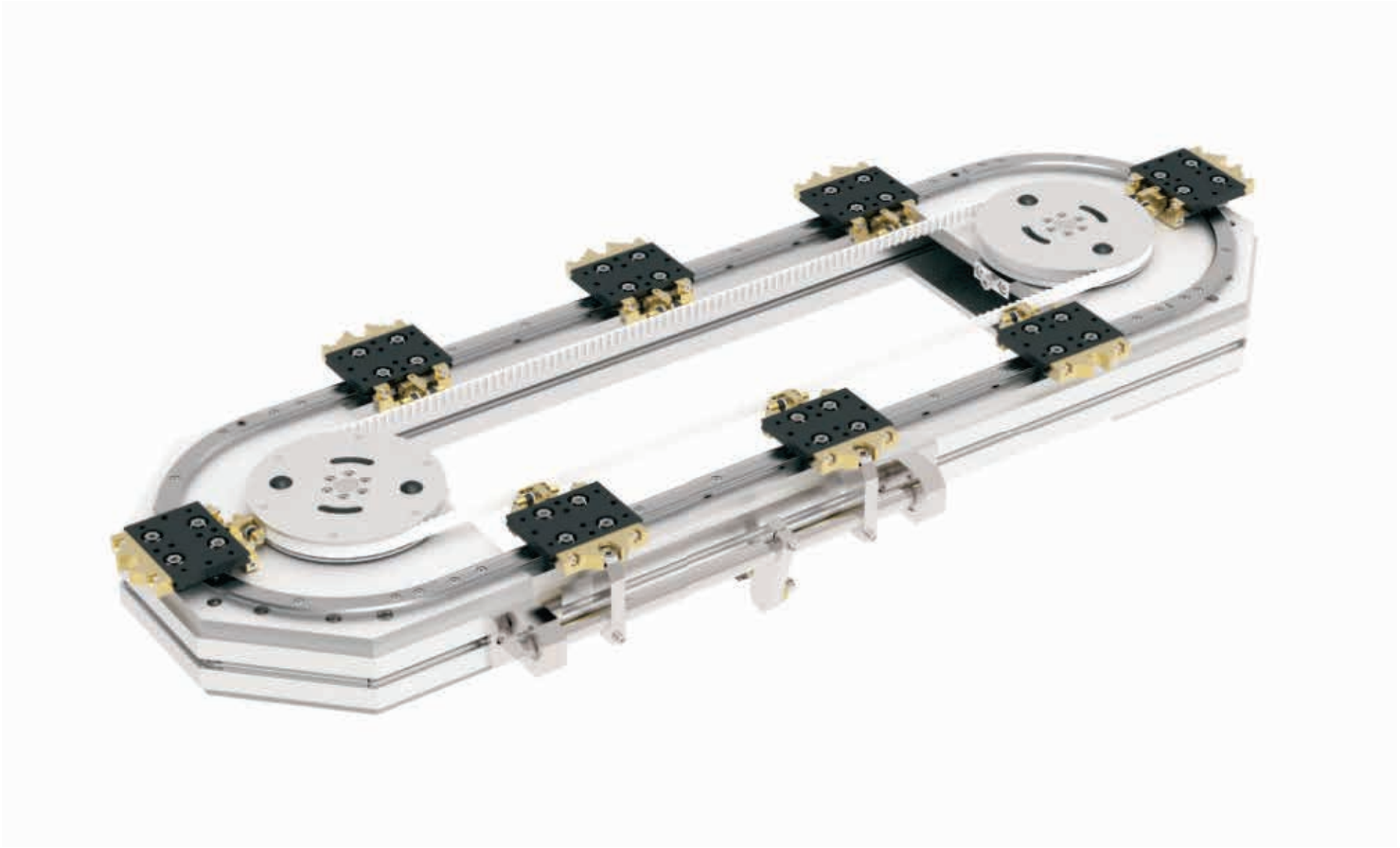
HELIX™
LINEAR TECHNOLOGIES

CR CURVE RAILS



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helixlinear.com

Helix Linear Technologies, Inc., Beachwood, Ohio USA

Helix Linear Technologies is the most high-tech lead screw manufacturing facility in the world. With the release of our new precision lead screws, Helix produces the broadest product line of any lead screw manufacturer globally. We offer precision rolled, milled, or ground screws in diameters from 1/8"= to 6", or 2mm to 150mm, and leads from 0.012" to 3", or .3mm to 75mm. Helix offers a complete line of nuts in standard and anti-backlash designs with centralizing threads to match our precision lead screws. Our lead screw assemblies have the lowest backlash on the market.

With the release of new product lines, Helix has even more economical options in the 1/8" to 1" diameter range. We have also developed additional custom anti-backlash nut designs, which are available upon request.
Helix services the expanding and evolving customer-driven market for precision linear motion products. When you need Acme, Trapezoidal, or high-helix lead screws with a precision, low backlash nut, or a state-of-the-art anti-backlash design, we deliver the highest quality and exceptional value to our customers.

CULTURE
Our culture is based on a team of smart, happy and competitive professionals focused on manufacturing innovative products centered on delivering precise electromechanical linear motion solutions. We are in the people business, as well as the product business. People make and sell our products and a team of smart, happy and competitive people make a company healthy.

OPERATIONS
Our company is built to deliver high-quality products and engineering support to solve the most demanding linear motion applications in any industry. We deliver components and subsystem solutions to high volume OEMs and custom machine builders to help secure their success.

