NEW PRODUCT

NB

GONIO WAY

RVF Type

Introducing A Standard Flat Installation-Surface Type for Curved Motion Bearing

-For Easy Processing of Tables and Beds-

Certificate No.958188

NIPPON BEARING CO., LTD.

GONIO WAY RVF Type

Nippon Bearing's Gonio Way family has adopted the RVF type with a flat installation surface for easy processing of tables and beds.
NB Gonio Way (RVF type) is a low-friction, non-recirculating curved motion bearing utilizing precision cross-rollers. The RVF type is ideal for changing the gradient or for obtaining an accurate gradient angle without changing the center of rotation. This component is used mainly in optical equipment and measuring devices where high precision is required.

STRUCTURE AND FEATURES

The NB Gonio Way RVF type consists of curved tracking bases with precisely ground V-grooves and flat installation surfaces, as well as a curved roller cage in which cross rollers are fitted. Precision rollers are employed as the rolling elements. Since the rolling elements do not recirculate, the frictional resistance will not vary significantly, providing curved movement with extremely low frictional resistance.

Flat Installation Surface

The flat installation surfaces of the RVF type do not require complicated machining of tables and beds when installing the product. As a result, machining costs can be reduced greatly.

Same Rotation Center

The curved V-grooves, which are finished with a precise grinding process, provide an accurate center of rotation.

Furthermore, the products are composed to provide identical rotation centers when products of each size are installed to two axes. (Refer to Table 4.)

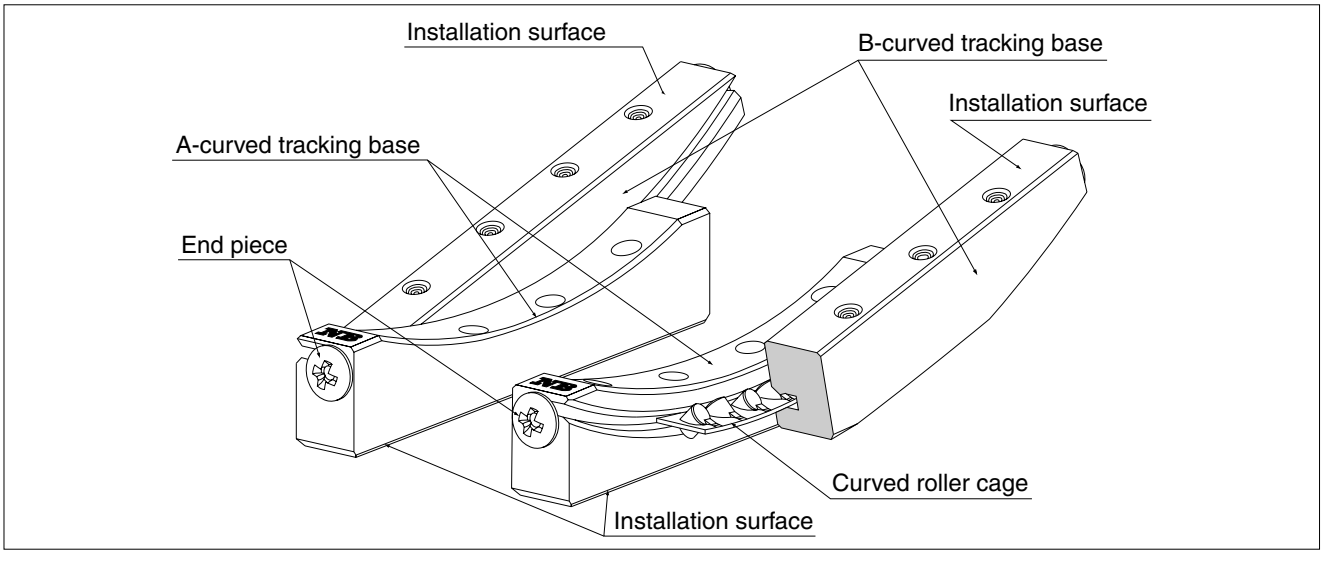
Low Frictional Resistance and Minute Motion

The precision grinding work and curved roller cage allow for extremely low frictional resistance. The negligible difference between starting and dynamic frictions allows the RVF type to follow minute movements accurately, realizing curved movement of high accuracy.

Low Noise

Since NB Gonio Way employs a non-recirculating design, noise will not be generated at the circulating area. In addition, the curved roller cage realizes quiet operation without contact noise between the rolling elements.

