Double-Row Angular Contact Roller Ring **RW**

Highly rigid double-row angular contact roller rings
capable of receiving a load in any direction

Highly rigid double-row angular contact roller rings capable of receiving a load in any direction

Model RW

Boosts rigidity by using more rollers.
Supports high rotational accuracy.

Feature 1 **High Rigidity**

Feature 2 **High Accuracy**

Feature 3 **Easy to Install**

Achieves high rigidity and precision by increasing the number of rollers with a double-row structure. High rigidity and regulated wobbling accuracy make it optimal for rotating mechanisms in machines with multiple functions.

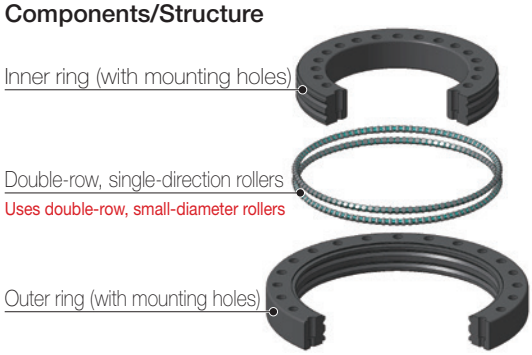
Model RW

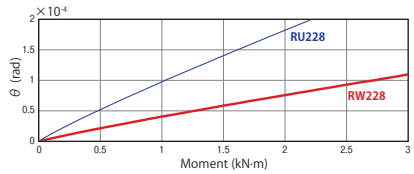
Feature 1 High Rigidity

An increased number of rollers achieves high rigidity.

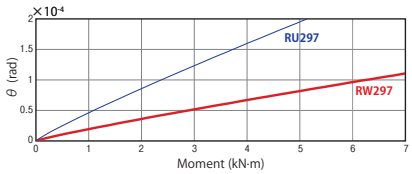
The Model RW uses multiple raceways and small-diameter rollers to increase the overall roller quantity. This achieves much higher rigidity when compared to conventional THK cross roller rings with the same inner and outer dimensions.