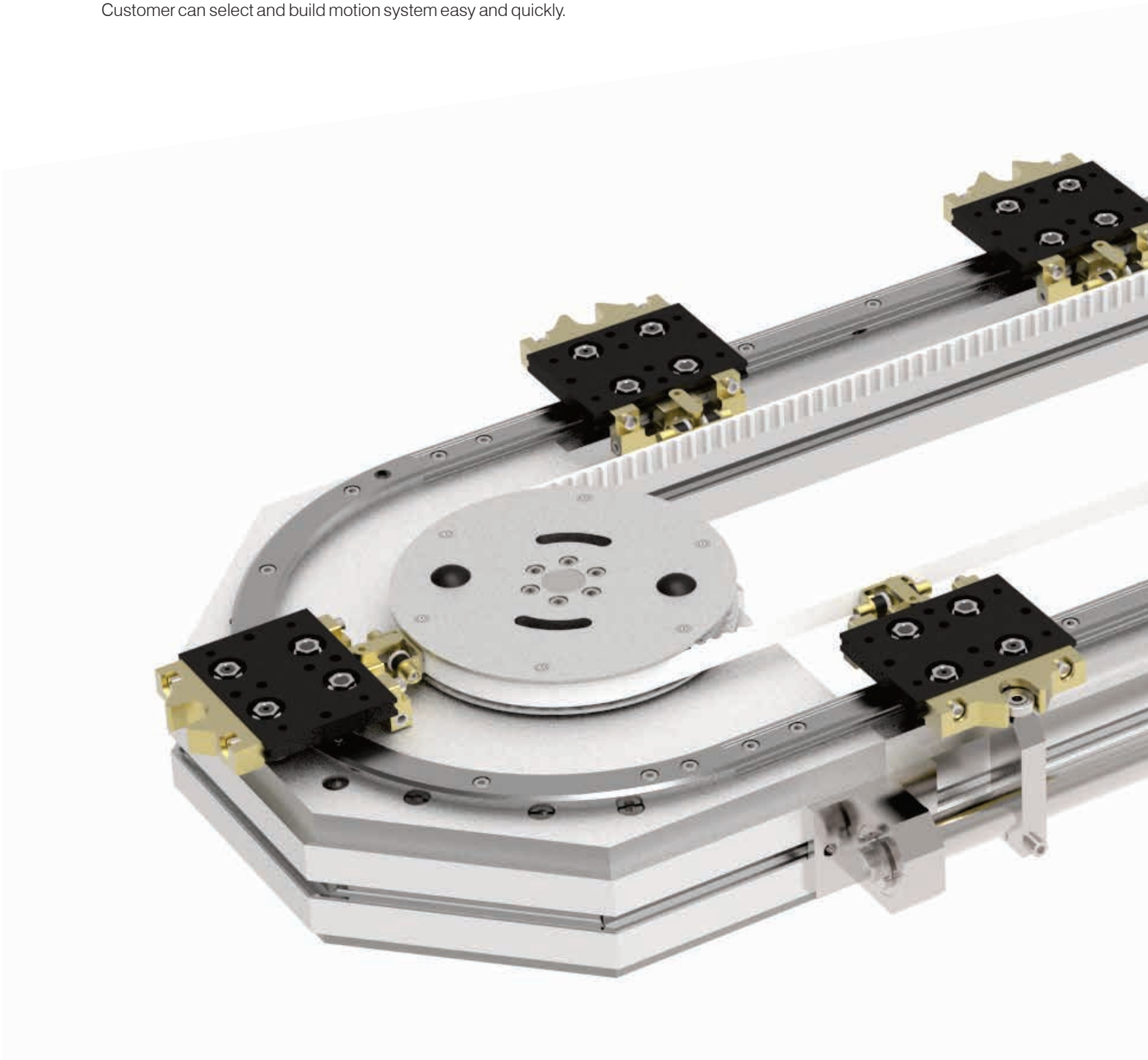
COMPANY
Helix is a global supplier to the Medical Device, Life Science, Security, Semiconductor, Aerospace, Electromechanical and Defense industries. Helix leads the linear motion industry by manufacturing the highest quality linear actuation solutions in the world. We focus entirely on manufacturing electro-mechanical actuation systems that help our customer be more productive and profitable. Our execution of innovative product designs solves real problems for our customers and builds a foundation for long term success.

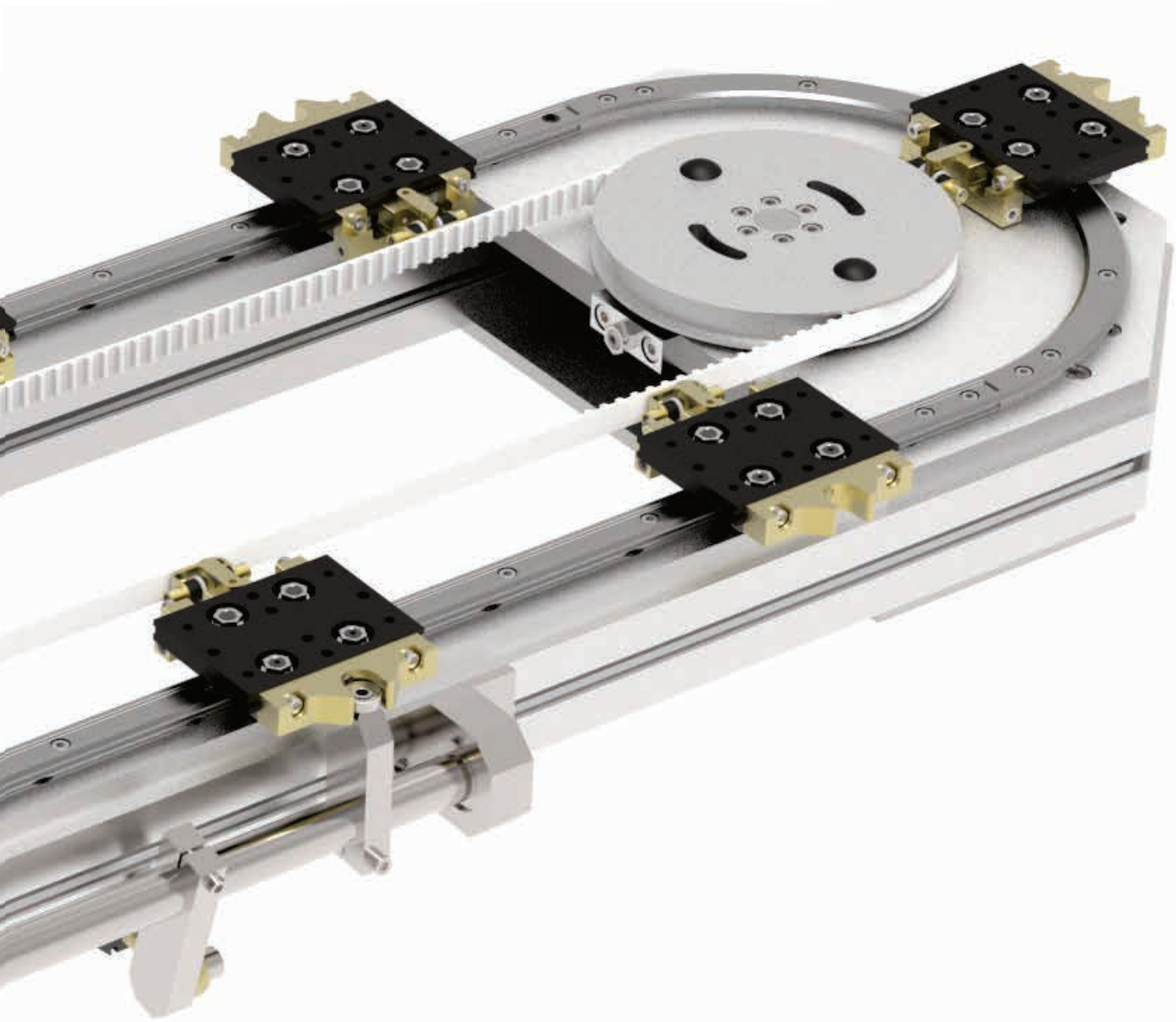
HISTORY
Helix was founded in 2011 to manufacture high-quality lead screws for the growing electromechanical actuation industry. Helix's rapid growth has included the addition of linear actuator solutions to deliver integrated and turnkey solutions.