Figure 1. Structure of RVF type



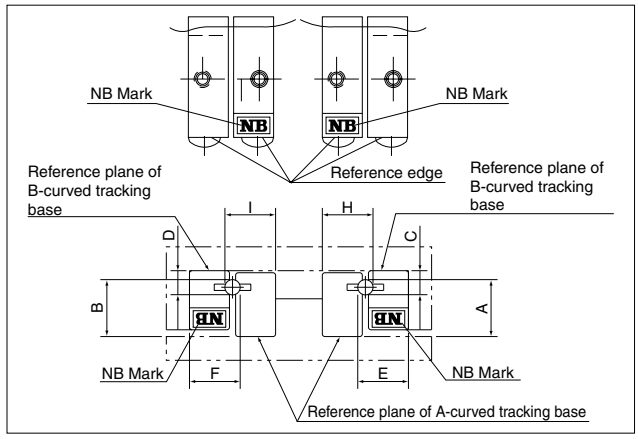
ACCURACY

The accuracies of the Gonio Way RVF type are represented by mutual dimensional errors of four units, which are measured along the overall length using the procedure as shown in Figure 2.

Table 1. Accuracy Unit/μm

Part Number	Mutual Error between A and B Mutual Error between C and D	Mutual Error between E and F Mutual Error between H and I
RVF2050- 70	10	10
RVF2050- 87		
RVF2050-103		
RVF2050-120		
RVF3070- 85		
RVF3070-110		
RVF3100-125		
RVF3100-160		

Figure 2. Measuring Method of Accuracy



LIFE CALCULATION

The life of a Gonio Way can be calculated using the following formula.

Travel life:

$$L=\left(\frac{f_T}{f_W}\cdot\frac{C}{P}\right)^{\frac{10}{3}}\cdot 50$$

L: travel life (km) f_T : temperature coefficient fw: load factor
C: basic dynamic load rating (N) P: Applied load (N)

Life time:

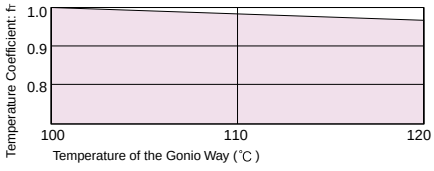
$$L_h=\frac{L\cdot 10^3}{2\cdot \ell s\cdot n_1\cdot 60}$$

L_h: life time (hour) ℓs: stroke (m)
n_1: strokes frequency per minute (cpm)

Temperature Coefficient: f_T

A Gonio Way is processed with quench hardening in order to enhance hardness while reducing wear. When the operating temperature exceeds 100℃, however, the hardness deteriorates, resulting in a decrease in the load capacity. Refer to Figure 3 for the temperature coefficient (f_T), which is the variation in hardness according to the temperature.

Figure 3. Temperature Coefficient: f_T



Load Factor: f_W

When calculating the load applied to a Gonio Way, it is necessary to accurately obtain the inertial force resulting from kinetic velocity and momentum, aside from the mass of the object. In addition, the time-varying values of each factor should be obtained accurately. However, curved-linear movement cycles are always accompanied by repeated start-stop movements. As well, there are uncertainties such as vibrations and physical shocks. As a result, it is difficult to calculate the load accurately. Generally, the service life calculation is simplified by using the load factor (f_W) provided in Table 2.

Table 2. Load Factor: f_w

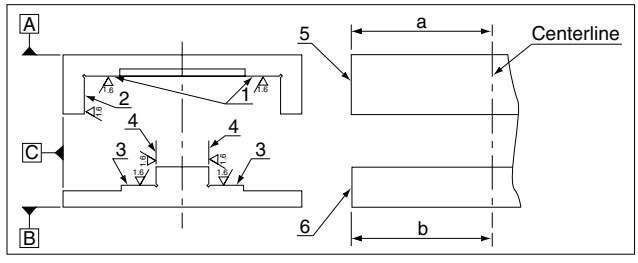
Operating Condition		Load Factor
Load	Speed	
No impact or vibrations	15 m/min. or below	1.0 to 1.5
Slight impact and vibrations	30 m/min. or below	1.5 to 2.0

ACCURACY OF MOUNTING SURFACE

To maximize the performance of NB's Gonio Way RVF type, it is important to finish the installation surface with high accuracies.

