PBC Linear®

CAM Roller Technology

Roller Bearings & Linear Guideways

Configure Online at
pbclinear.com

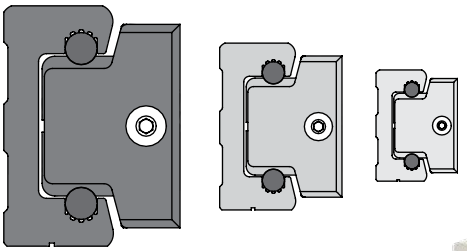
1-800-962-8979

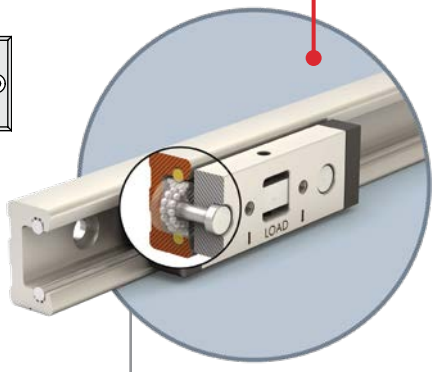
Product Comparison

Line drawings shown at 1:2 scale

Redi-Rail® Metric Series

Radial capacities from 1,000 N to 5,950 N

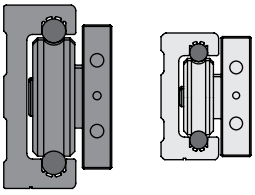


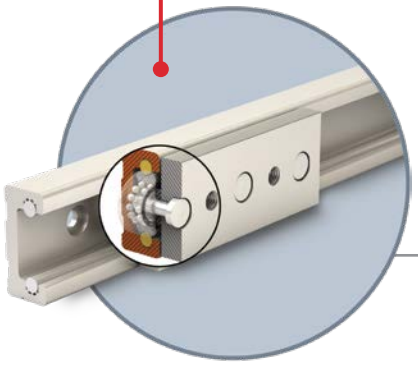


Patented side adjustable preload makes fine-tuning easy for the optimal fit

Redi-Rail Inch Series

Radial capacities from 340 lb. to 850 lb.



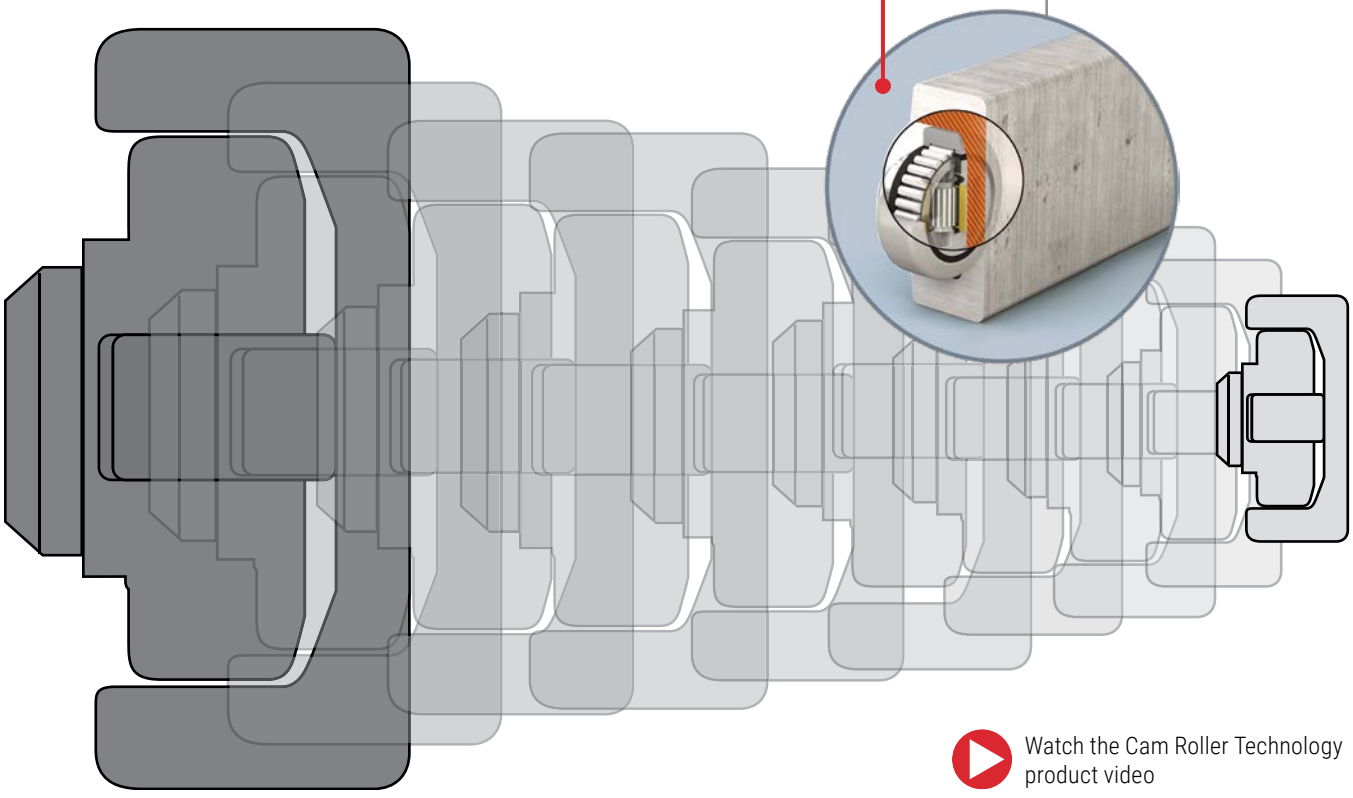


Industrial strength rail and slider are sealed against contamination

Hevi-Rail®

Bearing and rail system static radial capacities from 5.23 kN to 59.2 kN

Heavy duty bearing system handles extremely high loads and is cost effective

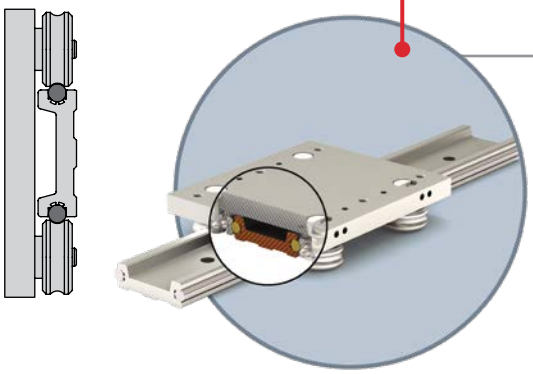


Watch the Cam Roller Technology product video

Line drawings shown at 1:2 scale.