INDEX

OVAL TRACK SYSTEM

Helix provides a wide choice of sizes and options to build linear, curve motion system. All of components including linear guides, ring guides, bearings and lubricate parts are designed standard and modularized. Customer can select and build motion system easy and quickly.





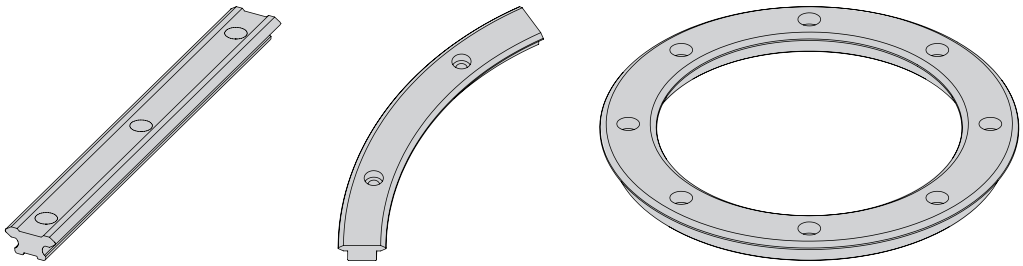
- Rail Profiles are produced in German.
- Design and produce according to DIN standard.
- Ring rail radius are standard, Straight rail length is optional.
- Additional locating device realize carriages precision location.
- The connections between belt and carriages are flexible and torque protected.
- Raydent (corrosion protection) is optional for rail.

Straight Rail

- Made of Germany high quality bearing steel
- Deep hardened in working surfaces for high wear resistance
- Ground Double 70° V working edges together to ensure parallelism
- Soft rail body for customization machining process
- Provide 3 standard sizes for customer's selection
- Two precision rails G1 and G3 is optional, ground and un-ground
- Precision G3 rail length could be up to 5.5meters without connection
- Longer length (Unlimited) can be achieved by connection

Ring Rail

- Made of high quality bearing steel
- Deep hardened in working surfaces for high wear resistance
- Ground Double 70° V working edge ensure parallelism
- All surfaces are ground for precision
- Provide wide range of standard sizes
- Customized assembly holes are available



Precision

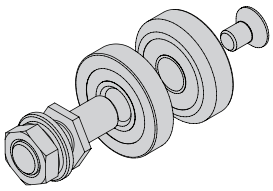
Helix provides two precision grades. G1 ground and G3 unground. Here we must emphasize that G3 grade's motion is also very smooth and stable. It is fit for smooth running without very high precision and low cost request. But when linear rail connect ring rail, it must be G1 grade.

G1 grade **G3 grade**

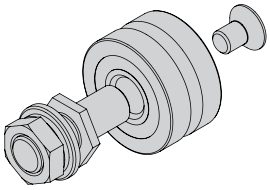
▽ ground surface

Rollers

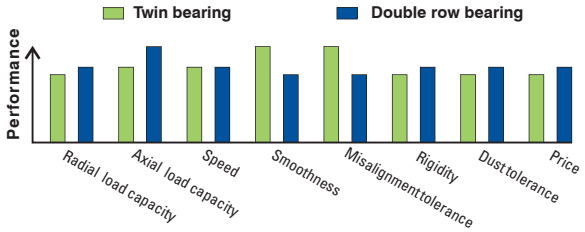
- Made of high quality bearing steel
- Whole body hardened for high wear resistance
- Supply Twin and Double row bearings *(See below figure)*
- Concentric / Eccentric bolt supplied



Twin bearing

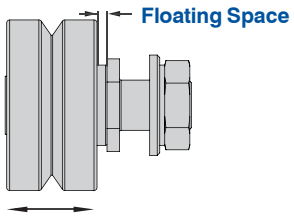


Double row bearing



Floating Bearing

- Outer ring could float in axial direction to compensate installation parallelism
- Made of high quality bearing steel
- Whole body hardened for high wear resistance
- Concentric / Eccentric bolt supplied



Roller Type Selection

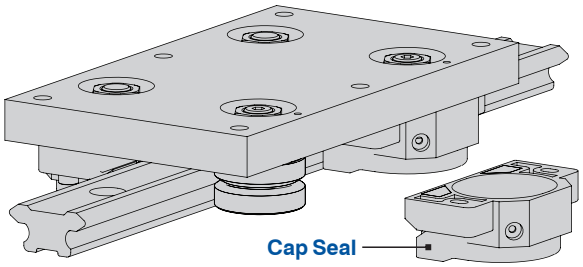
SS SVR 25 RS DR C

- C: Bolt Type, C :concentric, E: Eccentric, DE: Double Eccentric for Curve Rail
- DR: Roller Internal Structure (DR ; Double Balls Roller, F; Floating Roller, Vacant is Twin Bearing.)
- RS: Seal Type (RS : Rubber seals, ZZ : Steel Shields)
- 25: Roller Size
- SVR: Roller Type
- SS: Roller Material （SS：Stainless Steel, Vacant is Bearing Steel）

Roller Type Selection - Please refer to pages 14-15.