Parallelism of plane 1 against plane A
Perpendicularity of plane 2 against plane A
Perpendicularity of plane 5 against plane A
Parallelism of plane 3 against plane B
Perpendicularity of plane 4 against plane B
Perpendicularity of plane 6 against plane B
Parallelism of plane 2 against plane C
Parallelism of plane 4 against plane C
Mutual error between the size of a and b

Figure 4. Accuracy of installation surface



INSTALLATION

Installation Procedure

Setting the curved tracking bases temporarily

(1) Remove burrs, stains, and dust from the installation surface of the curved tracking bases of tables and beds. Foreign objects must be kept out of the assembly work as well.

(2) Apply oil of low viscosity to contact surfaces, check the reference edges of an A-curved tracking base and bed, and then tighten the bolts temporarily. (Figure 6-a)

(3) Align the reference edges (NB mark side) of a B-curved tracking base and an A-curved tracking base to the same orientation. Then, insert the curved roller cage between the curved tracking bases at the center area. Make sure that the curved roller cage will not interfere with the curved raceway grooves of the curved roller tracking bases. (Figure 6-b)

(4) Check the reference edge of the table, set the table over the B-curved tracking base, and then secure the table temporarily. (Figure 6-c)

Setting four curved tracking bases in parallel position

(5) Move the table to the maximum stroke ends of both sides and adjust the setting so that the curved roller cage is positioned at the center of the curved tracking base.

(6) Move the table to the center position and tighten the adjustment screw with slightly strong torque * by using a torque wrench. (Figure 6-d)

* "Slightly strong torque" here means slightly stronger than the torque at which the oscillation of the test indicator is stabilized at the minimum value when the table is moved right and left, or when pressure is applied to the rolling direction while the test indicator is attached to the side face (reference side) of the table. (Figure 6-i)

(7) Move the table to the maximum stroke end of one side and tighten the regulating screw on the curved roller cage with the same torque as in step (6). (Figure 6-e)

(8) Move the table to the maximum stroke end of the other side and tighten the adjustment screw with a torque wrench by repeating the procedure above. (Figure 6-f)

Securing the curved tracking bases

(9) Mount an edge reference plate between the reference edge of the A-curved tracking base and end piece, press it against the reference edge of the bed, and then tighten only the mounting bolt in the middle. (Figure 6-g)

(10) Repeat the procedure above to mount an edge reference plate between the reference edge of the B-curved tracking base and the end piece. Press it against the reference edge of the bed, and then tighten only the mounting bolt in the

Figure 5. Installation Example

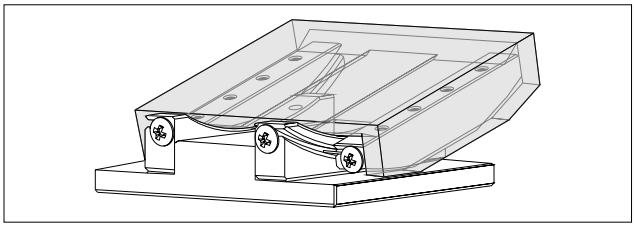
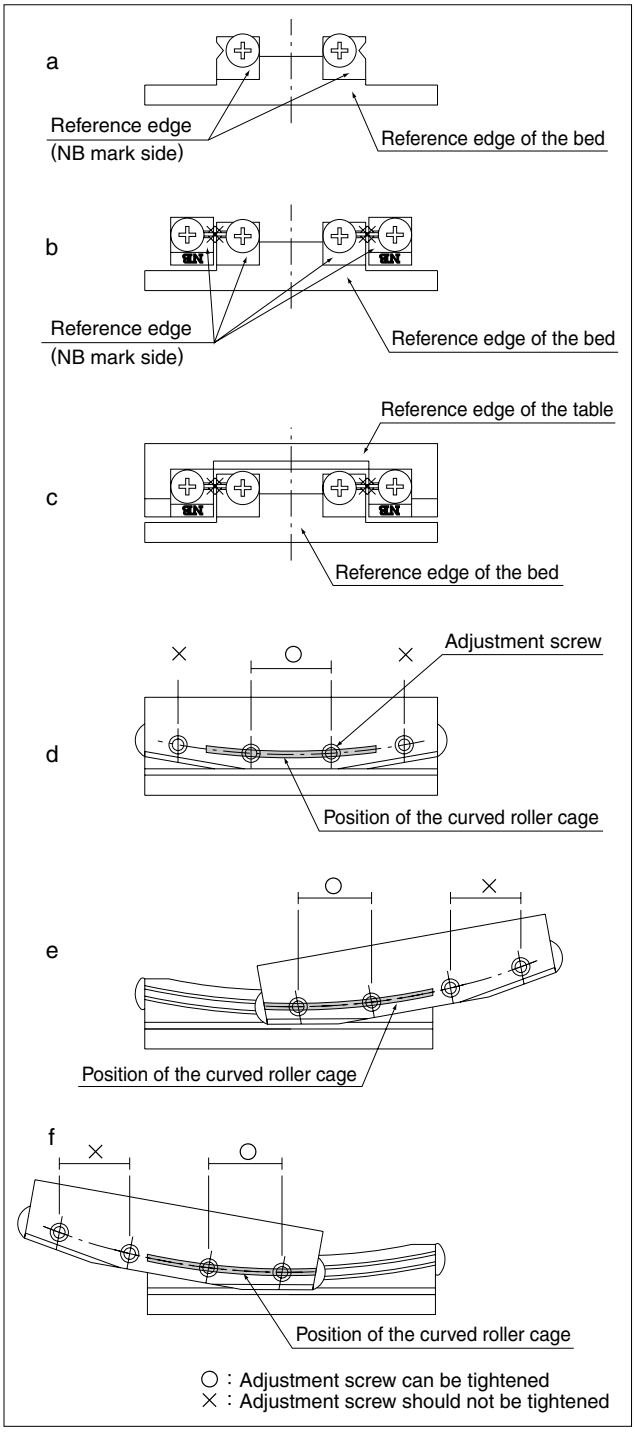


