	78,300	2,000
									H	50,300	90,000	103,300	
W61838	190	240	24	206	206	224	224	1.5	R	49,000	78,000	100,300	2,600
									H	61,000	108,500	140,000	
W61840	200	250	24	216	216	234	234	1.5	R	51,100	85,100	109,200	2,700
									H	61,600	112,300	144,500	
W61844	220	270	24	236	236	254	254	1.5	R	52,600	92,500	118,100	3,000
									H	63,800	123,400	157,900	

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 10 TO 220 MM

4 I DM618, duplex - Metric series

Open ball bearing as standard
Angular contact with one-piece machined cage - **H**
Angular contact with rings - **N**
Back to back pairing
Open ball bearing only
Variable sections and balls Ø
Tolerances: T5, T4, T2
Position 7

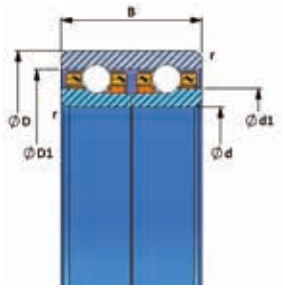


Basic designation	Dimensions in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WDM61800	10	19	5	13	16	.5	1,735	1,290	1,250	11
WDM61801	12	21	5	15	18.2	.5	2,140	1,760	1,700	13
WDM61802	15	24	5	17.9	21.1	.5	2,455	2,495	1,930	15
WDM61803	17	26	5	20.2	23.2	.5	2,490	2,550	2,350	17
WDM61804	20	32	7	24	28.25	.5	4,420	4,800	3,120	36
WDM61805	25	37	14	29	33	.3	5,110	6,350	3,425	44
WDM61806	30	42	14	34	38	.3	5,530	7,640	4,060	52
WDM61807	35	47	14	39	43	.3	5,760	8,640	4,550	58
WDM61808	40	52	14	44	48	.3	5,980	9,630	5,030	66
WDM61809	45	58	14	49	54	.3	8,610	13,510	7,110	76
WDM61810	50	65	14	55	60	.3	8,940	15,060	7,860	104
WDM61811	55	72	18	60.5	66.5	.3	12,140	20,170	10,590	160
WDM61812	60	78	20	66	72	.3	12,400	21,680	11,310	210
WDM61813	65	85	20	71.6	78.4	.6	15,970	27,490	16,200	248
WDM61814	70	90	20	76.6	83.4	.6	16,400	29,490	17,300	266
WDM61815	75	95	20	81.6	88.4	.6	16,810	31,490	18,410	280
WDM61816	80	100	20	86.6	93.4	.6	17,200	33,490	19,520	298
WDM61817	85	110	26	93.1	101.9	1.1	25,050	45,510	26,140	514
WDM61818	90	115	26	98.1	106.9	1.1	25,810	48,750	27,910	540
WDM61819	95	120	26	103.1	111.9	1.1	26,550	52,000	29,680	567
WDM61820	100	125	26	108.1	116.9	1.1	26,740	53,720	30,580	592
WDM61822	110	140	32	119.7	130.3	1.1	37,060	72,800	44,070	980
WDM61824	120	150	32	129.7	140.3	1.1	37,820	77,840	46,900	1,060
WDM61826	130	165	36	141.2	153.8	1.1	50,090	101,680	60,240	1,520
WDM61828	140	175	36	151.2	163.8	1.1	51,270	108,620	64,090	1,600
WDM61830	150	190	40	162.7	177.3	1.1	64,820	135,350	78,880	2,200
WDM61832	160	200	40	172.7	187.3	1.1	66,500	144,490	83,910	2,340
WDM61834	170	215	44	184.2	200.8	1.1	81,234	173,860	100,080	3,060
WDM61836	180	225	44	194.2	210.8	1.1	81,830	180,040	103,320	3,240
WDM61838	190	240	48	206	224	1.5	99,250	217,150	140,020	4,140
WDM61840	200	250	48	216	234	1.5	100,110	224,770	144,530	4,360
WDM61844	220	270	48	236	254	1.5	103,720	246,820	157,930	4,740

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 102 TO 305 MM



4 I ADM12, duplex - Metric series

Constant ball diameter: 1/4 inch (6.35 mm)
Constant section
Angular contact with one-piece machined cage - **H**
Angular contact with rings - **N**
Back to back pairing
Open ball bearing only
Tolerances: TA5, TA4
Position 7

Basic designation	Dimensions in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WADM12102	102	126	24	110.35	118.25	1.015	23,100	50,000	26,900	591
WADM12108	108	132	24	116.7	124.6	1.015	23,500	52,700	28,200	621
WADM12114	114	138	24	123.05	130.95	1.015	24,200	56,500	30,100	658
WADM12121	121	145	24	129.4	137.3	1.015	24,600	59,200	31,400	691
WADM12127	127	151	24	135.75	143.65	1.015	24,900	61,800	32,700	723
WADM12140	140	164	24	148.45	156.35	1.015	25,900	68,300	36,000	790
WADM12152	152	176	24	161.15	169.05	1.015	26,500	73,500	38,600	856
WADM12165	165	189	24	173.85	181.75	1.015	27,100	78,700	41,200	917
WADM12178	178	202	24	186.55	194.45	1.015	27,700	84,000	43,800	994
WADM12191	191	215	24	199.25	207.15	1.015	28,500	90,500	47,000	1,060
WADM12203	203	227	24	211.95	219.85	1.015	29,000	95,700	49,600	1,127
WADM12229	229	253	24	237.35	245.25	1.015	30,300	107,400	55,500	1,260
WADM12254	254	278	24	262.75	270.65	1.015	31,400	119,100	61,300	1,395
WADM12279	279	303	24	288.15	296.05	1.015	32,300	129,600	66,500	1,528
WADM12305	305	329	24	313.55	321.45	1.015	33,400	141,300	72,400	1,643