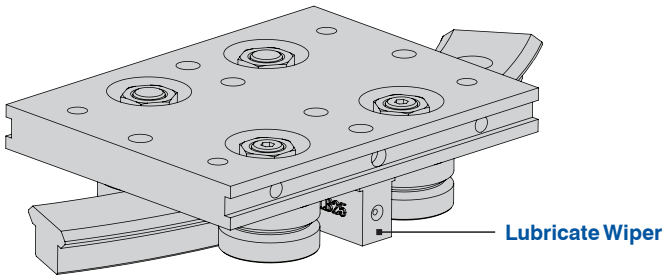
Cap Seal

- Protect bearing against dust
- Protect operator for safety
- Lubricated felt wiper contact rail's working surface to increase load capacity and life
- Standard and interchangeable



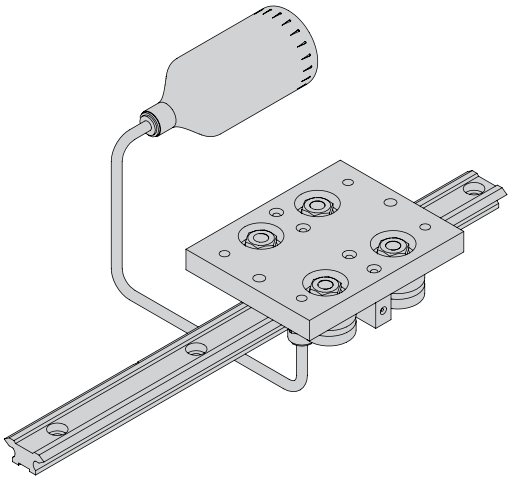
Lubricate Wiper

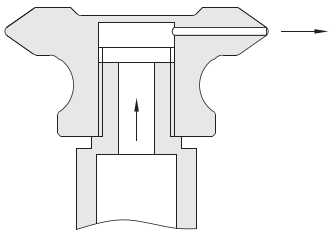
- Lubricated felt wiper contact rail's working surface to increase load capacity and life
- Lubricated felt wiper is pushed lightly by a small spring to ensure low friction with the rail's working surface
- Easy to fill lubricate oil from its fill hole
- Standard and interchangeable



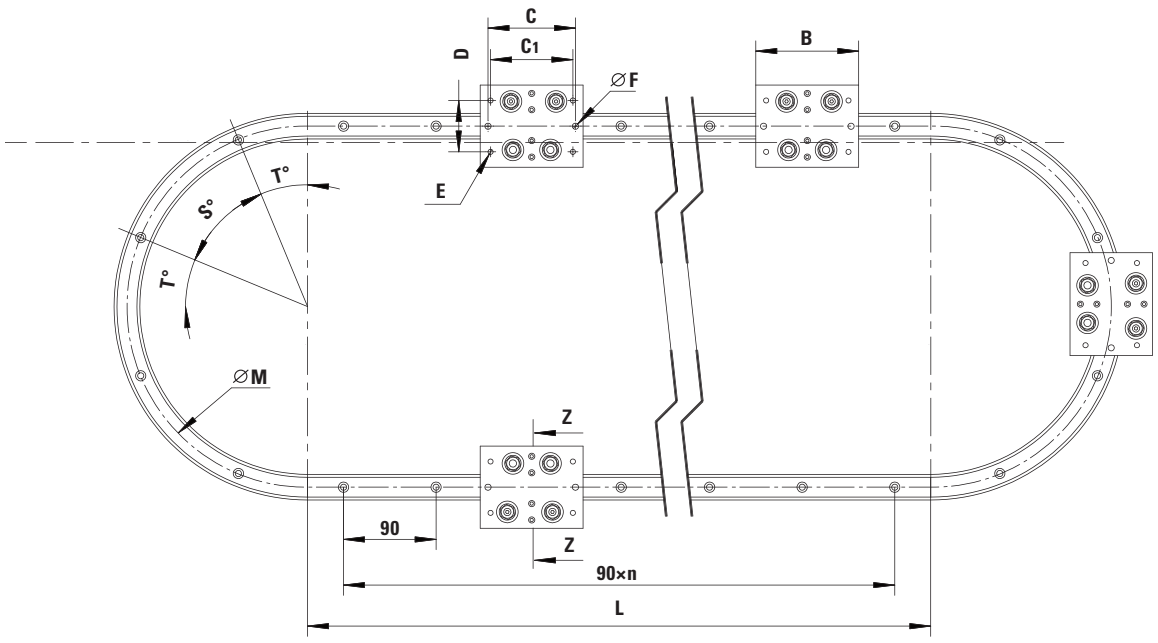
Lubricate

- Lubricated felt wiper contact rail's working surface to increase load capacity and life
- Lubricated felt wiper is pushed lightly by a small spring to ensure low friction with the rail's working surface
- Oil charging holes supplied for the Track Motion System
- Automatic lubricate bleed could connect to the rail's oil charging holes very easily.
- Standard and interchangeable

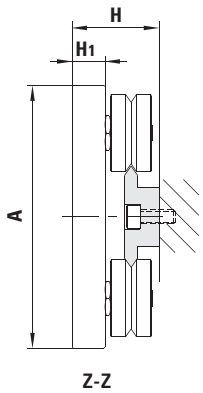




Oval Rail



Assembly Code	Components				
	Straight Rail	Ring Rail	Carriage	A	B
HSB-LGV25XL-CR25 159 R180	HSB-LGV25	HCR25 159 R180	HSRC25 159	80	95
HSB-LGV25XL-CR25 255 R180		HCR25 255 R180	HSRC25 255		100
HSB-LGV25XL-CR25 351 R180		HCR25 351 R180	HSRC25 351		105
HSB-LGV44XL-CR44 468 R180	HSB-LGV44	HCR44 468 R180	HSRC44 468	116	145
HSB-LGV44XL-CR44 612 R180		HCR44 612 R180	HSRC44 612		150
HSB-LGV76XL-CR76 799 R180	HSB-LGV76	HCR76 799 R180	HSRC76 799	185	190
HSB-LGV76XL-CR76 1033 R180		HCR76 1033 R180	HSRC76 1033		210
HSB-LGV76XL-CR76 1267 R180		HCR76 1267 R180	HSRC76 1267		250
HSB-L GV76XL-CR76 1501 R180		HCR76 1501 R180	HSRC76 1501		270