Figure 6. Installation Procedure (1)



middle. (Figure 6-h) In order to maintain parallelism of curved tracking bases, do not cycle the table during this process and make sure that there is no clearance between the edge of the table and the edge reference plate.

(11) Secure the rest of the mounting bolts on the curved roller cage one by one while moving the table as instructed in steps (7) and (8).

Adjusting the preload

(12) Move the table to the right and left with the test indicator attached to the side face of the table (reference side). Or, apply pressure in the rolling direction and confirm that the oscillation of the attached indicator is stabilized at the minimum level. (Figure 6-i)

(13) Return the mounting bolt on the B-curved tracking base at the adjustment screw side to the temporary setting.

(14) Return the table to the center position, slightly loosen the adjustment screw in the middle, and then gradually loosen the adjustment screws on the curved roller cage while moving the table as instructed in steps (7) and (8). Make sure not to reduce the preload too much.

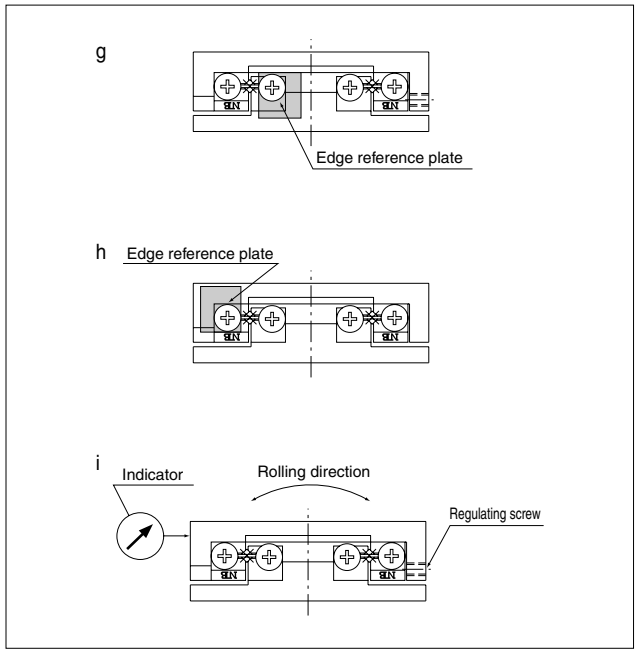
(15) Finally, secure the B-curved tracking base at the adjustment screw side, which has been installed temporarily. Secure the mounting bolts on the curved roller cage one by one while moving the table as instructed above.