Components/Structure

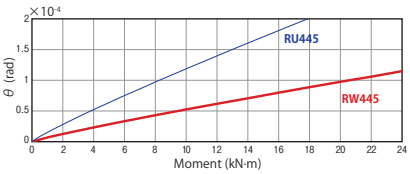




RW228 and RU228



RW297 and RU297



RW445 and RU445

Theoretical Rigidity Comparison

Feature 2 High Accuracy

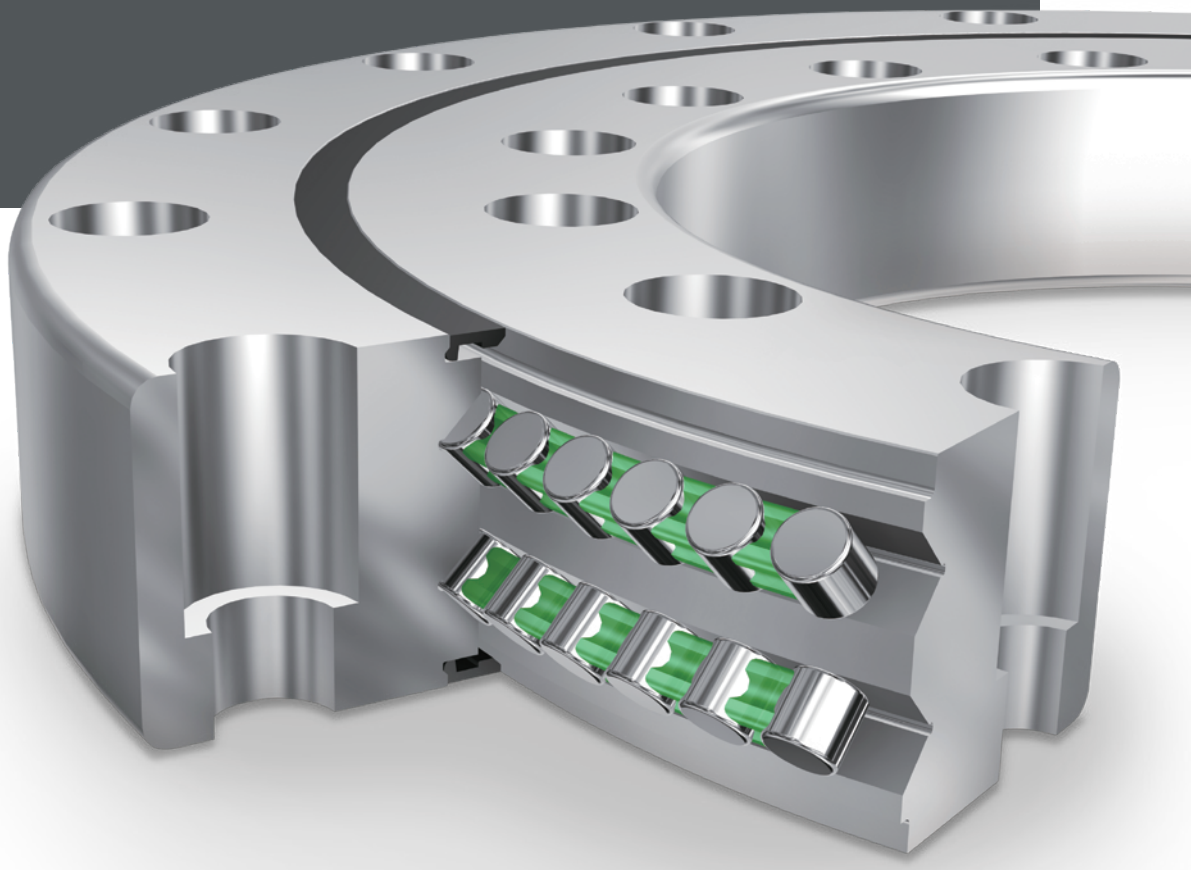
Wobbling accuracy of 2 μm allows for high rotational accuracy.

With the Model RW, it is possible to specify the runout accuracy (wobbling accuracy) of actual operating positions such as machining position and measurement position.

Feature 3 Easy to Install

Mounting holes in the inner and outer rings reduce the number of design steps and components.

The Model RW has mounting holes in the inner and outer rings, eliminating the need for other mounting components and allowing it to attach directly to shafts and housings.



Lineup

Unit: mm

Model No.	Inner diameter	Outer diameter
RW228	160	295
RW297	210	380
RW445	350	540

Available in dimensions other than those listed above. See p. 10 for details.

Model Number Coding

RW297 UU CC0 P2 B G X -N

Model No.

Seal code
No symbol: No seal
UU: Seals on both sides
U: Seal on one side (outer-ring counterbore side)
UT: Seal on one side (outer-ring non-counterbore side)

Radial clearance symbol
CC0: Negative clearance (preload specification)

Accuracy symbol
No symbol: Rotational accuracy grade 5
P4: Rotation accuracy grade 4
P2: Rotation accuracy grade 2
USP: Rotational accuracy grade USP
TSP: Rotational accuracy grade USP + wobbling accuracy

Component accuracy symbol
No symbol: Rotational accuracy of the inner ring
R: Rotational accuracy of the outer ring
B: Rotational accuracy of the inner and outer rings