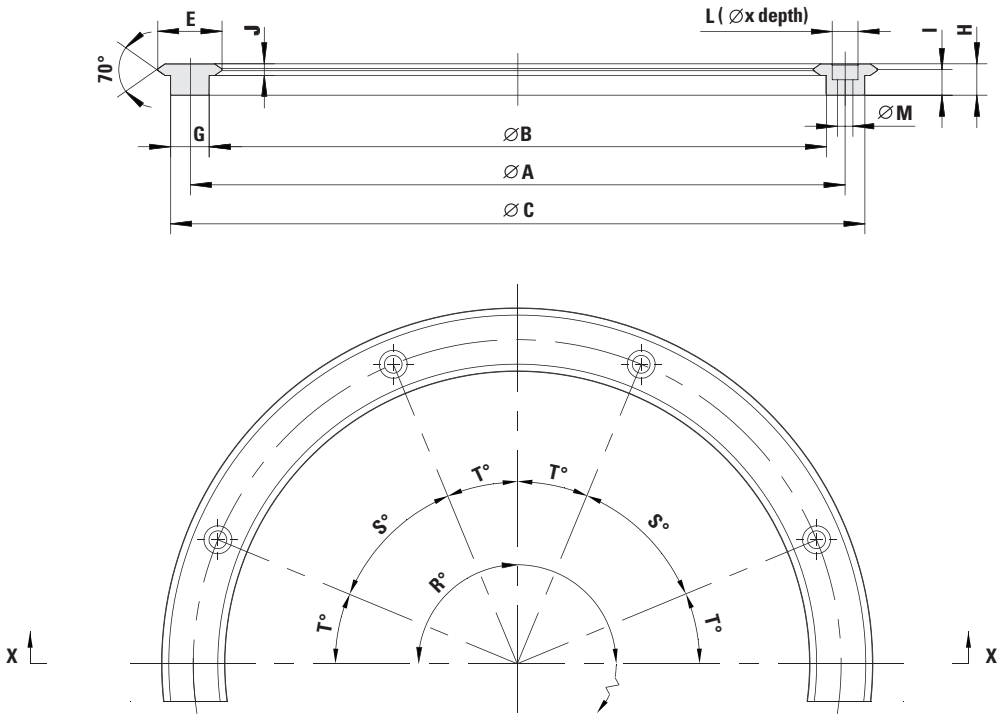
Type Code

SB- LGV 25 X 2000 -CR25 159 R180

- R180: Segement angular: 180°
- 159: Ring railway diameter
- CR25: Ring railway size
- 2000: Railway length
- 25: Railway size
- LGV: Linear railway
- SB-: Helix motion symbol

Dimension									
C	C_1	D	E	F	H	H_1	M	S°	T°
80	85	50	4xM6	2x6	30.5	11.5	159	45	22.5
85	80		4xM6	2x6			255	45	22.5
90	85		4xM6	2x6			351	30	15
125	120	75	4xM8	2x8	38.5	14.5	468	30	15
130	125		4xM8	2x8			612	22.5	11.25
165	160	100	4xM10	2x10	58.5	20	799	22.5	11.25
185	180		4xM10	2x10			1033	18	9
225	205		4xM10	2x10			1267	18	9
245	225		4xM10	2x10			1501	18	9

Ring Rail



Type	Applicable Bearing	A	B	C	E	G	H
HCR25 159	HSVR-25	159	143.6	174.4	25	15	12.25
HCR25 255	HSVR-25	255	239.6	270.4	25	15	12.25
HCR25 351	HSVR-25	351	335.6	366.4	25	15	12.25
HCR44 468	HSVR-34	468	442	494	44	26	15.5
HCR44 612	HSVR-34	612	586	638	44	26	15.5
HCR76 799	HSVR-54	799	749	849	76	50	24
HCR76 1033	HSVR-54	1033	983	1083	76	50	24
HCR76 1267	HSVR-54	1267	1217	1317	76	50	24
HCR76 1501	HSVR-54	1501	1451	1551	76	50	24

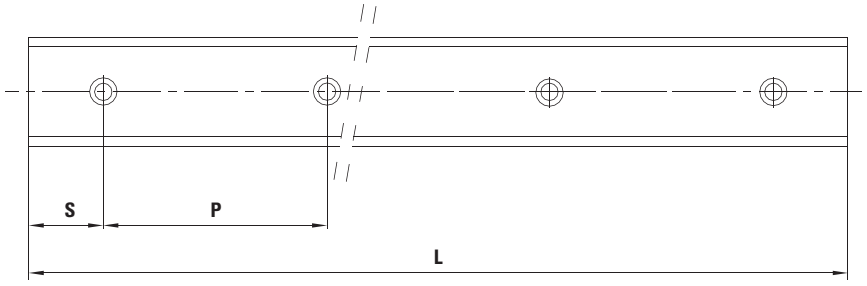
Type Code

HCR25 351 R180 (N)

- **(N)** — Screw holes option
- **R180** — Segement angular 90° 、180° 、full 360° Ring
- **HCR25 351** — Ring rail size

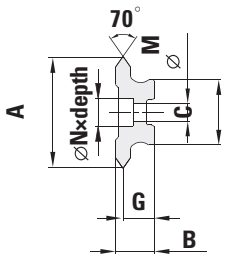
I	J	L (Ø×depth)	Ø M	Hole Number (R=360°)	Hole Position ±0.2		Weight (kg) (R=360°)
					S°	T°	
10	4.2	10x6	6	8	45	22.5	0.77
10	4.2	10x6	6	8	45	22.5	1.2
10	4.2	10x6	6	12	30	15	1.65
12.5	6	11x7	7	12	30	15	5.1
12.5	6	11x7	7	16	22.5	11.25	6.7
19.5	9	20x13	11	16	22.5	11.25	25
19.5	9	20x13	11	20	18	9	32
19.5	9	20x13	11	20	18	9	41
19.5	9	20x13	11	20	18	9	48.7

Straight Rail



Type	A		B		C	
	G1	G3	G1	G3	G1	G3
HSB-LGV25XL	25	25.2	12.25	12.9	15	15.5
HSB-LGV44XL	44	44.2	15.5	16.2	26	26.5
HSB-LGV76XL	76	76.2	24	24.7	50	50.5