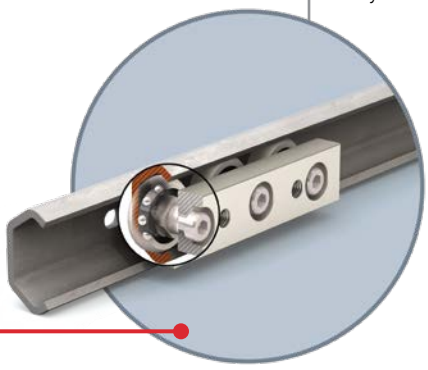
Low Profile Redi-Rail®

Radial capacity to 1,220 N



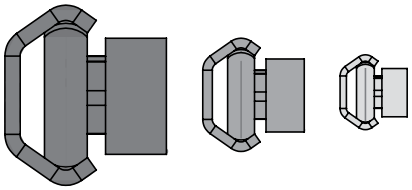
Low 19 mm profile is lightweight and thrives in tight spaces

Roll formed rails and machined aluminum slider body with preload adjustability



Commercial Rail

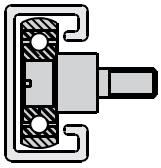
Radial capacities from 210 N to 1,330 N

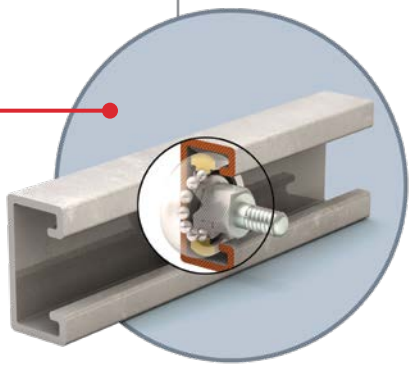


Low cost, strong, long-lasting solution

Hardened Crown Roller

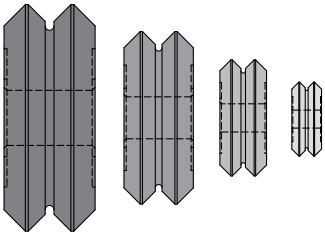
Loads to 300 lb.

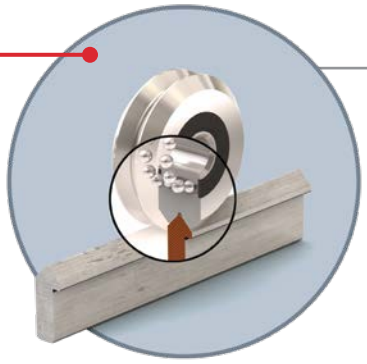




V-Guide™

Radial capacities from 1,260 N to 9,991 N





Industry standard v-wheels and rails are a versatile linear motion solution

Link to whitepaper "Lubrication for Roller Bearings and Raceways"

CAM ROLLER TECHNOLOGY PRODUCT SELECTION GUIDE

		Usage Criteria				Found on page
		Precision	Moment Load	Structural Element	Harsh Environment	
Redi-Rail® & Low Profile Redi-Rail						
	Precision straight rails and hardened gothic arch rollers are ideal for high speed and moderate load linear motion. Rollers are equipped with double-row sealed bearings. Rails are integrated with hardened steel races to ensure strength within a lightweight design.	Best / Better / Good	Best / Better / Good	Best / Better / Good	Best / Better / Good	6
Commercial Rail						
	Roll formed rails made of zinc plated steel provide a low cost and corrosion resistant solution. Machined aluminum slider body with steel wheels comes with standard adjustable preload.	Best / Better / Good	Best / Better / Good	Best / Better / Good	Best / Better / Good	16
Hardened Crown Roller						
	Pre-assembled rollers are self-aligning for easy installation. Roller bearings combined with rails in steel or powder coated finish are an inexpensive choice for long lasting linear motion.	Best / Better / Good	Best / Better / Good	Best / Better / Good	Best / Better / Good	16
Cam Yokes and Rollers						
	Rollers are easy to mount and ideal for numerous track roller applications involving moderate loading and shock.	Best / Better / Good	Best / Better / Good	Best / Better / Good	Best / Better / Good	22
V-Guide						
	V-Guide components offer an excellent solution for linear applications ranging from very clean to the harshest environments. Industry standard V-Guide wheels and rails are a versatile linear motion solution.	Best / Better / Good	Best / Better / Good	Best / Better / Good	Best / Better / Good	26
Hevi-Rail®						
	A heavy-duty linear bearing system that is cost effective for medium to low precision applications. The system is easy to mount, align, and use. High radial and axial load capacities ensure a long and productive life under continuous use.	Best / Better / Good	Best / Better / Good	Best / Better / Good	Best / Better / Good	32

I Inch Series M ISO Metric Series

Contents

Common Buttons and Links

If you are utilizing our digital catalog, you can click these icons throughout the publication to get more information.

Note: Hyperlinks go to English language website.