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

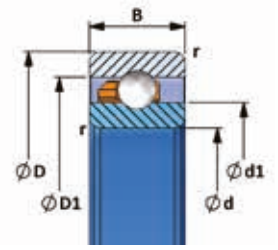
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 51 TO 203 MM

4 I AM8 - Metric series

Constant ball diameter: 5/32 inch (3.969 mm)
Constant section
Versions R, H and N
Open ball bearing only
Tolerances: TA5, TA4
Position 7



Basic designation	Dimensions in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAM851	51	67	8	56.27	61.2	.635	4,630	5,870	6,350	63
WAM864	64	80	8	68.97	73.9	.635	5,070	7,390	7,900	76
WAM876	76	92	8	81.67	86.6	.635	5,250	8,430	8,940	89
WAM889	89	105	8	94.37	99.3	.635	5,600	9,940	10,400	103
WAM8102	102	118	8	107.07	112	.635	5,920	11,400	12,000	116
WAM8108	108	124	8	113.42	118.35	.635	5,990	11,900	12,500	123
WAM8114	114	130	8	119.77	124.7	.635	6,140	12,700	13,300	130
WAM8121	121	137	8	126.12	131.05	.635	6,280	13,500	14,100	137
WAM8127	127	143	8	132.47	137.4	.635	6,410	14,200	14,800	143
WAM8140	140	156	8	145.17	150.1	.635	6,600	15,500	16,100	157
WAM8152	152	168	8	157.87	162.8	.635	6,770	16,800	17,400	170
WAM8165	165	181	8	170.57	175.5	.635	7,010	18,300	19,000	184
WAM8178	178	194	8	183.27	188.2	.635	7,230	19,800	20,500	197
WAM8191	191	207	8	195.97	200.9	.635	7,320	20,800	21,600	210
WAM8203	203	219	8	208.67	213.6	.635	7,470	22,100	22,900	224

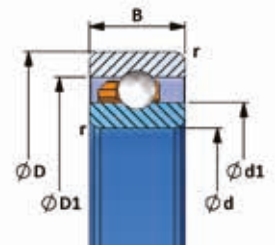
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 102 TO 305 MM

4 I AM12 - Metric series

Constant ball diameter: 1/4 inch (6.35 mm)
Constant section
Versions R, H and N
Open ball bearing only
Tolerances: TA5, TA4
Position 7

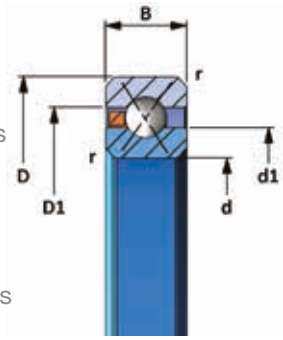


Basic designation	Dimensions in mm						Basic load rating N[2]			Mean mass[2]
							Radial		Axial static	
							Dyn.	Stat.		
	d	D	B	d1	D1	r[1]	C	Co	Cax	g
WAM12102	102	127	12	110.35	118.25	1.015	11,800	18,900	18,300	298
WAM12108	108	133	12	116.7	124.6	1.015	11,850	19,600	21,000	314
WAM12114	114	139	12	123.05	130.95	1.015	12,200	20,900	22,300	329
WAM12121	121	146	12	129.4	137.3	1.015	12,500	22,200	23,600	347
WAM12127	127	152	12	135.75	143.65	1.015	12,550	22,800	24,200	363
WAM12140	140	165	12	148.45	156.35	1.015	13,100	25,400	26,800	397
WAM12152	152	177	12	161.15	169.05	1.015	13,400	27,400	28,800	428
WAM12165	165	190	12	173.85	181.75	1.015	13,700	29,300	30,700	462
WAM12178	178	203	12	186.55	194.45	1.015	14,200	31,900	33,300	496
WAM12191	191	216	12	199.25	207.15	1.015	14,500	33,900	35,300	528
WAM12203	203	228	12	211.95	219.85	1.015	14,700	35,900	37,200	560
WAM12229	229	254	12	237.35	245.25	1.015	15,400	40,400	41,800	627
WAM12254	254	279	12	262.75	270.65	1.015	16,000	45,000	46,300	693
WAM12279	279	304	12	288.15	296.05	1.015	16,500	48,900	50,200	758
WAM12305	305	330	12	313.55	321.45	1.015	16,900	52,800	54,100	825

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 2 INCHES (d 50.8 MM) TO 9 INCHES (d 228.6 MM)



5 I SA10, Super Thin Section four points of contact

Ball bearing version X is designed with a 4 point-contact to support higher loads
The four point-contact ball bearings (version X) are adapted to support combined axial, radial and angular loads.
On specification (Kxxxx), a solid preload, is designed with an optimal internal play in order to achieve the stiffness and torque requirement.
The ball bearing with an internal preload is adjusted to ensure a homogeneous friction torque on the batch of bearing. It is measured on specification.
Constant section and ball diameter: 5/32 inch (3.969 mm) - Open bearings only
Version R and E
Tolerances: TA5, TA4
Position 7