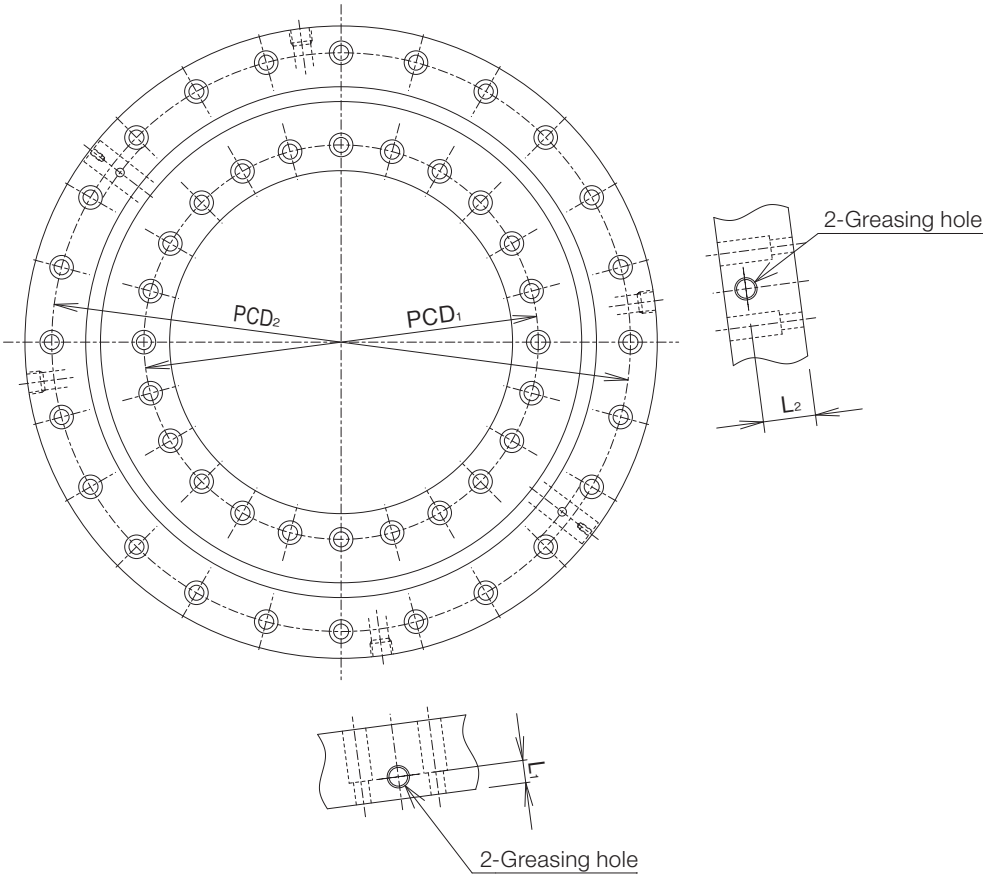
Mounting hole assembly direction symbol (excludes X type)
No symbol: Counterbores in inner and outer rings are in the same direction
G: Counterbores in inner and outer rings are in opposite directions

Inner ring hole machining symbol
No symbol: Inner ring counterbore
X: Inner ring tapped hole (through)

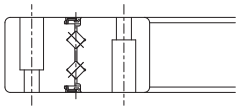
Option Symbols
No symbol: Without attached part
-N: With grease nipple (A-PT1/8)