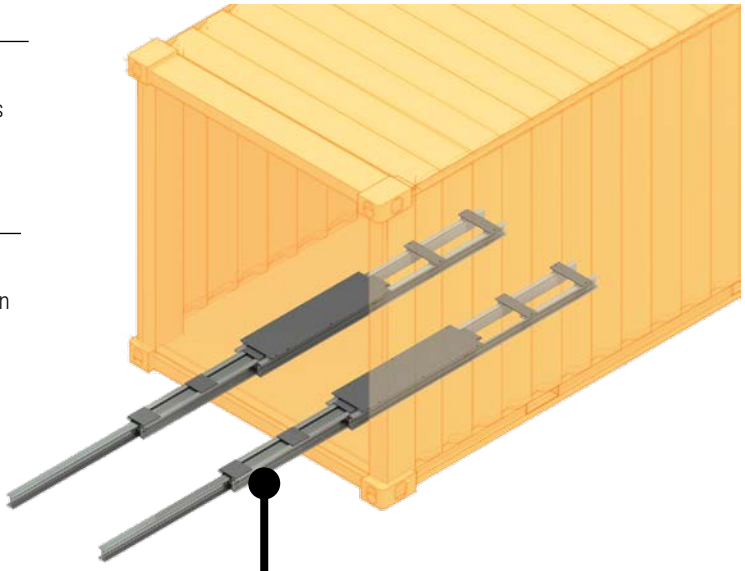
Link to specific product information

Watch product videos

Email an application engineer

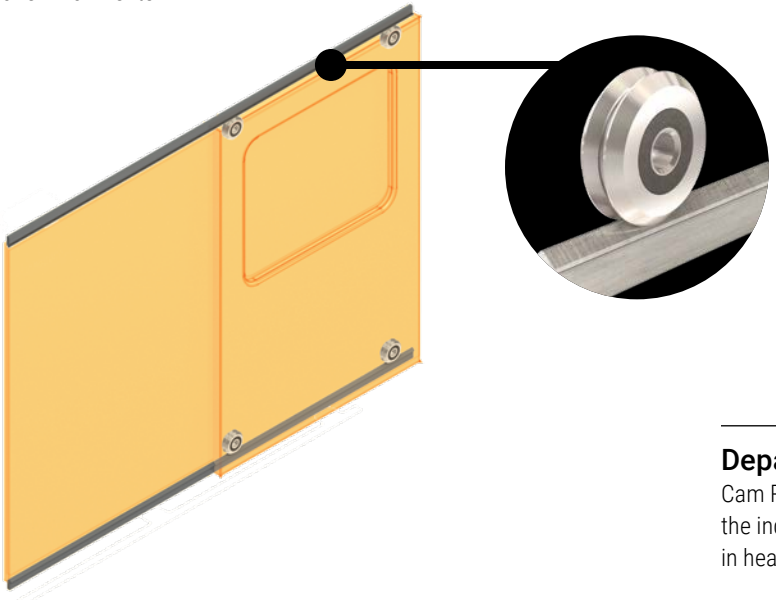
Applications

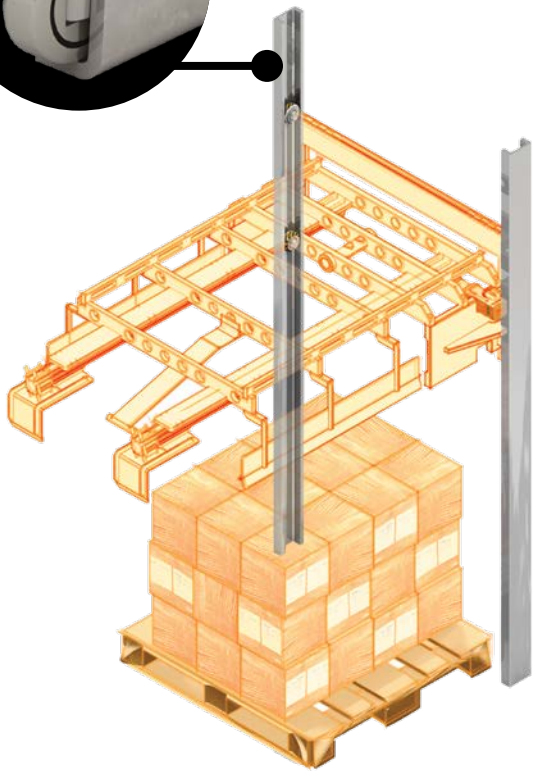
Rack Systems & Mobile Command Centers:
Hevi-Rail® combined roller systems handle extremely high loads in industrial strength applications. Systems can be optimized to provide telescopic sliding solutions.



Ergonomic & Mobile Seat Adjustment:
Commercial Rail roller bearings, Redi-Rail®, and Hardened Crown Roller each offer reliable mechanical roller systems for seat adjustment in clean and dirty environments.

Sliding Doors:
V-Guide wheels and rails are ideal for sliding door mechanisms. They provide smooth and quiet travel in a wide range of environments.

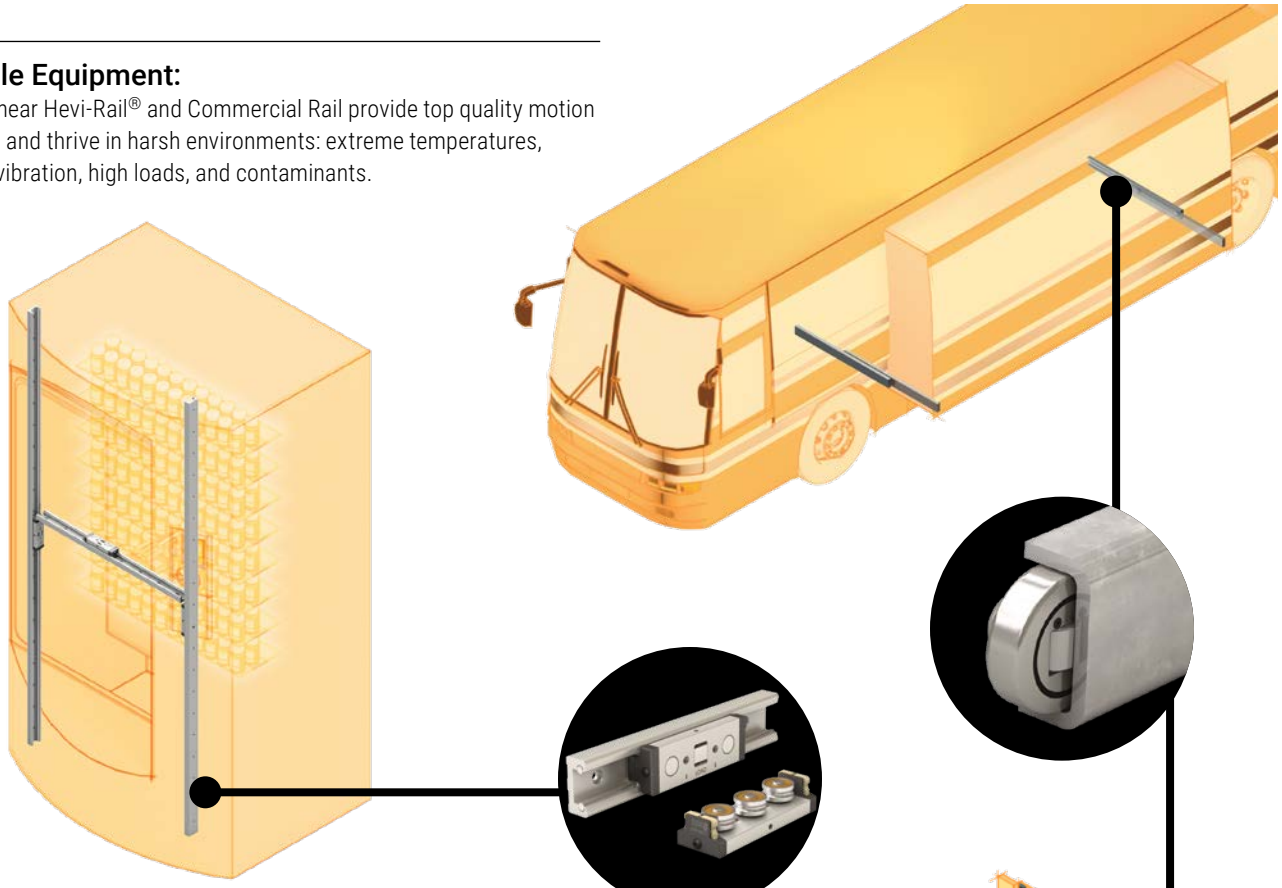




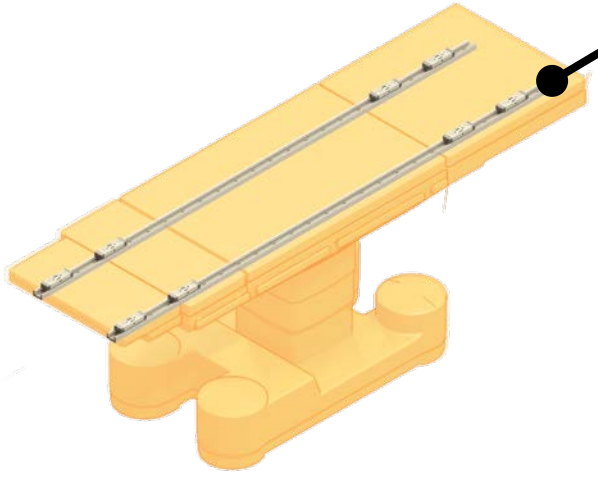
Depalletizers & Heavy duty lift systems:
Cam Roller products from PBC Linear, such as Hevi-Rail, provide the industrial strength and cantilever load capabilities required in heavy duty lift systems.