Basic designation	Dimensions *in inches* / in mm						Basic load rating[2]						Mean mass[2]
							Radial (N)		Axial (N)		Moment (N. m)		
							Dyn.	Stat.	Dyn.	Stat.	Dyn.	Stat.	
	d	D	B	d1	D1	r[1]	C	Co	Cax	Co ax	C Mt	Co Mt	g
WSA1032X	*2*	*2.625*	*.3125*	*2.232*	*2.393*	*.04*	5,878	9,123	5,020	10,537	114	117	65
	50.8	66.675	7.937	56.7	60.78	1.015							
WSA1040X	*2.5*	*3.125*	*.3125*	*2.732*	*2.890*	*.04*	6,413	11,407	5,450	13,088	151	178	85
	63.5	79.375	7.937	69.4	73.4	1.015							
WSA1048X	*3*	*3.625*	*.3125*	*3.233*	*3.393*	*.04*	6,627	12,763	5,600	15,040	184	243	100
	76.2	92.075	7.937	82.11	86.17	1.015							
WSA1056X	*3.5*	*4.125*	*.3125*	*3.732*	*3.891*	*.04*	7,062	14,852	5,940	17,345	226	326	115
	88.9	104.775	7.937	94.8	98.82	1.015							
WSA1064X	*4*	*4.625*	*.3125*	*4.232*	*4.390*	*.04*	7,455	16,938	6,230	19,897	269	420	130
	101.6	117.475	7.937	107.5	111.5	1.015							
WSA1068X	*4.25*	*4.875*	*.3125*	*4.482*	*4.640*	*.04*	7,536	17,621	6,310	20,749	288	465	138
	107.95	123.825	7.937	113.85	117.85	1.015							
WSA1072X	*4.5*	*5.125*	*.3125*	*4.732*	*4.892*	*.04*	7,716	18,663	6,450	22,026	311	520	145
	114.3	130.175	7.937	120.2	124.25	1.015							
WSA1076X	*4.75*	*5.375*	*.3125*	*4.982*	*5.142*	*.04*	7,888	19,705	6,590	23,301	334	580	153
	120.65	136.525	7.937	126.55	130.6	1.015							
WSA1080X	*5*	*5.625*	*.3125*	*5.232*	*5.390*	*.04*	8,055	20,747	6,720	24,577	358	640	161
	127	142.875	7.937	132.9	136.9	1.015							
WSA1088X	*5.5*	*6.125*	*.3125*	*5.732*	*5.890*	*.04*	8,283	22,473	6,880	26,706	402	770	176
	139.7	155.575	7.937	145.6	149.6	1.015							
WSA1096X	*6*	*6.625*	*.3125*	*6.232*	*6.390*	*.04*	8,501	24,200	7,045	28,835	448	900	191
	152.4	168.275	7.937	158.3	162.3	1.015							
WSA10104X	*6.5*	*7.125*	*.3125*	*6.732*	*6.892*	*.04*	8,789	26,283	7,270	31,387	499	1,060	205
	165.1	180.975	7.937	171	175.05	1.015							
WSA10112X	*7*	*7.625*	*.3125*	*7.232*	*7.393*	*.04*	9,061	28,365	7,490	33,937	552	1,200	220
	177.8	193.675	7.937	183.69	187.79	1.015							
WSA10120X	*7.5*	*8.125*	*.3125*	*7.732*	*7.890*	*.04*	9,175	29,738	7,570	35,644	596	1,380	236
	190.5	206.375	7.937	196.4	200.4	1.015							
WSA10128X	*8*	*8.625*	*.3125*	*8.232*	*8.392*	*.04*	9,772	35,277	7,700	37,772	647	1,560	251
	203.2	219.075	7.937	209.1	213.15	1.015							
WSA10144X[3]	*9*	*9.625*	*.3125*	*9.232*	*9.390*	*.04*	9,601	35,917	8,020	42,453	755	1,970	281
	228.6	244.475	7.937	234.5	238.5	1.015							

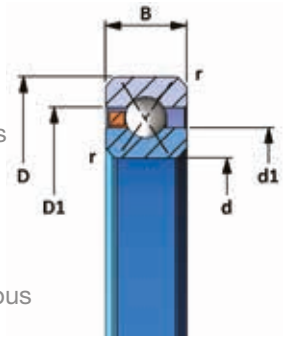
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 R version values of load capacity.