Type Code



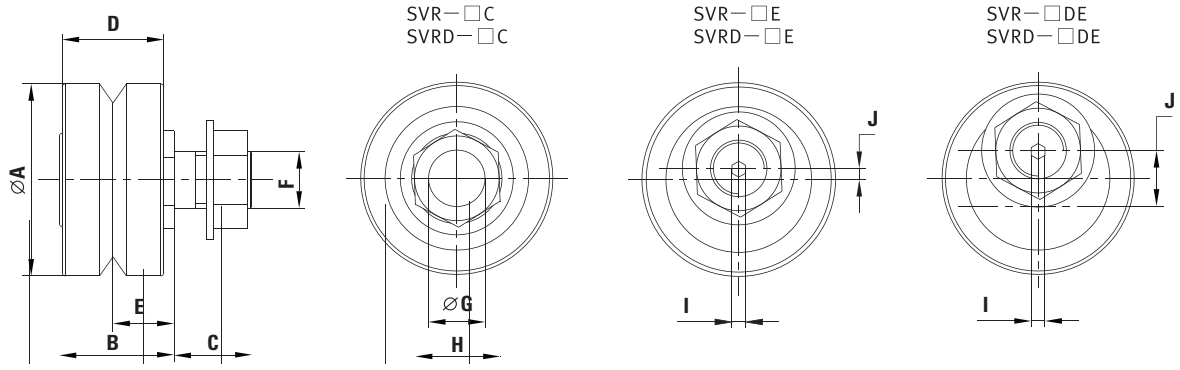
G1

HSB- LGV 25 X 1000 G1

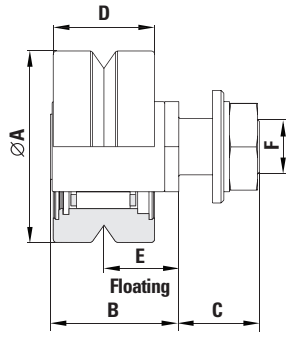
- G1 — Precision grade G1or G3
- 1000 — Railway length
- 25 — Railway size
- LGV — Linear railway
- HSB — Helix motion symbol

G		M	N x depth	P	S	Lmax	
G1	G3					G1	G3
10	10.35	5.5	10x5.5	90	45	2000	5500
12.5	12.85	7	11x7	90	45	2000	5500
19.5	19.85	11	20x12	90	45	1900	5500

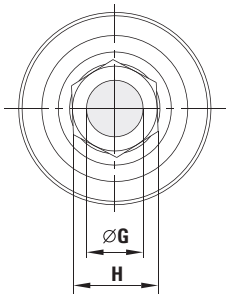
Rollers



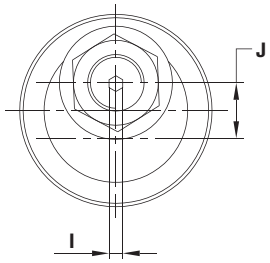
Type	Roller Category	Outer Diameter A	Eccentrical Distance J	Bearing Load Capacities(N)			
				Radial		Axial	
				Co	C	Co	C
HSVR-25C	Twin bearing	25	-	1320	3320	330	800
HSVR-25E			0.75				
HSVR-25DE			2				
HSVRD-25C	Double row bearing		-	2535	7710	840	1650
HSVRD-25E			0.75				
HSVRD-25DE			2				
HSVRF-25C	Floating bearing		-	6150	4980	-	-
HSVRF-25DE			2				
HSVR-34C	Twin bearing	34	-	2630	5980	560	1280
HSVR-34E			1				
HSVR-34DE			2.5				
HSVRD-34C	Double row bearing		-	5260	9690	1380	2540
HSVRD-34E			1				
HSVRD-34DE			2.5				
HSVRF-34C	Floating bearing		-	12600	11000	-	-
HSVRF-34DE			2.5				
HSVR-54C	Twin bearing	54	-	6700	13700	1180	2350
HSVR-54E			1.5				
HSVR-54DE			5.5				
HSVRD-54C	Double row bearing		-	13400	22200	2800	4650
HSVRD-54E			1.5				
HSVRD-54DE			5.5				
HSVRF-54C	Floating bearing		-	29000	21300	-	-
HSVRF-54DE			5.5				



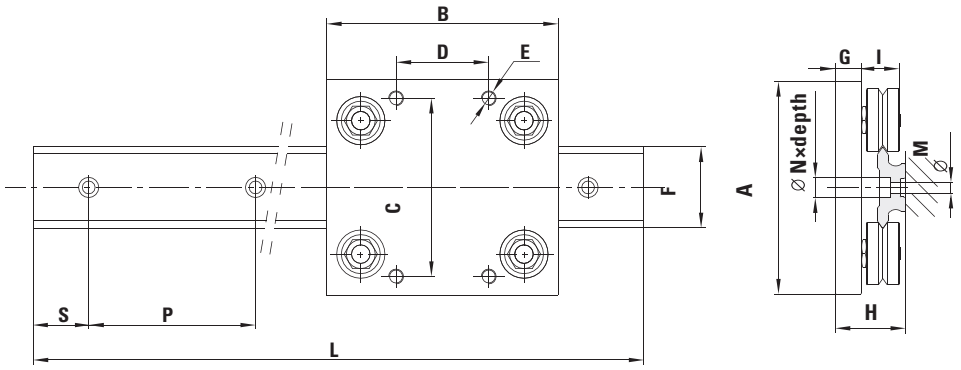
SVRF—□C



SVRF—□DE

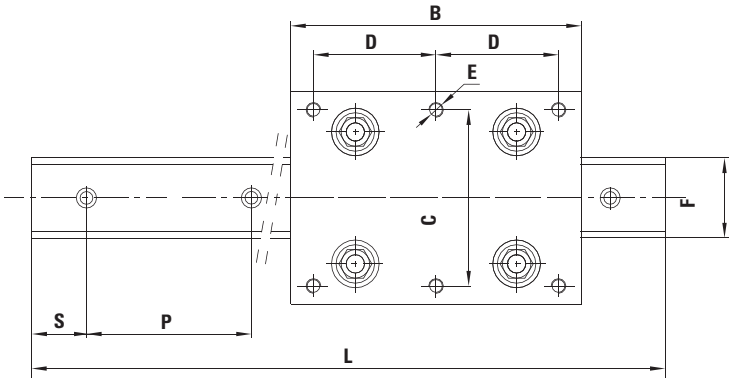


Dimension							
B	C	D	E	F	G	H	I
16.5	11.3	14	9	M8	8	13	3
18.1	11.3		Max 10.5 Min9				
21	14.3	18	11.5	M10	10	15	4
23.2	14.3		Max 13.5 Min11.5				
33.5	19.8	28	19	M14	14	27	6
37.2	19.8		Max 21.6 Min19				