Applications

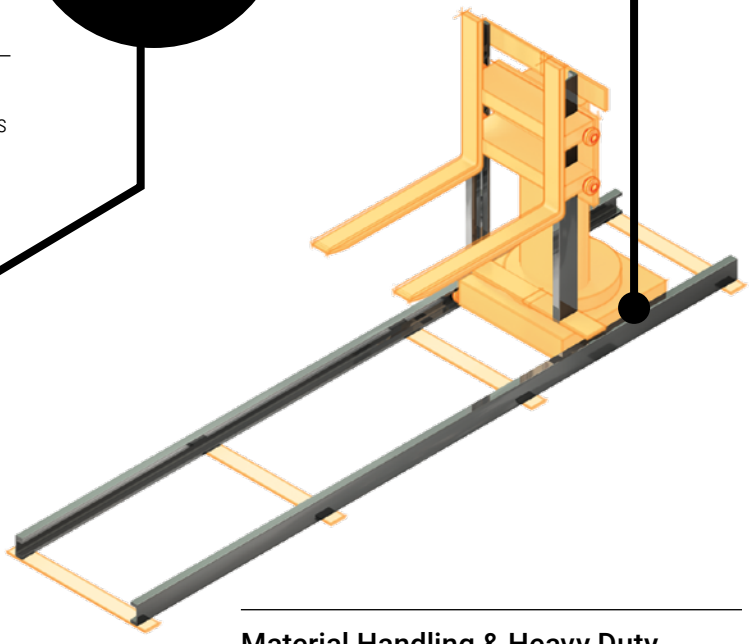
Mobile Equipment:
PBC Linear Hevi-Rail® and Commercial Rail provide top quality motion control and thrive in harsh environments: extreme temperatures, heavy vibration, high loads, and contaminants.



Kiosk & Automated Retail:
A motion control solution, such as Redi-Rail®, has many benefits including reduced part count, decreased installation costs, and improved performance.



Medical & Laboratory Equipment:
Redi-Rail provides smooth and consistent rolling performance for medical applications such as tables, carts, and chairs.



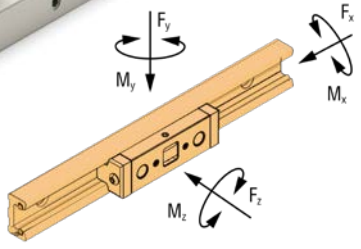
Material Handling & Heavy Duty Industrial Systems:
Hevi-Rail bearings provide smooth linear guidance in the toughest applications. Hevi-Rail is an economical solution in the harshest industrial environments, handling loads up to 6.6 tons per bearing.

Redi-Rail® Linear Guides

METRIC SERIES

Product overview

- Patented side adjustment feature makes setting preload easy
- Integral seals to wipe raceway
- Bearings sealed against contamination
- Gothic arch rollers
- Operating temperature range from -20°C to 80°C (-4°F to 176°F)
- Oil-filled plastic or UHMW spring loaded wipers
- Custom carriages can be designed, engineered, and manufactured to meet your specific requirements



Series	# of Rollers	F_d N	F_y N	F_z N	M_x N-M	M_y N-M	M_z N-M	MAX Speed M/min	MAX Speed M/S
RR30	3	1,440	1,000	330	2	6	13	300	5
	4	1,440	1,000	440	4	11	25	300	5
	5	2,160	1,500	550	4	17	38	300	5
RR45	3	4,404	2,660	827	7	20	48	420	7
	4	4,404	2,660	1,103	13	40	96	420	7
	5	6,606	3,990	1,379	13	60	144	420	7
RR65	3	10,200	5,950	1,678	19	58	155	480	8
	4	10,200	5,950	2,237	38	116	309	480	8
	5	15,300	8,925	2,796	38	175	464	480	8

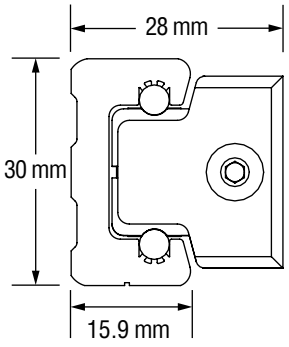
F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities

Conversions

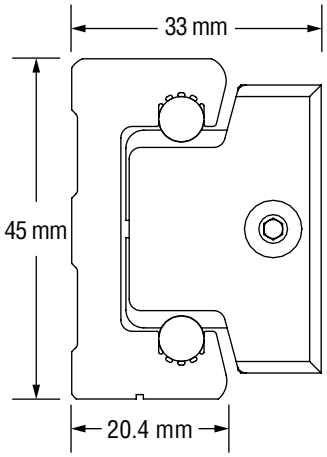
newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

1:1 Scale Dimensions shown in mm

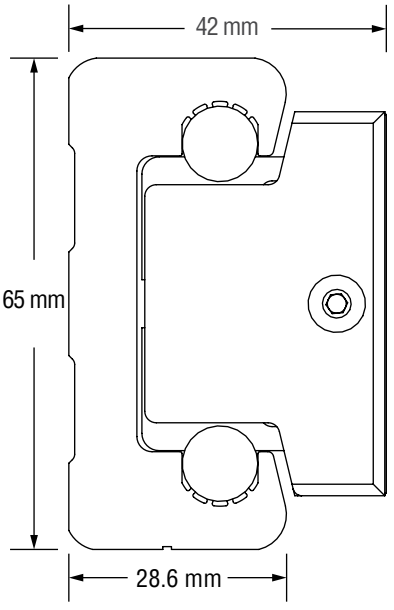
RR30



RR45



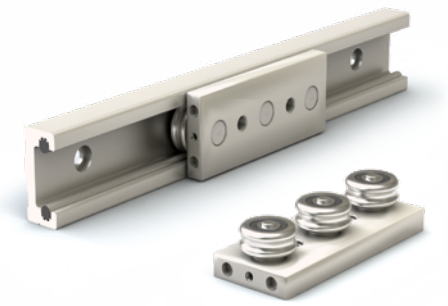
RR65



Link to video "How to Adjust Redi-Rail Carriages"

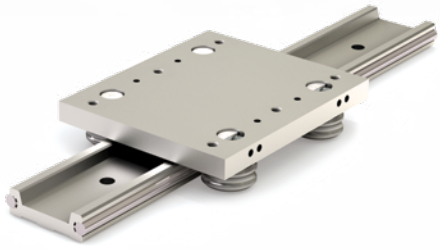
INCH SERIES

Series	# of Rollers	F_d lb.	F_y lb.	F_z lb.	M_x lb./in.	M_y lb./in.	M_z lb./in.	MAX Speed FPM	MAX Speed IPM
RR14	3	421	340	79	21	54	201	500	6,000
RR18	3	1,032	850	168	67	153	677	800	9,600

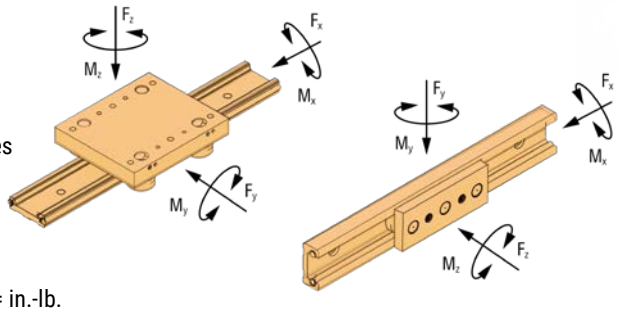


LOW PROFILE

Series	# of Rollers	F_d N	F_d lb.	F_y N	F_y lb.	F_z N	F_z lb.	M_x N-M	M_x lb./in.	M_y N-M	M_y lb./in.	M_z N-M	M_z lb./in.	MAX Speed FPM	MAX Speed IPM
RRL34	4	1,488	329	1,220	270	510	110	14	120	31	270	13	110	500	6,000