3 Ball bearing is proposed only in version E.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 10 INCHES (d 254 MM)



5 I SA12, Super Thin Section four points of contact

Ball bearing version X is designed with a 4 point-contact to support higher loads
The four point-contact ball bearings (version X) are adapted to support combined axial, radial and angular loads.
On specification (Kxxxx), a solid preload, is designed with an optimal internal play in order to achieve the stiffness and torque requirement.
The ball bearing with an internal preload is adjusted to ensure a homogeneous friction torque on the batch of bearing. It is measured on specification.
Constant section and ball diameter: 5/32 inch (3.969 mm) - Open bearings only
Version R and E
Tolerances: TA5, TA4
Position 7

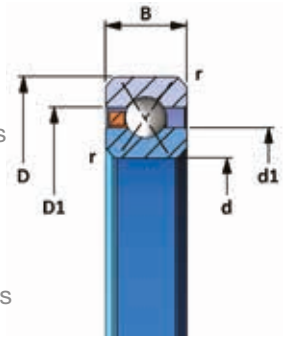
Basic designation	Dimensions *in inches* / in mm						Basic load rating[2]						Mean mass[2]
							Radial (N)		Axial (N)		Moment (N. m)		
							Dyn.	Stat.	Dyn.	Stat.	Dyn.	Stat.	
	d	D	B	d1	D1	r[1]	C	Co	Cax	Co ax	C Mt	Co Mt	g
WSA1264X	*4*	*4.75*	*.3750*	*4.278*	*4.469*	*.04*	9,547	20,239	9,420	26,104	347	555	179
	101.6	120.65	9.525	108.65	113.5	1.015							
WSA1268X	*4.25*	*5*	*.3750*	*4.530*	*4.720*	*.04*	9,703	21,311	9,550	27,209	373	610	188
	107.95	127	9.525	115.05	119.9	1.015							
WSA1272X	*4.5*	*5.25*	*.3750*	*4.778*	*4.968*	*.04*	9,854	22,382	9,680	29,142	399	694	199
	114.3	133.35	9.525	121.36	126.18	1.015							
WSA1276X	*4.75*	*5.5*	*.3750*	*5.028*	*5.220*	*.04*	10,002	23,452	9,820	29,779	426	753	209
	120.65	139.7	9.525	127.7	132.6	1.015							
WSA1280X	*5*	*5.75*	*.3750*	*5.276*	*5.468*	*.04*	10,286	25,032	10,080	30,247	459	795	219
	127	146.05	9.525	134.01	138.89	1.015							
WSA1288X	*5.5*	*6.25*	*.3750*	*5.776*	*5.969*	*.04*	10,555	27,172	10,310	32,261	515	929	239
	139.7	158.75	9.525	146.7	151.6	1.015							
WSA1296X	*6*	*6.75*	*.3750*	*6.276*	*6.469*	*.04*	10,939	29,825	10,650	35,319	578	1,106	260
	152.4	171.45	9.525	159.4	164.3	1.015							
WSA12104X	*6.5*	*7.25*	*.3750*	*6.776*	*6.969*	*.04*	11,181	31,851	10,870	37,769	637	1,277	280
	165.1	184.15	9.525	172.1	177	1.015							
WSA12112X	*7*	*7.75*	*.3750*	*7.276*	*7.469*	*.04*	11,530	34,350	11,190	40,827	704	1,483	300
	177.8	196.85	9.525	184.8	189.7	1.015							
WSA12120X	*7.5*	*8.25*	*.3750*	*7.778*	*7.970*	*.04*	11,751	36,336	11,390	45,860	765	1,776	321
	190.5	209.55	9.525	197.55	202.45	1.015							
WSA12128X	*8*	*8.75*	*.3750*	*8.278*	*8.469*	*.04*	12,071	38,834	11,660	49,767	835	2,062	342
	203.2	222.25	9.525	210.25	215.1	1.015							
WSA12144X	*9*	*9.75*	*.3750*	*9.276*	*9.469*	*.04*	12,474	42,809	12,020	51,231	965	2,377	382
	228.6	247.65	9.525	235.6	240.5	1.015							
WSA12160X	*10*	*10.75*	*.3750*	*10.275*	*10.469*	*.04*	13,041	47,803	12,530	56,518	1,115	2,900	422
	254	273.05	9.525	260.99	265.9	1.015							

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 R version values of load capacity.

C. THIN SECTION BALL BEARINGS

BORE DIAMETER d FROM 4 INCHES (d 101.6 MM) TO 12 INCHES (d 304.8 MM)



5 I SA16, Super Thin Section four points of contact

Ball bearing version X is designed with a 4 point-contact to support higher loads
The four point-contact ball bearings (version X) are adapted to support combined axial, radial and angular loads.
On specification (Kxxxx), a solid preload, is designed with an optimal internal play in order to achieve the stiffness and torque requirement.
The ball bearing with an internal preload is adjusted to ensure a homogeneous friction torque on the batch of bearing. It is measured on specification.
Constant section and ball diameter: 1/4 inch (6.35 mm) - Open bearings only
Version R and E
Tolerances: TA5, TA4
Position 7