Table 3. Recommended Tightening Torque for Mounting Bolts Unit/N・m

Nominal Designation of Screw	Tightening Torque
M2.5	0.5
M3	1.1

(When using stainless-steel screw A2-70 on aluminum seating for tightening)

Figure 6. Installation Procedure (2)



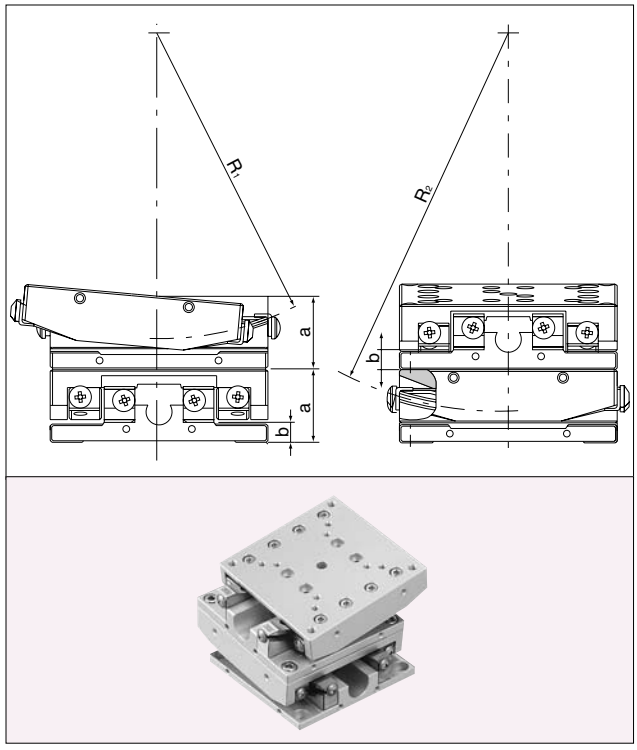
2-AXES AND CUSTOM SPECIFICATIONS

When incorporating RVF type units onto two shafts as illustrated in Figure 7, adjust the height of one lifting shaft as instructed in Table 4. Then, adjust dimension b (the height of the installation surface of the A-curved tracking base) in Figure 7 to the same dimension in order to obtain the identical rotation center for the two shafts. In addition, requests can be made for custom specifications including table units fitted for two shafts, non-standard lengths for curved tracking bases, the radius of rotation, the rotation range, and the number of rollers. Contact NB for further information and arrangements.

Table 4.Two-Shaft Specifications Unit/mm

Model Number Combinations	a	R_1	R_2
RVF2050- 70 RVF2050- 87	17	70	87
RVF2050-103 RVF2050-120	17	103	120
RVF3070- 85 RVF3070-110	25	85	110
RVF3100-125 RVF3100-160	35	125	160

Figure 7. Two-Shaft Specifications



PRECAUTIONS FOR USE

Lubrication

The NB Gonio Way is pre-lubricated with lithium soap-based grease prior to shipment and is therefore ready for immediate use. Make sure to lubricate with a similar type of grease periodically according to the operating conditions.

Dust Prevention

When foreign objects including dust and dirt enter a NB Gonio Way, the accuracy and operating life may deteriorate. It is advised to install an additional protective cover to protect an NB Gonio Way used in a harsh environment.

Operating Environment

The recommended range of ambient temperature for an NB Gonio Way is between -20˚ C and 110˚ C.

Adjustment

When a Gonio Way is used without sufficient adjustment of the accuracies on the installation surface and preload, the motion accuracy will deteriorate, resulting in skewed movement and a reduced operating life. It is advised that adjustments are to be made carefully.

Cage Creep

When an NB Gonio Way RVF type is operated at high speed, or when an offset load or vibrations are applied, the cage may deviate from its normal position. Make sure to determine the rotation range with a sufficient margin and do not apply excessive preload.

Stopper

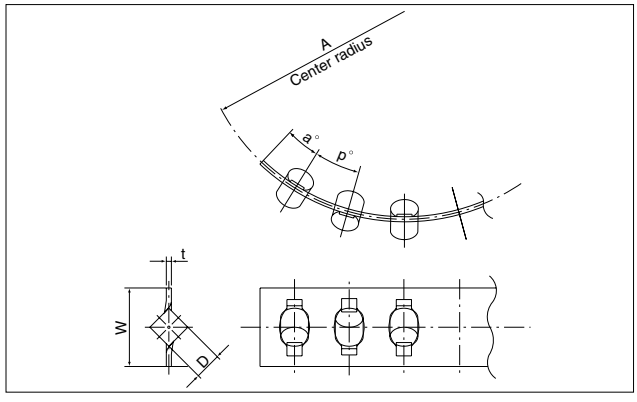
End pieces are attached to both ends of an NB Gonio Way. However, note that the end pieces are designed to prevent removal of the curved roller cage, and are not intended for use as a mechanical stopper.