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities



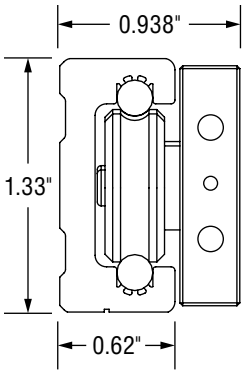
Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

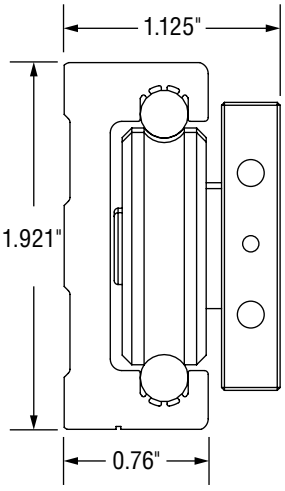
1:1 Scale

Dimensions shown in inches for RR14 & RR18; mm for RRL34

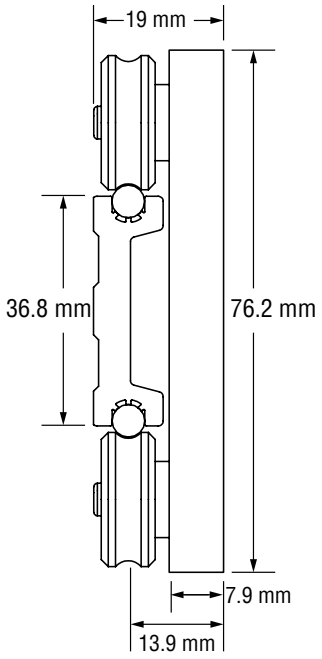
RR14



RR18

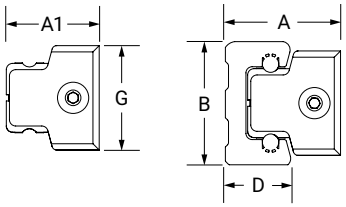


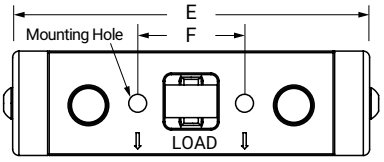
RRL34

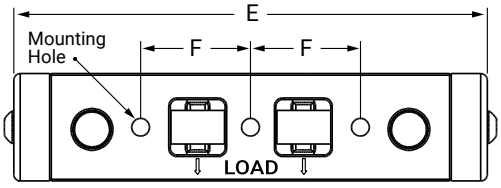


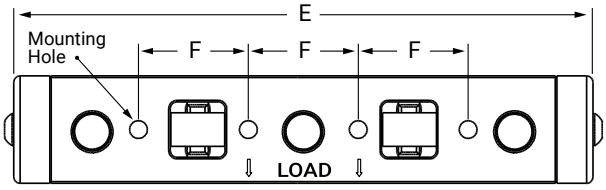
Link to video "Adjusting Pre-Load on Low Profile Redi-Rail Carriages"

CARRIAGE DIMENSIONS



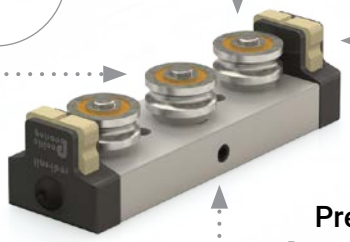






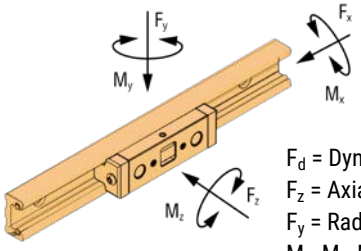
Double Row Bearing
High speed & acceleration

Sealed Roller
Ideal around contaminants



Wiper
Molded plastic casing spring-load for even pressure

Pre-Load Adjustment
Patented side adjustable preload



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F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Dimensional Information mm

Part No.	# of Rollers	A1	A	G	B	D	E	F	Mounting Holes	Weight kg
RRS30	3	22.6	28	25.4	30	15.9	86.90	26	M5 x 0.8	0.09
	4	22.6	28	25.4	30	15.9	112.00	26	M5 x 0.8	0.12
	5	22.6	28	25.4	30	15.9	137.00	26	M5 x 0.8	0.17
RRS45	3	25.8	33	38.1	45	20.4	117.00	36	M8 x 1.25	0.23
	4	25.8	33	38.1	45	20.4	152.00	35	M8 x 1.25	0.28
	5	25.8	33	38.1	45	20.4	189.50	35	M8 x 1.25	0.33
RRS65	3	32.3	42	50.8	65	28.6	162.00	52	M8 x 1.25	0.39
	4	32.3	42	50.8	65	28.6	215.35	52	M8 x 1.25	0.51
	5	32.3	42	50.8	65	28.6	268.70	52	M8 x 1.25	0.63

Load Ratings

Part No.	# of Rollers	F_d N	F_y N	F_z N	M_x N-M	M_y N-M	M_z N-M
RRS30	3	1,440	1,000	330	2	6	13
	4	1,440	1,000	440	4	11	25
	5	2,160	1,500	550	4	17	38
RRS45	3	4,404	2,660	827	7	20	48
	4	4,404	2,660	1,103	13	40	96
	5	6,606	3,990	1,379	13	60	144
RRS65	3	10,200	5,950	1,678	19	58	155
	4	10,200	5,950	2,237	38	116	309
	5	15,300	8,925	2,796	38	175	464

Carriage Ordering Information

Steel Roller Version — Stainless Steel Roller Version

RRS **XX** **U** **A** - **X** - **SS**

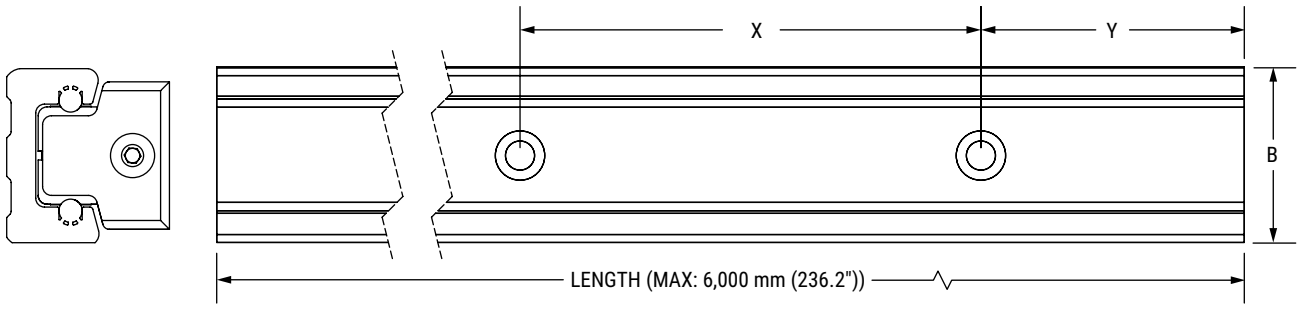
- **RRS** — **Redi-Rail Slide**
- **XX** — **Nominal Size**
  30 = Dimension
  45 = Dimension
  65 = Dimension
- **U** — **Wiper Options**
  No Entry = Oil filled plastic (standard)
  U = UHMW wipers
- **A** — **Adjustable Pre-Load**
- **X** — **Number of Rollers**
  3 = 3 Rollers
  4 = 4 Rollers*
  5 = 5 Rollers*
- **SS** — **Corrosion Resistance**
  SS = 440 SST Rollers