Basic designation	Dimensions *in inches* / in mm						Basic load rating[2]						Mean mass[2]
							Radial (N)		Axial (N)		Moment (N. m)		
							Dyn.	Stat.	Dyn.	Stat.	Dyn.	Stat.	
	d	D	B	d1	D1	r[1]	C	Co	Cax	Co ax	C Mt	Co Mt	g
WSA1664X	*4*	*5*	*.5*	*4.370*	*4.623*	*.06*	14,579	27,462	14,440	36,062	543	781	331
	101.6	127	12.7	111	117.42	1.525							
WSA1668X	*4.25*	*5.25*	*.5*	*4.594*	*4.72*	*.06*	14,662	28,450	14,500	36,853	577	844	349
	107.95	133.35	12.7	116.7	119.9	1.525							
WSA1672X	*4.5*	*5.5*	*.5*	*4.844*	*4.968*	*.06*	15,043	30,325	14,850	38,350	623	927	366
	114.3	139.7	12.7	123.05	126.18	1.525							
WSA1676X	*4.75*	*5.75*	*.5*	*5.094*	*5.220*	*.06*	15,407	32,203	15,190	39,759	670	1,010	385
	120.65	146.05	12.7	129.4	132.6	1.525							
WSA1680X	*5*	*6*	*.5*	*5.344*	*5.468*	*.06*	15,480	33,184	15,250	42,662	705	1,139	403
	127	152.4	12.7	135.75	138.89	1.525							
WSA1688X	*5.5*	*6.5*	*.5*	*5.844*	*5.969*	*.06*	16,159	36,941	15,860	47,806	802	1,397	440
	139.7	165.1	12.7	148.45	151.6	1.525							
WSA1696X	*6*	*7*	*.5*	*6.344*	*6.469*	*.06*	16,543	39,798	16,190	50,257	890	1,595	477
	152.4	177.8	12.7	161.15	164.3	1.525							
WSA16104X	*6.5*	*7.5*	*.5*	*6.844*	*6.969*	*.06*	16,912	42,652	16,520	54,856	980	1,880	513
	165.1	190.5	12.7	173.85	177	1.525							
WSA16112X	*7*	*8*	*.5*	*7.344*	*7.469*	*.06*	17,496	46,414	17,050	58,302	1,085	2,143	550
	177.8	203.2	12.7	186.55	189.7	1.525							
WSA16120X	*7.5*	*8.5*	*.5*	*7.844*	*7.97*	*.06*	17,830	49,267	17,350	61,101	1,180	2,400	586
	190.5	215.9	12.7	199.25	202.45	1.525							
WSA16128X	*8*	*9*	*.5*	*8.344*	*8.469*	*.06*	18,153	52,119	17,650	65,206	1,275	2,725	623
	203.2	228.6	12.7	211.95	215.1	1.525							
WSA16144X	*9*	*10*	*.5*	*9.344*	*8.469*	*.06*	18,968	58,402	18,360	73,248	1,487	3,430	696
	228.6	254	12.7	237.35	215.1	1.525							
WSA16160X	*10*	*11*	*.5*	*10.344*	*8.469*	*.06*	19,727	64,612	19,040	80,432	1,710	4,170	770
	254	279.4	12.7	262.75	215.1	1.525							
WSA16176X	*11*	*12*	*.5*	*11.344*	*7.89*	*.06*	20,262	69,912	19,520	89,134	1,920	5,075	843
	279.4	304.8	12.7	288.15	200.4	1.525							
WSA16192X	*12*	*13*	*.5*	*12.344*	*7.89*	*.06*	20,774	75,215	19,970	96,107	2,140	5,955	924
	304.8	330.2	12.7	313.55	200.4	1.525							

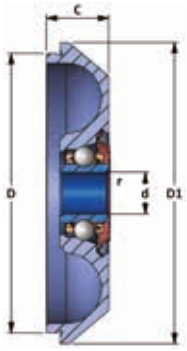
1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 R version values of load capacity.

D. SPECIFIC BALL BEARINGS

1 I End-bell ball bearings for gyroscope rotors

These ball bearings form the extremities of a gyroscope rotor. They are generally supplied with a precisely controlled contact angle, and may also be supplied in pairs.



Designation	Dimensions in mm				
	d	D	C	D1	r
SP3181	1.984	15.9	3.556	17.145	.2
SP1690	2.38	15.9	3.556	17.145	.2
SP5090	4	23	4.8	26	.2

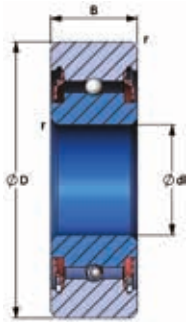
2 I Shaft and outer ring assemblies

They are mainly used in gyroscope rotors with high performance levels and comprise a shaft having ground raceways, and two outer-ring E type assemblies. This principle increases the rigidity and the accuracy of the unit. Please consult our Design & Engineering Department for new designs based on this principle.

3 I Specific ball bearings for gyroscope gimbal arrangements

a I Ball bearings with spring ball separators

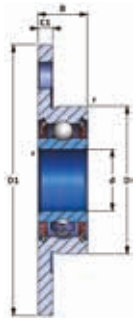
Low torque and small size.



Designation	Dimensions in mm			
	d	D	B	r
SP4619ZZ	4.762	12.7	3.967	.3
SP4620ZZ	6.35	15.875	4.978	.3
SP6125ZZ	7.937	15.875	4.978	.3

b I Ball bearings with extra-large drilled flange

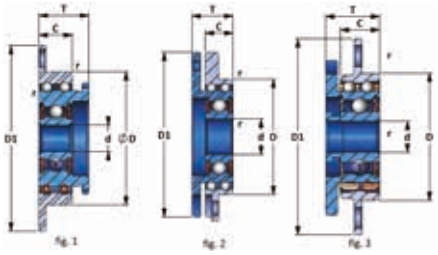
A low torque ball bearing may be supplied with this type of flange. Details regarding mounting are available on request.



Designation	Dimensions in mm					
	d	D	B	D1	C1	r
KSP2824ZZ	4.762	12.7	3.967	22.225	1.321	.13
SP5007ZZ	5	12	4	22	1.2	.15
SP4040ZZ	6.35	15.875	4.978	25.4	1.651	.3

c I Three-ring assemblies

They are used in gyroscope gimbal arrangements. The torque of the sensitive inner ball bearing may be greatly reduced by keeping the intermediate ring in rotation. The double row of balls of the outer ball bearing provides an accurate axial positioning. Please consult our Design & Engineering Department for details.