Select an option | Fixed symbol

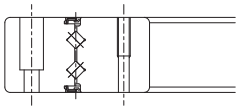
Specification Table



RW228 to RW445

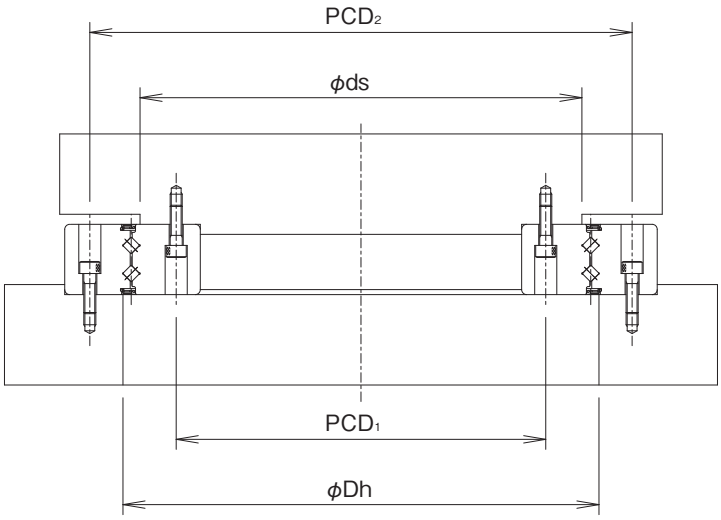


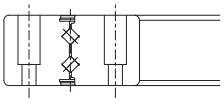
RW228G to RW445G



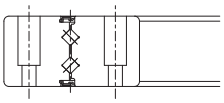
RW228X to RW445X

Model No.	Main dimensions											
	Inner diameter		Outer diameter		Roller pitch circle diameter	Width		Greasing hole				
	d	Tolerance*	D	Tolerance*	dp	B	Tolerance	Hole diameter	L_1	L_2	r_{min}	
RW228 (G)	160	0 -0.025	295	0 -0.035	228.8	35	0 -0.100	Rc1/8	10.5	24.5	2	
RW228X												
RW297 (G)	210	0 -0.030	380	0 -0.040	299.2	40	0 -0.100	Rc1/8	12	28	2.5	
RW297X												
RW445 (G)	350	0 -0.040	540	0 -0.050	445.4	50	0 -0.150	Rc1/8	15	35	2.5	
RW445X												

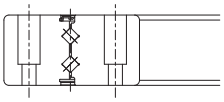




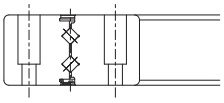
Model RW
Without seals



Model RW (UU Type)
With seals on both sides

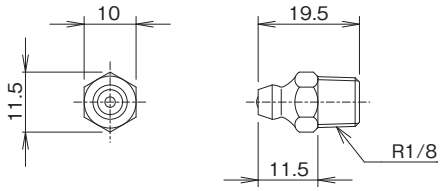


Model RW (U Type)
With seal (outer-ring counterbore side)



Model RW (UT Type)
With seal (outer-ring non-counterbore side)

Options



Grease nipple (A-PT1/8)

*Lubrication accessories (piping joints, grease nipples) other than the standard options are also available. Please contact THK if surface treatment is required. (For details about other lubrication accessories, please see the "Accessories for Lubrication" section of the catalog.)

Unit: mm

Shoulder height		Basic load rating (radial)		Weight	Mounting hole dimensions				Model No.
					Inner ring		Outer ring		
ds	Dh	C	C_0		PCD_1	Mounting hole	PCD_2	Mounting hole	
		(kN)	(kN)	(kg)					
220	240	58.4	158	12	184	24-ϕ7 drilled through, ϕ11 counterbore depth 24.5	270	24-ϕ7 drilled through, ϕ11 counterbore depth 24.5	RW228 (G)
						24-M6 depth 18			RW228X
285	315	101	287	22	240	24-ϕ9.3 drilled through, ϕ14.5 counterbore depth 28	350	24-ϕ9.3 drilled through, ϕ14.5 counterbore depth 28	RW297 (G)
						24-M8 depth 24			RW297X
425	465	214	647	47	385	32-ϕ9.3 drilled through, ϕ14.5 counterbore depth 35	505	32-ϕ9.3 drilled through, ϕ14.5 counterbore depth 35	RW445 (G)
						32-M8 depth 24			RW445X

* The tolerance of the bearing inner diameter and outer diameter is the arithmetic average of the maximum and minimum diameters obtained by measuring the bearing inner diameter at two points.

Radial Clearance

Radial clearance for the Model RW is adjusted to negative clearance (preload) at the time of shipment and is regulated by starting torque.

Radial Clearance

Model No.	Starting torque (N·m)	
	Min.	Max.
RW228	1	10
RW297	3	20
RW445	10	65

Note) Starting torque does not include seal resistance.

Accuracy Standards

The Model RW is manufactured with accuracies in accordance with the following tables.

Rotational Accuracy

Rotational Accuracy of the Inner Ring

Unit: μm

Model No.	Radial runout tolerance of the inner ring					Axial runout tolerance of the inner ring				
	P5 Grade	P4 Grade	P2 Grade	USP Grade	TSP Grade	P5 Grade	P4 Grade	P2 Grade	USP Grade	TSP Grade
RW228	8	6	5	2.5	2.5	8	6	5	2.5	2.5
RW297	10	8	5	3	3	10	8	5	3	3
RW445	15	12	7	4	4	15	12	7	4	4

Note) The Model RW has a standard rotational accuracy grade of P5. (This is not shown in the Model No.)