Configure Online

* 4 and 5 wheel carriages not aviable in stainless steel option

Ordering example:
RRS65U for steel roller and
RRS30A-3R-SS for stainless steel roller

RAIL DIMENSIONS



Customer specifies "Y" dimension

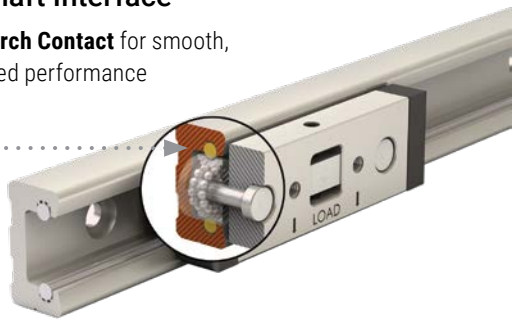
Dimensional Information mm

Part No.	X	B	Mounting Fasteners	Weight kg/m
RR30	60	30	M5 BHCS	0.868
RR45	60	45	M6 BHCS	1.718
RR65	80	65	M6 BHCS	3.758

Note: Rail lengths are available up to 6 m. Y dimension is specified by customer at time of order. If Y is not specified, holes are centered on length of rail. BHCS - Button Head Cap Screw.

Roller/Shaft Interface

Gothic Arch Contact for smooth, high speed performance



Rail Ordering Information

RR **XX** - [ ] **XXXX**

Redi-Rail

Nominal Size
30 = Dimension
45 = Dimension
65 = Dimension

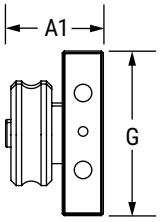
Rail Type
Blank = Rail with steel rods (standard)
CR = Corrosion resistant rail with 440 SST rods

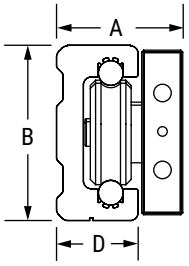
Length (mm)
Example: 1200 mm, MAX: 6,000 mm (236.2")

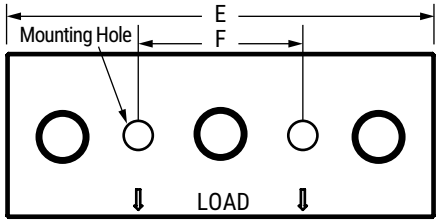
Configure Online

Ordering example: RR65-1200; Y = 20 mm
Specify Y dimension (hole to end) at time of order

CARRIAGE DIMENSIONS







Sealed Roller
Ideal around contaminants

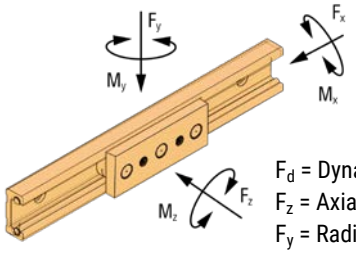
Double Row Bearing
High speed & acceleration

Standard

with Lubrication Option

Dimensional Information inches

Part No.	A1	A	G	B	D	E	F	Mounting Holes	Weight lb.
RRS14	0.702	0.938	1.25	1.32	0.62	3.25	1.250	1/4-28	0.25
RRS14PW						4.13			
RRS18	0.823	1.125	1.50	1.91	0.76	4.50	1.625	5/16-24	0.50
RRS18PW						5.36			



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities

Load Ratings

Part No.	Fd lb.	Fy lb.	Fz lb.	Mx lb.-in.	My lb.-in.	Mz lb.-in.
RRS14/PW	421	340	79	21	54	201
RRS18/PW	1,032	850	168	67	153	677

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Carriage Ordering Information

Steel Roller Version — Stainless Steel Roller Version

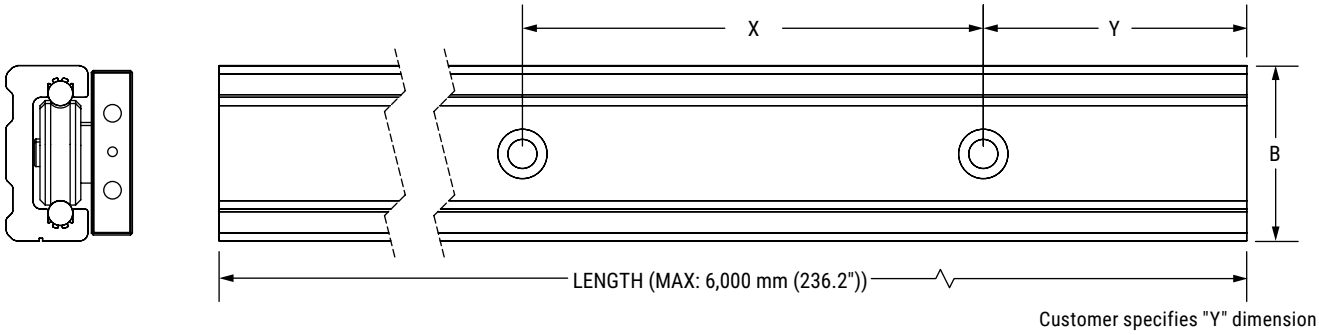
RRS **XX** **PW** **F** – **3R** – **SS**

- **RRS** — **Redi-Rail Slide**
- **XX** — **Nominal Size**: 14 = Dimension, 18 = Dimension
- **PW** — **Wiper Option**: No Entry = No wipers, PW = Oil filled plastic wipers
- **F** — **Fixed Pre-Load**
- **3R** — **Number of Rollers**
- **SS** — **Corrosion Resistance**: SS = 440 SST Rollers

Configure Online

Ordering example: RRS18 for steel roller and RRS14F-3R-SS for stainless steel roller

RAIL DIMENSIONS



Customer specifies "Y" dimension

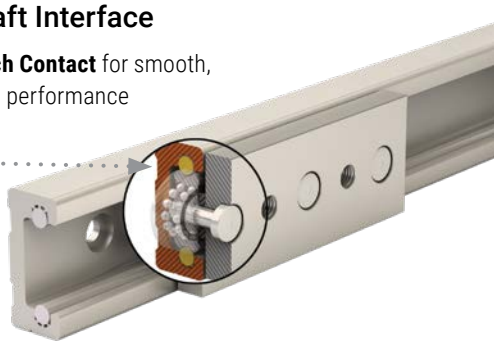
Dimensional Information inches

Part No.	X	B	Mounting Fasteners	Weight lb./ft
RR14	3.5	1.32	#10 BHCS	0.56
RR18	3.5	1.91	1/4" BHCS	0.85

Note: Rail lengths are available up to 19' (6 m). Y dimension is specified by customer at time of order. If Y is not specified, holes are centered on length of rail. BHCS - Button Head Cap Screw.