Designation	Fig.	Dimensions in mm					
		d	D	T	D1	C	r
SP4441	3	3.175	13	5.5	20	4	.3
SP5258	1	3.175	15.875	5.944	22.098	3.967	.13
SP5255	1	4.762	15.875	5.944	22.098	3.967	.13
SP5264	2	6.35	2.635	7.34	30.162	4.978	.3

E. ADR X-SPACE BALL BEARINGS

1 I Metric series

Thin section super duplex ball bearings
Angular contact versions only with full cage
Back-to-Back configuration (DO)
Non-separable version only
Open version only
Contact angle 15°
Tolerance class T4/TA4 (metric/inch) – ABEC 7
Space qualified materials

AISI 440C/X105CrMo17 + phenolic resin (space qualified)
Fluid lubrication for space application
Note: Solid or specific lubrication on demand only

Documentation:
Technical Definition of Product (TDP), overall dimension drawing, DML, DPL
Specific calculations (launching/orbit loads, stiffness, lifetime, friction, etc.):
personalised document supplied on demand

Basic designation	Dimensions in mm						Basic load rating N[2] for axial/radial and Nm[2] for moment						Mass
							Radial		Axial		Moment		
							Dyn.	Stat.	Dyn.	Stat.	Dyn.	Stat.	
	d	D	B	d1	D1	r[1]	C	Co	Cax	Co ax	C Mt	Co Mt	g
XDM608H	8	22	14	12.45	19.4	.3	3,775	2,396	2,490	2,240	21.6	12.8	24.6
XDM61801H	12	21	10	15	19.2	.3	2,002	1,694	1,315	1,313	10.7	8.5	12.3
XDM61802H	15	24	10	17.9	22.2	.3	2,382	2,378	1,535	2,117	14.1	13.4	14.5
XDM61902H	15	28	14	18.95	25.9	.3	4,656	3,781	3,040	3,648	32.7	24.9	31
XDM61804H	20	32	14	24	29.6	.3	4,000	4,230	2,550	3,327	32.1	32.3	36
XDM61905H	25	42	18	30.3	38.8	.3	7,918	8,256	5,020	7,554	80.9	80	84
XDM61806H	30	42	14	34	39.8	.3	4,572	6,085	2,830	6,042	45.8	58.6	52
XDM61907H	35	55	20	41.1	51.1	.3	10,587	12,246	6,630	8,578	136	143.4	146
XDM61807H	35	47	14	39	44.8	.3	4,752	6,893	2,900	6,864	52.2	73.5	60
XDM61813H	65	85	20	71.6	81.2	.6	13,149	21,940	7,880	21,870	245	405	260

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 Load ratings per ISO 76 and ISO 281. For space application, a margin must be applied (ECSS requirements or contact ADR).

Note : References based and designed from space heritage ball bearings and compliant to ECSS standard requirements (materials, outgassing, etc.)

E. ADR X-SPACE BALL BEARINGS

2 I Thin Section series

Thin section super duplex ball bearings
Angular contact versions only with full cage
Back-to-Back configuration (DO)
Non-separable version only
Open version only
Contact angle 15°
Tolerance class T4/TA4 (metric/inch) – ABEC 7
Space qualified materials

AISI 440C/X105CrMo17 + phenolic resin (space qualified)
Fluid lubrication for space application
Note: Solid or specific lubrication on demand only

Documentation:
Technical Definition of Product (TDP), overall dimension drawing , DML, DPL
Specific calculations (launching/orbit loads, stiffness, lifetime, friction, etc.):
personalised document supplied on demand