Careful Handling

Dropping an NB Gonio Way may cause the rolling elements to make dents on the raceway surface. This will prevent smooth motion and will also affect accuracies. Make sure to handle the product with care.

Use within a Same Set

The mutual errors of accuracies of curved tracing bases are adjusted within a particular set. Note that the accuracy may be affected when curved tracking bases of different sets are used together in combination.



CR TYPE -Curved Roller Cage-

Part number configuration

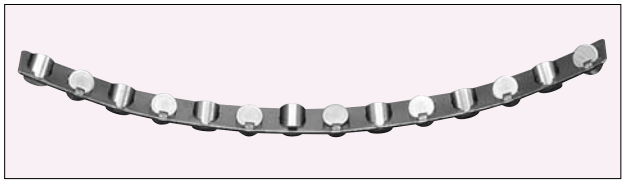
Example) **CR 3 - 110 - 10Z**

CR Type

Size

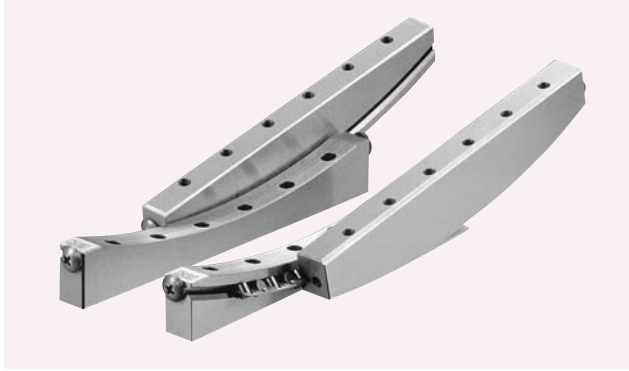
Number of rollers

Center radius



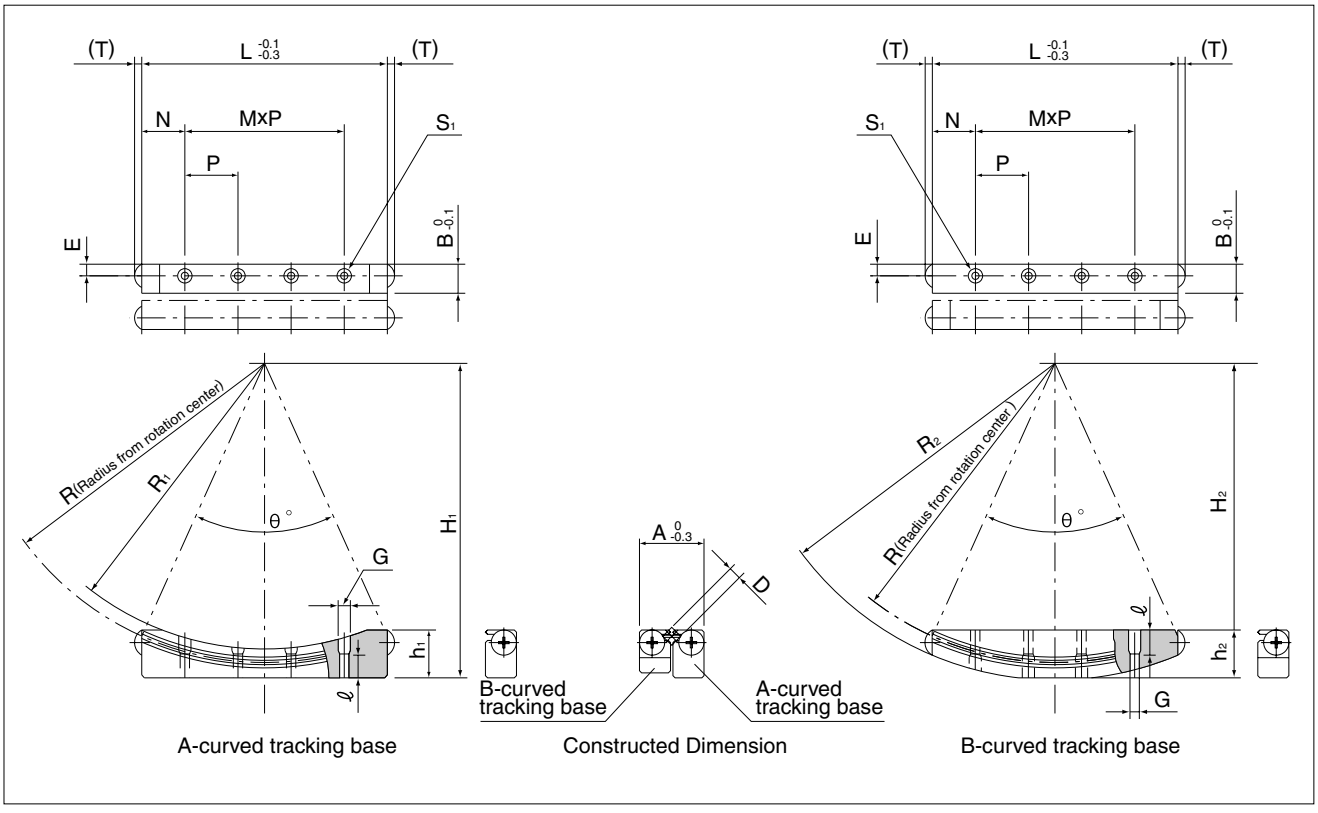
Call Number	Roller Diameter D mm	Center Radius A mm	t mm	W mm	p˚	a˚
CR2- 70-11Z	2	70	0.3	5.6	3.3˚	2.0˚
CR2- 87-10Z	2	87	0.3	5.6	2.6˚	1.6˚
CR2-103-10Z	2	103	0.3	5.6	2.2˚	1.4˚
CR2-120- 9Z	2	120	0.3	5.6	1.9˚	1.2˚
CR3- 85-11Z	3	85	0.4	7.2	3.4˚	2.9˚
CR3-110-10Z	3	110	0.4	7.2	2.6˚	1.5˚
CR3-125-16Z	3	125	0.4	7.2	2.3˚	1.3˚
CR3-160-14Z	3	160	0.4	7.2	1.8˚	1.0˚

RVF TYPE
-GONIO WAY Flat Rail-



Part number configuration
Example) **RVF 3 100 - 125 - 16Z**

- RVF Type
- Size
- Total length of curved tracking base
- Radius from rotation center