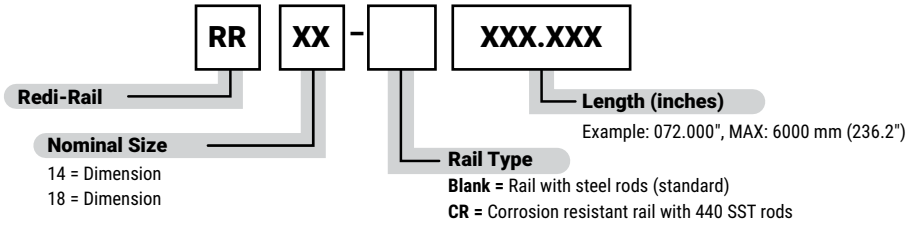
Roller/Shaft Interface

Gothic Arch Contact for smooth, high speed performance



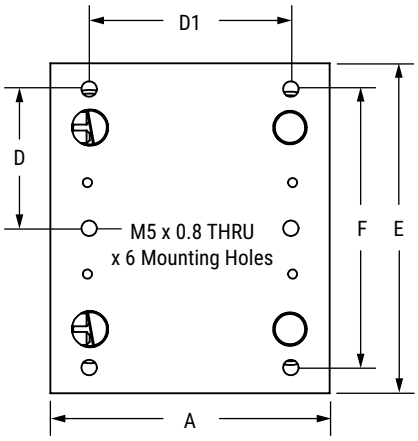
Rail Ordering Information

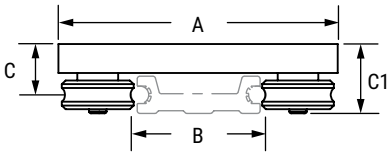
Configure Online

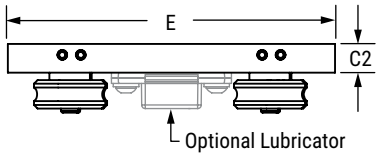


Ordering example: RR18-072.000; Y = 2 inches
Specify Y dimension (hole to end) at time of order

CARRIAGE DIMENSIONS

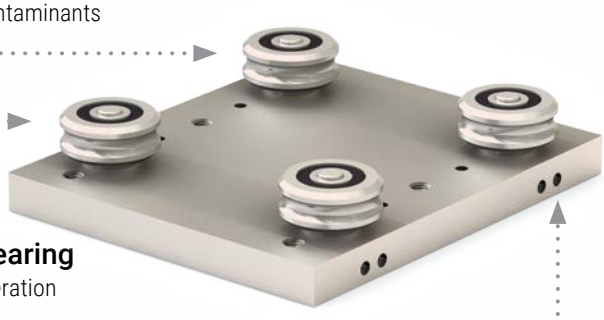






Sealed Roller
Ideal around contaminants

Double Row Bearing
High speed & acceleration



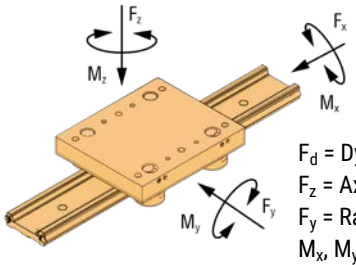
Pre-Load Adjustment
Patented side adjustable preload

Dimensional Information mm

Part No.	A	B	C	C1	C2	D	D1	E	F	Mounting Holes	Weight lb.
RRL34C	76.2	36.8	13.9	19	7.9	38	55	90	76	M5 x 0.8 Thru x 6	0.5

Load Ratings

Part No.	F_y		F_z		M_x		M_y		M_z	
	n	lb.	n	lb.	n-m	lb./ in.	n-m	lb./ in.	n-m	lb./ in.
RRL34C	1,220	270	510	110	14	120	31	270	13	110



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Carriage Ordering Information

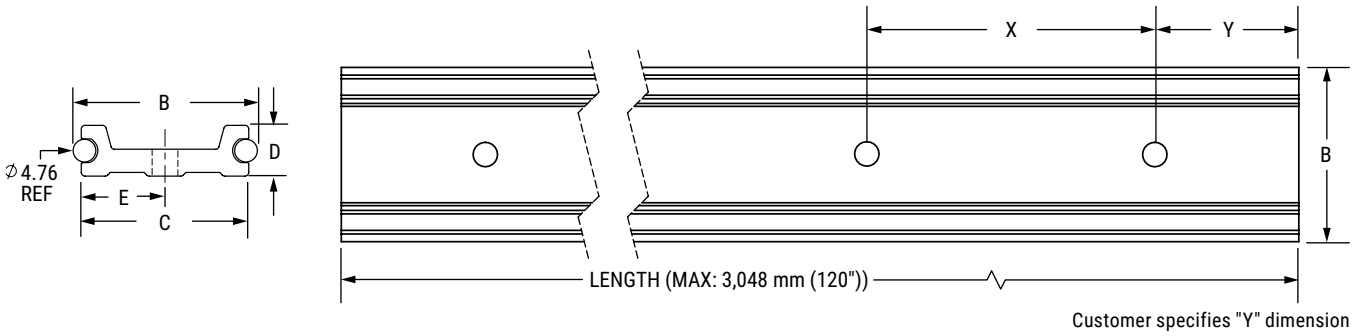
RRL **34** **C** – **A** **X** – **X** **19** **A** – **C0**

- **RRL** — Low Profile Redi-Rail
- **34** — Size 34
- **C** — Carriage
- **A** — Carriage Style: **A** = 4-Roller Flat Plate
- **X** — Roller Type: **2** = Sealed Steel (Std); **3** = Sealed Stainless Steel
- **X** — Wiper/Lubricator: **0** = Nothing; **1** = Lube Pad (wiper)
- **19** — System Height: 19 mm
- **A** — Preload: **A** = Side Adjustable (Std)
- **C0** — Corrosion Resistance: **C0** = Clear Anodize (Std)

Configure Online

Ordering example:
RRL34C-A2-19A-C0

RAIL DIMENSIONS



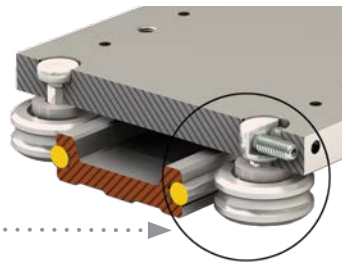
Dimensional Information mm

Part No.	B	C	D	E	X	Mounting Fasteners	Weight kg/m
RRL34	36.8	33.5	10.2	16.8	80	M5 BHCS	0.7559

Note: Rail lengths are available up to 10 ft (3048 mm). Y dimension is specified by customer at time of order. If Y is not specified, holes are centered on length of rail. BHCS - Button Head Cap Screw.

Roller/Shaft Interface

Gothic Arch Contact
for smooth, high speed performance



Rail Ordering Information

RRL **34** **R** – **XXX.XXX** – **RX**

- **RRL** — **Low Profile Redi-Rail**
- **34** — **Size 34**
- **R** — **Rail**
- **XXX.XXX** — **Length** (inches), MAX: 120 inches (3,048 mm)
- **RX** — **Corrosion Resistance**
  - **R0** = Clear anodize aluminum rail with RC60 steel shafting (Standard)
  - **R1** = Clear anodize aluminum rail with stainless shafting

Configure Online

Ordering example: RRL34R-200.000-R0; Y = 45 mm
Specify Y dimension (hole to end) at time of order