SLC A

Rail	Carriage	Roller	Dimension							
			A	B	C	D	E	F	G	H / G1
HSB-LGV25XL	HSLC25A	HSVR-25C	80	80	65	24	4xM6	25	11.5	30.5
	HSLC25B	HSVR-25E		135		60	6xM6			
	HSLC25C			180		82	6xM6			
HSB-LGV44XL	HSLC44A		116	125	96	50	4xM8	44	14.5	38.5
	HSLC44B			180		80	6xM8			
	HSLC44C			225		103	6xM8			
HSB-LGV76XL	HSLC76A	HSVR-54C	185	200	160	90	4xM10	76	20	58.5
	HSLC76B	HSVR-54E		300		135	6xM10			
	HSLC76C			400		185	6xM10			



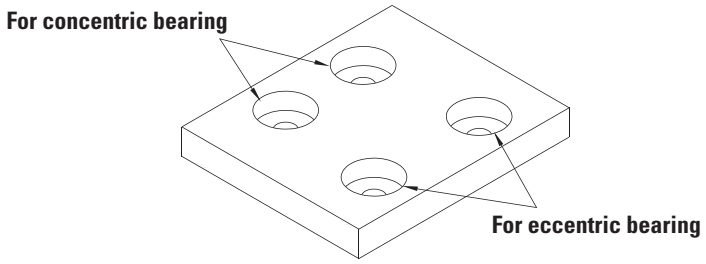
SLC B/C

								load capacities(N)			
	I	M	Nx depth	P	S	Lmax		Double Row Bearings		Twin Bearings	
G3						G1	G3	Fy	Fz	Fy	Fz
30.85	16.5	5.5	10x5.5	90	45	2000	5500	1600	3000	1280	1200
38.85	21	7	11x7	90	45	2000	5500	3600	6000	3200	2800
58.85	33.5	11	20x12	90	45	1900	5500	10000	10000	7200	6400

Assembly manual

1. Match rollers to carriage plate

Please mount the concentric bearing to one side of carriage plate, and eccentric bearing to the other side following the direction of railway. In case of circle motion carriage, the concentric bearing should be mounted to the side where mounting-hole distance is shorter. Please refer to below picture.



Circle motion carriage plate

2. Mounting to railway

Carriage assembly should be mounted from the end of railway. Please do not put any overstress when mounting.

3. Adjust the clearance between bearing and railway

-Tighten concentric bearings first.

-Then rotate eccentric bearing via rotate hexagonal key at the end of stud to adjust the clearance between railway and bearing.

-Adjust the clearance to zero.

-Slide the carriage by hand and adjust to the extent where there causes a slight slipping resistance.

Correct condition is where moving power becomes the recommended value as below table by putting load by push-pull gauge to the running direction of carriage.

Recommended pre-load by push-pull gauge

V track bearing size	Pre-load(N)
25	4
44	8
76	12

-Keep eccentric bearing's position and tighten the nut.

Important note

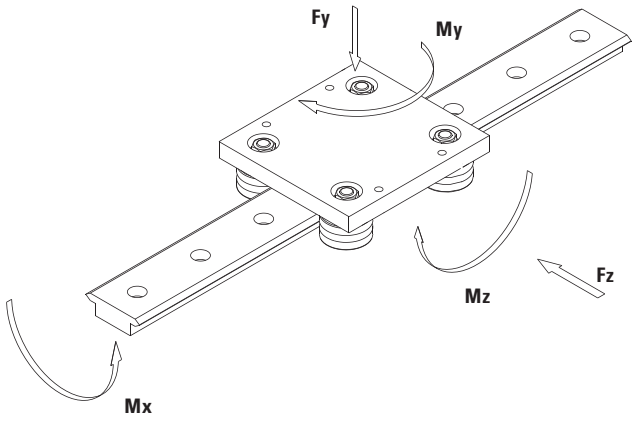
Appropriate pre-load provide the system rigidity. However, over preload will decrease system's life rapidly. Please be careful.

Load / Life calculation

Due to the hardness of the railway and fatigue analysis of railway and roller, the railway's life does not determine the system life. It is determined by roller's life. Load capacity of the motion guide system varies mainly by the size of bearing and railway, lubricated or not, and the load magnitude and direction. Other factors include speed and acceleration and environment etc. To calculate system life, loading factor LF should be calculated firstly. Here we provide two methods to calculate the loading factor.

Standard 4 bearings carriage calculation

If the system use Helix standard 4 bearings carriage, then calculation can use below formula.



$$LF = \frac{Fy}{Fymax} + \frac{Fz}{Fzmax} + \frac{Mx}{Mxmax} + \frac{My}{Mymax} + \frac{Mz}{Mzmax}$$

Fy - Actual load in Y direction. (N)

Fz - Actual load in Z direction. (N)

Mx - Actual moment in X direction. (N·m)

My - Actual moment in Y direction. (N·m)

Mz - Actual moment in Z direction. (N·m)

Below parameters can be taken from the table of Load capacity.

Fy max - Max load capacity in Y direction. (N)

Fz max - Max load capacity in Z direction. (N)

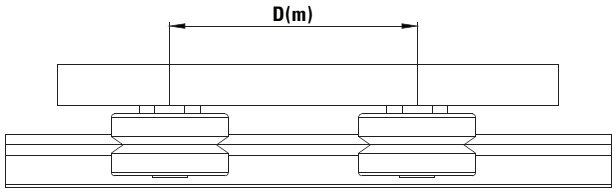
Mx max - Max moment capacity in X direction. (N·m)

My max - Max moment capacity in Y direction. (N·m)

Mz max - Max moment capacity in Z direction. (N·m)