- Number of rollers



(One set includes A-curved tracking bases (2), B-curved tracking bases (2), curved roller cages (2), end pieces (8), and installation reference plate (2).)

Part Number	Rotation Range	Roller Diameter D	Number of Rollers Z	Major Dimensions																		Basic Load Rating		Weight
				L	R	R_1	R_2	H_1	H_2	h_1	h_2	A	B	M×P	N	E	S_1	ℓ	G	T	θ°	Dynamic C	Static Co	
		mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	mm	mm		N	N	g
RVF2050- 70-11Z	±5°	2	11	50	70	67	73	72.5	64.5	7.5	7.5	15	7.25	3×12.5	6.25	2.5	M2.5	4	3	2.1	41.8°	1,179	1,468	66
RVF2050- 87-10Z			10		87	84	89.5	89.5	81.5	7.5	7.5										33.3°	1,179	1,468	70
RVF2050-103-10Z			10		103	100	106	105.5	97.5	7.5	8			3×13	5.5					2.1	28.0°	1,179	1,468	70
RVF2050-120- 9Z			9		120	117	123	122.5	114.5	7.5	8										24.0°	997	1,174	70
RVF3070- 85-11Z	±10°	3	11	70	85	81	89	89.5	75.5	14	12.5	18	8.5	3×15	12.5	3	M3	7	3.5	1.9	48.6°	2,631	3,515	182
RVF3070-110-10Z			10		110	106	114	114.5	100.5	12.8	12.5										37.1°	2,631	3,515	182
RVF3100-125-16Z			16	100	125	121	129	129.5	110.5	17.5	18		8.5	5×15	12.5	3	M3	7	3.5	1.9	47.1°	3,745	5,626	327
RVF3100-160-14Z			14		160	156	164	164.5	145.5	15	18										36.4°	3,387	4,921	323

1N≒0.102kgf

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