Rotational Accuracy of the Outer Ring

Unit: μm

Model No.	Radial runout tolerance of the outer ring				Axial runout tolerance of the outer ring			
	P5 Grade	P4 Grade	P2 Grade	USP Grade	P5 Grade	P4 Grade	P2 Grade	USP Grade
RW228	18	11	7	4	18	11	7	4
RW297	20	13	8	5	20	13	8	5
RW445	25	16	10	7	25	16	10	7

Note) The Model RW has a standard rotational accuracy grade of P5. (This is not shown in the Model No.)

Wobbling Accuracy (for TSP Grade inner rings only)

The rotational accuracy of the bearing excludes accuracy related to shape (circularity, flatness, etc.), and represents only the rotational deviation of the bearing.

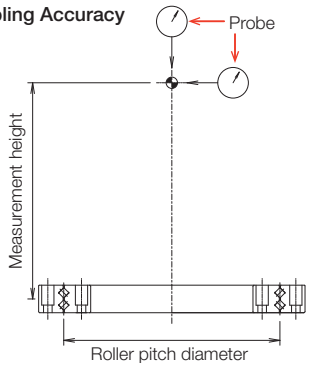
Measurement conditions: measurement height = roller pitch diameter

Wobbling Accuracy

Unit: μm

Model No.	TSP Grade	
	Radial direction	Axial direction
RW228	2	2
RW297	2	2
RW445	2	2

Measuring the Wobbling Accuracy



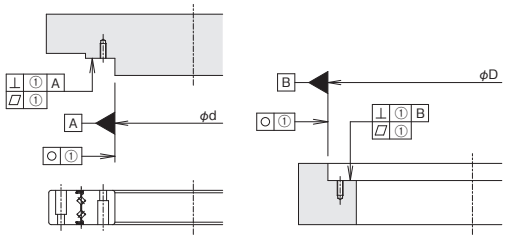
Peripheral Design

Recommended machining accuracies for peripheral attachments (shafts, housings, etc.) are displayed below.

1. Recommended Machining Accuracies for Paired Components

Standard dimensions d, D (mm)		Circularity/perpendicularity/ flatness (μm)
Above	Or less	
120	180	5
180	250	7
250	315	8
315	400	9
400	500	10
500	630	11

Peripheral Machining Accuracy

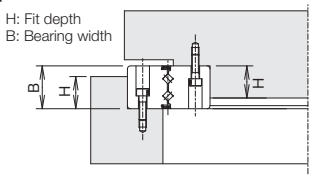


Use the table below as a guideline for shaft and housing depths.

2. Shafts and Housing Depths

Application	Fit depth: H
When positioning accuracy is needed	0.15 to 0.25×B
When loads are large	0.50 to 0.75×B
When high rigidity is needed	0.75 to 1.00×B

Housing Fit Depth

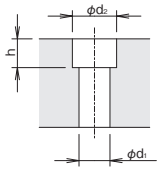


The values below are recommended for the bolt holes used to secure paired components.

3. Recommended Bolt Hole Dimensions for Paired Components

Unit: mm

Model No.	Bolt size	Recommended bolt hole dimensions		
		d_1	d_2	h
RW228	M6	7	11	6.5
RW297	M8	9.3	14.5	8.6
RW445	M8	9.3	14.5	8.6



Fit

The Model RW does not normally need a fitting, but when precise positioning accuracy is required, or if it will operate under a heavy load, we recommend inserting it in a shaft and housing with a fit tolerance of g6 for the shaft and H7 for the hole. If higher rigidity is needed, we recommend measuring the inner and outer diameters of the bearings and applying a slightly tighter fit (about 0 to 5 μm).

*When applying a tight fit, add a removal tap to the shaft and housing.

Lubrication

Model RW recommended lubrication specifications are listed in the table below. Furthermore, the Model RW is filled with THK AFB-LF grease as standard.

Lubrication Specifications

Lubrication specifications	Lubricant
Grease lubricant	THK AFB-LF grease (standard sealing grease)
Oil lubricant	ISO VG68 oil

*Non-standard greases are also available. Contact THK for details.