Straight rail carrige's load capacity

Carriage Type	Dry system Double Row Bearings and Twin Bearings					Lubricated system/Twin Bearings					Lubricated system/Double Row Bearings				
	Fy	Fz	Mx	My	Mz	Fy	Fz	Mx	My	Mz	Fy	Fz	Mx	My	Mz
	N	N	Nm	Nm	Nm	N	N	Nm	Nm	Nm	N	N	Nm	Nm	Nm
HSLC25	410	410	4.6	200xD	200xD	1300	1225	14	600xD	640xD	1610	3020	18.2	1500xD	800xD
HSLC44	790	790	16	400xD	400xD	3250	2830	65	1400xD	1600xD	3620	6050	74	3000xD	1800xD
HSLC76	1850	1850	65	900xD	900xD	7250	6380	255	3200xD	3600xD	10050	10050	365	5000xD	5000xD

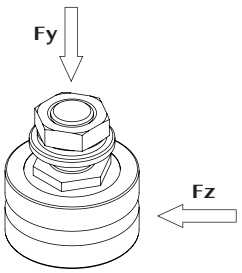


Ring rail carriage's load capacity

Carriage Type	Dry system Double Row Bearings and Twin Bearings					Lubricated system/Twin Bearings					Lubricated system/Double Row Bearings				
	Fy	Fz	Mx	My	Mz	Fy	Fz	Mx	My	Mz	Fy	Fz	Mx	My	Mz
	N	N	Nm	Nm	Nm	N	N	Nm	Nm	Nm	N	N	Nm	Nm	Nm
HSRC25 159	410	410	4.6	8.7	8.7	1300	1225	14	25.5	27.5	1610	3020	18.2	65	33.5
HSRC25 255	410	410	4.6	8.2	8.2	1300	1225	14	23.5	25.5	1610	3020	18.2	60	31.5
HSRC25 351	410	410	4.6	8.7	8.7	1300	1225	14	24.5	27.5	1610	3020	18.2	64	33.5
HSRC44 468	790	790	16	28.2	28.2	3250	2830	65	97	112	3620	6050	74	215	120
HSRC44 612	790	790	16	28	28	3250	2830	65	100	110	3620	6050	74	225	130
HSRC76 799	1850	1850	65	87	87	7250	6380	255	305	345	10050	10050	365	480	480
HSRC76 1033	1850	1850	65	105	105	7250	6380	255	365	415	10050	10050	365	580	580
HSRC76 1267	1850	1850	65	122	122	7250	6380	255	425	480	10050	10050	365	680	680
HSRC76 1501	1850	1850	65	138	138	7250	6380	255	490	550	10050	10050	365	780	780

Roller load factor

If the system does not use Helix standard 4 roller carriage, It is necessary to calculate each roller's loading factor. Biggest loaded roller's load determines the system's life.



$$LF = \frac{Fy}{Fymax} + \frac{Fz}{Fzmax}$$

LF - Loading factor

LF should be less than 1.0 for any combination of load

Fy - Actual axial capacity. (N)

Fz - Actual radial capacity. (N)

Below parameters can be taken from below table.

Fy max - Max axial load. (N)

Fz max - Max radial load. (N)

Roller's load capacity

Roller Type Selection - Please refer to pages 14-15.

Life calculation

After getting Loading Factor LF, the life in km can be calculated by selecting one of below two formulas. The basic life can be taken from table below.

Dry system

$$Life(km) = \frac{Basic\_life}{(0.03+0.97LF*f)^2}$$

Lubricated system

$$Life(km) = \frac{Basic\_life}{(0.03+0.97LF*f)^3}$$

Basic life

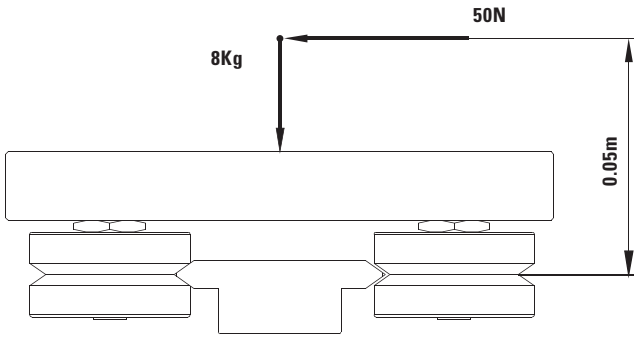
Bearing type	Dry system	Lubricated system
HSVR-25	100	150
HSVR-34	100	150
HSVR-54	150	250

f - Reduction coefficient of the application and environment.

None vibration or shock, Low speed (< 1m/s), Low frequency shift direction, clean environment.	1-1.5
Light vibration or shock, medium speed (1-2.5m/s) medium frequency shift direction, some dirtiness	1.5-2
Heavy vibration or shock, high speed (> 2.5m/s) high frequency shift direction, heavy dirty	2-3.5

Calculation example

A machine use SB-LGV25 spacer railway and standard carriage. The carriage and work-piece total weight 8 kg. When the carriage moving, there is an external load of 50 N exerted as below drawing. Working environment is clean. There is none vibration or shock.



The load factor LF is calculated use formula

$$LF = \frac{Fy}{Fymax} + \frac{Fz}{Fzmax} + \frac{Mx}{Mxmax} + \frac{My}{Mymax} + \frac{Mz}{Mzmax}$$

Fy = 8kg x 9.8 (gravity) = 78.40 N

Fz = 50 N

Mx = 50 x 0.05 = 2.5 N·m

My = 0

Mz = 0

Take parameters Fy max, Fz max, Mx max, My max, Mz max from table and then fill in the formula.

$$\mathbf{LF} = \frac{78.4}{1280} + \frac{50}{1200} + \frac{2.5}{14} + \frac{0}{\text{Mymax}} + \frac{0}{\text{Mzmax}} = 0.2816$$

Then life (km) calculation can use formula as below:

Dry system

$$\mathbf{Life(km)} = \frac{\text{Basic\_life}}{(0.03+0.97\text{LF}*f)^2}$$

Basic life is 100km.

According to the description of working condition, take f=1.3.

$$\mathbf{Life(km)} = \frac{100}{(0.03+0.97*0.2816*1.3)^2} = 674\text{km}$$

Lubricated system

Basic life is 150 km, take f=1.1

$$\mathbf{Life(km)} = \frac{\text{Basic\_life}}{(0.03+0.97\text{LF}*f)^3}$$

$$\mathbf{Life(km)} = \frac{150}{(0.03+0.97*0.2816*1.1)^3} = 4155\text{km}$$

From this example, it shows clearly that lubrication is so important for the life. Please pay attention to install the lubrication system for your system.

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