Basic designation	Dimensions *in inches* / in mm						Basic load rating N² for axial/radial and Nm² for moment						Mass
							Radial		Axial		Moment		
							Dyn.	Stat.	Dyn.	Stat.	Dyn.	Stat.	
	d	D	B	d1	D1	r[1]	C	Co	Cax	Co ax	C Mt	Co Mt	g
XAA717H	*1.0625*	*1.5*	*.5*	*1.2035*	*1.4209*	*.015*	4,866	5,909	3,200	4,695	44.9	51.3	38
	26.9875	38.1	12.7	30.57	36.090	.38							
XAA721H	*1.3125*	*1.75*	*.5*	*1.4535*	*1.6705*	*.015*	5,118	6,771	3,310	5,505	54	66.5	45
	33.3375	44.45	12.7	36.92	42.430	.38							
XAA624H	*1.5*	*1.875*	*.375*	*1.6291*	*1.7906*	*.0098*	3,491	5,412	2,190	4,560	37.2	53	33
	38.1	47.625	9.525	41.380	45.48	.25							
XAA725H	*1.5625*	*2*	*.5*	*1.7035*	*1.9201*	*.015*	5,564	8,116	3,535	6,709	65.7	89	52
	39.6875	50.8	12.7	43.27	48.77	.38							
XAA832H	*2*	*2.5*	*.5*	*2.172*	*2.3878*	*.025*	5,956	9,858	3,700	8,326	84.3	128.9	79
	50.8	63.5	12.7	55.17	60.65	.635							
XAA840H	*2.5*	*3*	*.5*	*2.672*	*2.8866*	*.025*	6,279	11,599	3,820	9,943	104.3	177.8	96
	63.5	76.2	12.7	67.87	73.32	.635							
XAA1040H	*2.5*	*3.125*	*.625*	*2.7154*	*2.9811*	*.04*	9,789	19,131	6,700	10,360	201	187.5	151
	63.5	79.375	15.875	68.97	75.72	1.015							
XAA1349H	*3.0625*	*3.875*	*.625*	*3.3521*	*3.672*	*.015*	13,930	28,968	9,420	15,381	317	352	260
	77.7875	98.425	15.875	85.144	93.27	.38							
XAA848H	*3*	*3.5*	*.5*	*3.172*	*3.3858*	*.025*	6,651	13,575	3,980	11,758	182.3	239	114
	76.2	88.9	12.7	80.57	86	.635							
XAA856H	*3.5*	*4*	*.5*	*3.672*	*3.885*	*.025*	6,988	15,551	4,125	13,573	149.5	309	132
	88.9	101.6	12.7	93.27	98.68	.635							
XAA1064H	*4*	*4.6250*	*.6250*	*4.2154*	*4.4783*	*.04*	11,110	26,761	7,350	14,306	325.5	347.5	233
	101.6	117.475	15.875	107.07	113.75	1.015							
XAA1076H	*4.75*	*5.375*	*.625*	*4.9654*	*5.2272*	*.04*	12,356	35,940	7,920	19,044	459	579	274
	120.65	136.525	15.875	126.12	132.77	1.015							
XAA1080H	*5*	*5.625*	*.625*	*5.2154*	*5.4701*	*.04*	12,623	37,973	8,050	20,096	408.5	636	288
	127	142.875	15.875	132.47	138.94	1.015							

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.

2 Load ratings per ISO 76 and ISO 281. For space application, a margin must be applied (ECSS requirements or contact ADR).

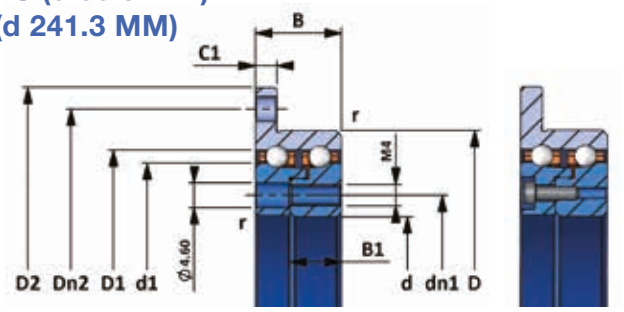
Note : References based and designed from space heritage ball bearings and compliant to ECSS standard requirements (materials, outgassing, etc.)

F. INTEGRATED BALL BEARINGS

BORE DIAMETER d FROM 3.5 INCHES (d 88.9 MM) TO 9.5 INCHES (d 241.3 MM)

I Series KADV12

Constant ball diameter: 5/32 inch (3.969 mm)
Constant section, versions H and N
K versions (Flange on outer ring with n1 holes)
Inner rings with n2 threaded holes
Back-to-back duplex configuration maintained by screws
Preload value upon request
Open ball bearing only
Tolerances: TA5, TA4
Position 7



Basic designation	Dimensions *in inches* / in mm								
	d	D	B	B1	C1	D2	d1	D1	r[1]
WKADV1264	*3.5*	*4.75*	*.625*	*.375*	*.1563*	*5.375*	*4.278*	*4.472*	*.04*
	88.9	120.65	15.875	9.525	3.969	136.525	108.66	113.59	1.015
WKADV1268	*3.75*	*5*	*.625*	*.375*	*.1563*	*5.625*	*4.528*	*4.722*	*.04*
	95.25	127	15.875	9.525	3.969	142.875	115.01	119.94	1.015
WKADV1272	*4*	*5.25*	*.625*	*.375*	*.1563*	*5.875*	*4.778*	*4.972*	*.04*
	101.6	133.35	15.875	9.525	3.969	149.225	121.36	126.29	1.015
WKADV1276	*4.25*	*5.5*	*.625*	*.375*	*.1563*	*6.125*	*5.028*	*5.222*	*.04*
	107.95	139.7	15.875	9.525	3.969	155.575	127.71	132.64	1.015
WKADV1280	*4.5*	*5.75*	*.625*	*.375*	*.1563*	*6.375*	*5.278*	*5.472*	*.04*
	114.3	146.05	15.875	9.525	3.969	161.925	134.06	138.99	1.015
WKADV1288	*5*	*6.25*	*.625*	*.375*	*.1563*	*6.875*	*5.778*	*5.972*	*.04*
	127	158.75	15.875	9.525	3.969	174.625	146.76	151.69	1.015
WKADV1296	*5.5*	*6.75*	*.625*	*.375*	*.1563*	*7.375*	*6.278*	*6.472*	*.04*
	139.7	171.45	15.875	9.525	3.969	187.325	159.46	164.39	1.015
WKADV12104	*6*	*7.25*	*.625*	*.375*	*.1563*	*7.875*	*6.778*	*6.972*	*.04*
	152.4	184.15	15.875	9.525	3.969	200.025	172.16	177.09	1.015
WKADV12112	*6.5*	*7.75*	*.625*	*.375*	*.1563*	*8.375*	*7.278*	*7.472*	*.04*
	165.1	196.85	15.875	9.525	3.969	212.725	184.86	189.79	1.015
WKADV12120	*7*	*8.25*	*.625*	*.375*	*.1563*	*8.875*	*7.778*	*7.972*	*.04*
	177.8	209.55	15.875	9.525	3.969	225.425	197.56	202.49	1.015
WKADV12128	*7.5*	*8.75*	*.625*	*.375*	*.1563*	*9.375*	*8.278*	*8.472*	*.04*
	190.5	222.25	15.875	9.525	3.969	238.125	210.26	215.19	1.015
WKADV12144	*8.5*	*9.75*	*.625*	*.375*	*.1563*	*10.375*	*9.278*	*9.472*	*.04*
	215.9	247.65	15.875	9.525	3.969	263.525	235.66	240.59	1.015
WKADV12160	*9.5*	*10.75*	*.625*	*.375*	*.1563*	*11.375*	*10.278*	*10.472*	*.04*
	241.3	273.05	15.875	9.525	3.969	288.925	261.06	265.99	1.015