AFB-LF Representative Physical Properties

Item		Representative property	Testing method
Consistency enhancer		Lithium-based	
Base oil		Refined mineral oil	
Base oil kinematic viscosity mm^2/s (40℃)		170	JIS K 2220 23
Worked penetration (25˚C, 60 W)		275	JIS K 2220 7
Mixing stability (100,000 W)		345	JIS K 2220 15
Dropping point: ˚C		193	JIS K 2220 8
Evaporation volume: mass% (99˚C, 22 h)		0.4	JIS K 2220 10
Oil separation rate: mass% (100˚C, 24 h)		0.6	JIS K 2220 11
Copper plate corrosion (B method, 100˚C, 24 h)		Passed	JIS K 2220 9
Low-temperature torque mN·m (-20˚C)	Starting	130	JIS K 2220 18
	Rotational	51	
4-ball testing (welding load): N		3089	ASTM D2596
Operating temperature range: ˚C		-15 to 100	
Color		Yellowish brown	

Installation Procedure

Follow this procedure to install the Model RW.

■ Inspecting Components before Installation

Thoroughly clean the housing and other assembly parts, and make sure there are no burrs.

■ Installing the Cross Roller Ring onto a Housing or Shaft

As it is easy for the product to tilt during installation, use a plastic mallet to gradually insert the product by tapping around its outside edge. Continue to hammer carefully until you hear the sound of it making direct contact with the reference surface.

Note) When inserting the inner ring, hammer the inner ring. When inserting the outer ring, hammer the outer ring.

■ Tightening Mounting Bolts

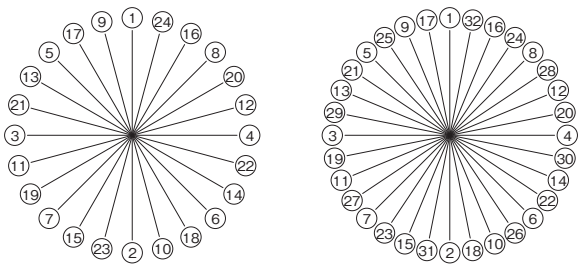
(1) Installation to devices is done from the raceway wheel on the rotating side.

(2) After attaching the Model RW to paired components, align the mounting bolts while rotating the Model RW several times.

(3) Install the mounting bolts. When manually turning the bolts, make sure they do not show skewing caused by misalignment of the holes.

(4) Bolt tightening should be divided into three or four steps, from temporary tightening to final tightening, moving diagonally between bolts in order. (See figure on right.)

(5) Tighten the bolts evenly, using a torque wrench set to the values in the table to the right.



With 24 bolts With 32 bolts

Example Bolt Tightening Order

Bolt Tightening Torque

Model No.	Bolt size	Tightening torque (N·m)
RW228	M6	14
RW297	M8	30
RW445	M8	30

Static Safety Factor

The basic static load rating C_0 is a static load of a defined direction and size where the calculated contact stress of the roller and the raceway at the contact area under maximum stress is 4000 (MPa). (Contact stress exceeding this value may impede rotation.) This load rating is indicated by C_0 in the specification table. It is necessary to consider the following static safety factors based on static and dynamic loads.

$$\frac{C_0}{P_0}=f_s$$

f_s : Static safety factor
C_0 : Basic static load rating (N)
P_0 : Static equivalent radial load (N)

Static Safety Factor (f_s)

Load conditions	Lower limit of f_s
Normal load	1 to 2
Impact load	2 to 3

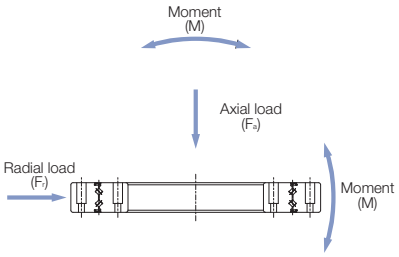
*The values in the table above are guidelines for minimum static safety factors. However, considering dynamic performance such as service life, we recommend a value of 7 or above.