1 Minimum ball bearing corner radius and maximum shaft or housing fillet radius.
2 H version values.

Comments

→ **Centring diameter d is only for B1 width.**

Dimensions *in inches* / in mm				Basic load rating N[2]			Mean mass[2]	Basic designation
				Radial		Axial static		
				Dyn.	Stat.			
dn1	n1	Dn2	n2	C	Co	Cax	g	
3.813	8	*5.063*	8	11,600	30,700	16,100	610	WKADV1264
96.85		128.6						
4.063	8	*5.313*	8	11,900	32,700	17,100	648	WKADV1268
103.2		134.95						
4.313	10	*5.563*	10	12,100	34,300	17,900	680	WKADV1272
109.55		141.3						
4.563	10	*5.813*	10	12,300	36,300	18,900	718	WKADV1276
115.9		147.65						
4.813	12	*6.063*	12	12,500	37,800	19,700	750	WKADV1280
122.25		154						
5.313	12	*6.563*	12	12,900	41,400	21,400	825	WKADV1288
134.95		166.7						
5.813	12	*7.063*	12	13,300	45,000	23,200	899	WKADV1296
147.65		179.4						
6.313	16	*7.563*	16	13,700	49,000	25,200	965	WKADV12104
160.35		192.1						
6.813	16	*8.063*	16	14,100	52,600	27,000	1,040	WKADV12112
173.05		204.8						
7.313	16	*8.563*	16	14,400	56,100	28,800	1,120	WKADV12120
185.75		217.5						
7.813	16	*9.063*	16	14,700	59,700	30,600	1,190	WKADV12128
198.45		230.2						
8.813	20	*10.063*	20	15,300	66,800	34,100	1,330	WKADV12144
223.85		255.6						
9.813	20	*11.063*	20	15,900	74,000	37,700	1,480	WKADV12160
249.25		281						

THE MOST COMMON UNITS OF MEASUREMENT

Measurement	Unit	Symbol
Dimension	Millimetre	mm
Surface, Area	Square millimetre	mm^2
Volume	Cubic millimetre	mm^3
Rotational angular speed	Radian per second	rad/s
Volumic mass	Kilogramme per cubic metre	Kg/m^3
Load	Newton	N
Moment load	Newton - metre	N.m
Pressure, stress	Mega Pascal	MPa
Kinematics viscosity	Square millimetre per second	mm^2/s
Power	Watt	W
Coefficient of thermal expansion	Inverse Kelvin	K^{-1}
Thermal conductivity	Watt per Kelvin metre	W/(m.K)

THE MOST COMMON UNITS OF MEASUREMENT

	mm	cm	m	inches	feet
1 mm =	1	10^{-1}	10^{-3}	$3.93701\ 10^{-2}$	$3.28084\ 10^{-3}$
1 cm =	10	1	10^{-2}	$3.93701\ 10^{-1}$	$3.28084\ 10^{-2}$
1 m =	10^3	10^2	1	39.3701	3.28084
1 inch =	25.4	2.54	$2.54\ 10^{-2}$	1	$8.3333\ 10^{-2}$
1 foot =	304.8	30.48	$3.048\ 10^{-1}$	12	1

MASS CONVERSION TABLE

	g	Kg	Oz	Pound (lb)
1 g =	1	10^{-3}	$3.5274\ 10^{-2}$	$2.20462\ 10^{-3}$
1 Kg =	10^3	1	35.274	2.20462
1 Oz =	28.3495	$2.83495\ 10^{-2}$	1	$6.25\ 10^{-2}$
1 Pound =	453.592	0.4536	16	1

PRESSURE CONVERSION TABLE

	Mpa	Pa	N/mm^2	Bar	millibar	Torr
1 MPa =	1	10^6	1	10	10^4	$7.5\ 10^3$
1 Pa =	10^{-6}	1	10^{-6}	10^{-5}	10^{-2}	$7.5\ 10^{-3}$
1 N/mm^2 =	1	10^6	1	10	10^4	$7.5\ 10^3$
1 Bar =	10^{-1}	10^5	10^{-1}	1	10^3	$7.5\ 10^2$
1 millibar =	10^{-4}	10^2	10^{-4}	10^3	1	$7.5\ 10^{-1}$
1 Torr =	$1.33\ 10^{-4}$	133	$1.33\ 10^{-4}$	$1.33\ 10^{-3}$	1.33	1

NOTES

NOTES

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