Static Equivalent Radial Load: P_0

The static equivalent radial load of the Model RW is obtained from the following formula.

$$P_0=X_0\cdot\left(F_r+\frac{2M}{dp}\right)+Y_0\cdot F_a$$

P_0 : Static equivalent radial load (N)
F_r : Radial load (N)
F_a : Axial load (N)
M : Moment (N·mm)
X_0 : Static radial factor (X_0=1)
Y_0 : Static axial factor (Y_0=0.44)
dp : Roller pitch circle diameter (mm)



Nominal Life and Service Life Time

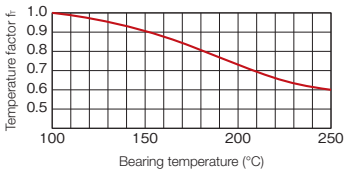
Calculating the Nominal Life

The nominal life (L_{10}) is obtained from the following formula using the basic dynamic load rating (C) and the load applied to the RW (P_C).

Calculating the modified nominal life

During use, the Model RW may be subjected to vibrations and shocks as well as fluctuating loads, which are difficult to detect. In addition, the operating temperature will have a decisive impact on the service life. Taking these factors into account, the modified nominal life (L_{10m}) can be calculated according to the following formula.

Temperature Factor (f_T)



Note) The normal service temperature is 80°C or below. If the product is to be used at a higher temperature, contact THK.

Load Factor (f_w)

Usage conditions	fw
With smooth motion and no impacts	1 to 1.2
With normal motion	1.2 to 1.5
With severe impacts	1.5 to 3

Dynamic Equivalent Radial Load P_C

The dynamic equivalent radial load of the Model RW is obtained from the following formula.

$$P_C=X\cdot\left(F_r+\frac{2M}{dp}\right)+Y\cdot F_a$$

P_C : Dynamic equivalent radial load (N)
F_r : Radial load (N)
F_a : Axial load (N)
M : Moment (N·mm)
X : Dynamic radial factor
Y : Dynamic axial factor
dp : Roller pitch circle diameter (mm)

- When F_r = 0 (N) and M = 0 (N·mm), perform the calculation assuming that X = 0.67 and Y = 0.67.
- For service life calculation with a preload taken into account, contact THK.

$$L_{10}=\left(\frac{C}{P_C}\right)^{\frac{10}{3}}\times 10^6$$

L_{10} : Nominal life[1] (rev)
C : Basic dynamic load rating[2] (N)
P_C : Dynamic equivalent radial load (N)

Modified Factor α

$$\alpha=\frac{f_T}{f_w}$$

α : Modified factor
f_T : Temperature factor
f_w : Load factor

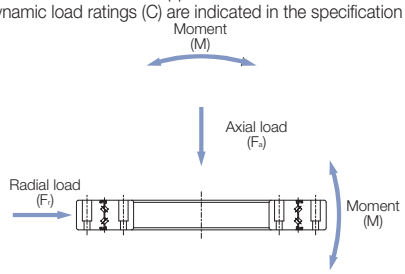
Modified Nominal Life L_{10m}

$$L_{10m}=\left(\alpha\times\frac{C}{P_C}\right)^{\frac{10}{3}}\times 10^6$$

L_{10m} : Modified nominal life[1] (rev)
C : Basic dynamic load rating[2] (N)
P_C : Dynamic equivalent radial load (N)

[1] Nominal life is determined by load calculations assuming adequate lubrication and ideal assembly conditions. Service conditions such as rocking motion or low-speed motion can have an impact on lubrication status. Consult with THK about the calculation of service life under rocking motion or low-speed motion.

[2] The basic dynamic load rating (C) indicates the radial load for which the nominal life is one million rotations when a group of identical Model RW units independently operate under that load when it is applied with a constant direction and magnitude. The basic dynamic load ratings (C) are indicated in the specification tables.



Dynamic Radial Factor and Dynamic Axial Factor

Category	X	Y
$\frac{F_a}{F_r+2M/dp}\le 1.5$	1	0.45
$\frac{F_a}{F_r+2M/dp}>1.5$	0.67	0.67

Calculating the Service Life Time

The nominal life of the Model RW is obtained using the following formula.

For Rotary Motion

$$L_h=\frac{L_{10}}{n_r\times 60}$$

L_h : Service life time (h)
n_r : Revolutions per minute (min^{-1})

Production by Special Order

The following dimensions are also available from THK. Contact THK for details.

Dimensions Available for Production by Special Order Unit: mm

Inner diameter	Outer diameter
100	185
120	210
150	240
180	280
200	300
260	385
325	450
395	525
460	600
580	750
650	870

Handling

(1) Please use at least two people to move any product weighing 20 kg or more, or use a dolly or another method of conveyance. Otherwise, it may cause injury or damage the unit.
(2) Do not disassemble the double-row angular contact roller ring.
(3) Make sure the double-row angular contact roller ring is not dropped or subjected to any sudden impact. Otherwise, it may cause injury or damage the unit. Even if there is no outward indication of damage, a sudden impact could prevent the unit from functioning properly.
(4) Wear appropriate safety gear, such as protective gloves and safety shoes, when handling the product.

Precautions on Use

(1) Prevent foreign materials, such as cutting chips or coolant, from entering the product. Failure to do so could damage the product.
(2) Prevent foreign materials, such as cutting chips, coolant, corrosive solvents, or water from getting in the product by using a bellows or cover when the product is used in an environment where such a thing is likely.
(3) Do not use this product if the external temperature exceeds 80°C. If used above this temperature, there is a risk that the resin and rubber parts may deform or become damaged.
(4) If foreign materials such as cutting chips adhere to the product, replenish the lubricant after washing the product.
(5) Slight oscillations can inhibit the formation of an oil film between the raceways and the area of contact for the balls, resulting in fretting. We recommend periodically rotating the double-row angular contact roller ring several times to help ensure that a film forms on the surfaces and rolling elements.
(6) Please be aware that the double-row angular contact roller ring seals are dust seals and may be unable to prevent the ingress of very fine particles and liquids.
(7) Do not forcibly drive a pin, key, or other positioning device into the product. This could create indentations on the raceway and impair the product's function.
(8) When installing the double-row angular contact roller ring to a housing, if the inner ring is fixed, hammer the inner ring to insert it. If the outer ring is fixed, hammer the outer ring. Hammering the non-fixed side may cause damage to the unit.
(9) If the mounting material lacks sufficient rigidity or accuracy, the bearing load may be focused in one area, and bearing functionality will dramatically decrease. Therefore, consider carefully the rigidity and accuracy of the housing and base, and the strength of the securing bolts.

Lubrication

(1) Do not mix different lubricants. Even grease containing the same type of thickening agent may, if mixed, interact negatively due to disparate additives or other ingredients.
(2) When using the product in locations exposed to constant vibrations or in special environments such as in clean rooms, vacuums, and low/high temperatures, use a lubricant suitable for its use/environment.
(3) Grease viscosity can vary depending on the temperature. Please keep in mind that the torque of the double-row angular contact roller ring may be affected by changes in viscosity.
(4) Since the double-row angular contact roller ring unit contains high-quality lithium soap group grease No. 2, you can start using the product without replenishing grease. However, the product requires regular lubrication, since it has a smaller internal space than ordinary roller bearings and because the rollers need frequent lubrication due to their rolling contact structure. To replenish grease, it is necessary to provide greasing holes that lead to the oil grooves formed on the inner and outer rings. Regularly resupply grease of the same group so that it is distributed throughout the interior of the bearing at least every three to six months. The final greasing interval/amount should be set at the actual machine. When the bearing is filled up with grease, the initial rotational torque temporarily increases. However, surplus grease will run off of the seals and the torque will return to a normal level after a short period of time.
(5) Excess grease may protrude from the outside edge of the double-row angular contact roller ring. The structure of peripheral components will require careful consideration if contamination due to grease around the edges of the device is a concern.
(6) When planning to use a special grease or a lubricant other than grease, please contact THK.

Storage

When storing the double-row angular contact roller ring, enclose it in a package designated by THK and store it in a room in a horizontal orientation while avoiding high temperatures, low temperatures, and high humidity. Please note that if the product has been kept in storage for an extended period, the lubricant inside may have deteriorated. Please ensure that you replenish the lubricant before using.

Disposal

The product should be treated as industrial waste and disposed of appropriately.

Double-Row Angular Contact Roller Ring **RW**

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