Redi-Rail® Linear Guides

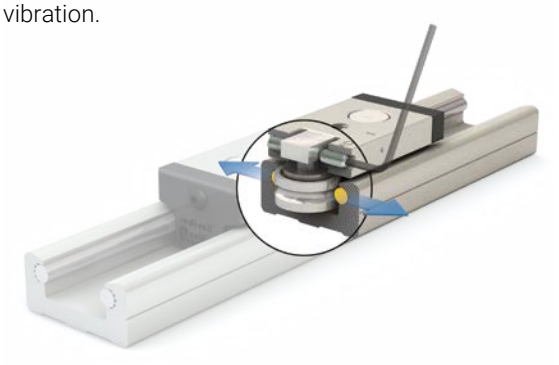
Product overview

- Sealed double row bearings provide smooth linear guidance that is maintenance free
- Side adjusted preload simplifies assembly and installation
- Operating temperature range from -20°C to 80°C (-4°F to 176°F)
- Butt-joinable for longer lengths
- Available in Inch or ISO Metric

Adjusting Slide Preload ON Metric Series

Slide preload is initially set by the factory. If further adjustments are needed, here are some simple steps to follow:

1. To loosen the eccentric (center) roller, use an allen wrench to loosen the screw that is on the side of the mounting block. Be sure to loosen the screw that is on the side of the direction you want the roller to move.
2. When it is loose, tighten the set screw on the opposite side of the block. This will move the roller and mounting stud.
3. Make a very small change, retighten the first set screw, and try it out. If the preload is too loose, you will feel the slider rock and you will hear a slight "clunk." If it is too tight, the slider will roll rough, like riding a bicycle on a gravel road.
4. Move the slide along the length of the rail by hand. Adjust it so that it does not feel loose anywhere. It may take you several times to get the proper adjustment.
5. Make sure the rollers are tightened with the proper adjustment prior to operation. It is recommended to lock the set screws in place with a breakable threadlocker so they will hold position and minimize any effects of vibration.



Mounting Slider body & Max Capacity

The table shows recommended bolt tightening torques for mounting to the slide body. Be sure to use bolts that are long enough to obtain full thread engagement.

Lubrication – Rails & Bearings

Redi-Rail rollers are internally lubricated for life, but the rails must always have a layer of grease. As a guideline, reapply fresh grease every 50,000 cycles. PBC Linear recommends white lithium based grease.

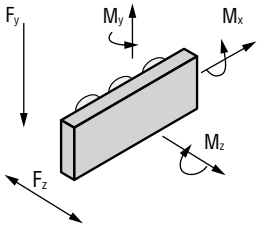
Slider Orientation

The 3-roller slide should be installed in the rail so the load is shared on the two outside rollers. The orientation marks indicate how to align the slider with the load direction.

MOUNTING TORQUE

Part No.	in.-lb. Torque	Nm Torque
RRS14, RRS30	25	3
RRS18, RRS45	70	8
RRS65	150	24

LIFE CALCULATIONS



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Part No. Inch	F_y lb.	F_z lb.	M_x lb.-in.	M_y lb.-in.	M_z lb.-in.
RRS14	336	79	21.0	54.0	201.0
RRS18	847	168	67.0	153.0	677.0
Metric	N	N	Nm	Nm	Nm
RRS30	1,002	330	1.8	5.5	12.5
RRS45	2,660	827	6.6	19.9	47.9
RRS65	5,950	1,678	19.0	58.2	154.7

To calculate an approximate life for Redi-Rail sliders, use the following equation:

Inch Series

$L_{RR} = 10^7 \cdot (F_d/(\text{Load}_{\text{Equiv}} \cdot RF))^{3.0}$ (inches)

F_d = Slider Life Capacity which is found in the table

$\text{Load}_{\text{Equiv}}$ = Equivalent Radial Load found from the following equation:

$$\text{Load}_{\text{Equiv}} = F_y \cdot \left(\frac{\text{Load}_{\text{Axial}}}{F_z} + \frac{M_x}{M_x\ \text{MAX}} + \frac{M_y}{M_y\ \text{MAX}} + \frac{M_z}{M_z\ \text{MAX}} \right) + \text{Load}_{\text{Radial}}$$

Part No.	Speed $_{fpm}$	Speed $_{ipm}$	F_d
RRS14	500	6,000	421
RRS18	800	9,600	1,032

Metric Series

$L_{RR} = (F_d/(\text{Load}_{\text{Equiv}} \cdot RF))^{3.0} \cdot 100{,}000$ (meters)

F_d = Slider Life Capacity which is found in the table

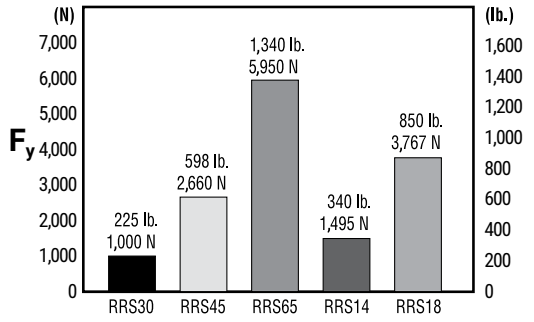
$\text{Load}_{\text{Equiv}}$ = Equivalent Radial Load found from the following equation:

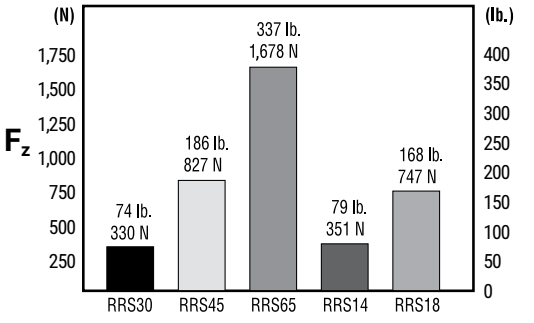
$$\text{Load}_{\text{Equiv}} = F_y \cdot \left(\frac{\text{Load}_{\text{Axial}}}{F_z} + \frac{M_x}{M_x\ \text{MAX}} + \frac{M_y}{M_y\ \text{MAX}} + \frac{M_z}{M_z\ \text{MAX}} \right) + \text{Load}_{\text{Radial}}$$

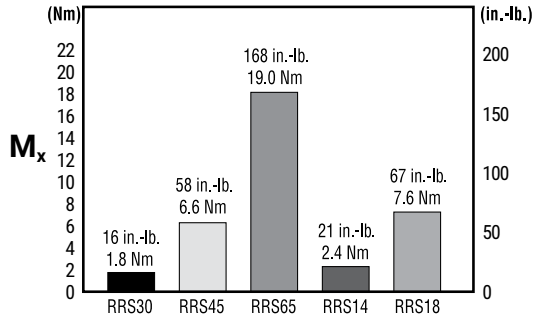
Part No.	Speed $_{m/min}$	Speed $_{m/s}$	F_d N
RR30	300	5.0	1,440
RR45	420	7.0	4,404
RR65	480	8.0	10,200

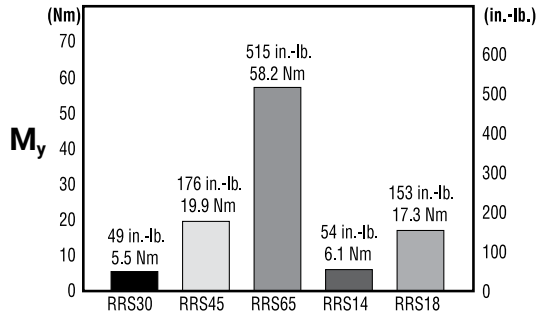
Note: Reduction factors apply to both inch and metric series
RF = Reduction Factor of the application or environment
= 1.0 to 1.5 for very clean, low speed (<30% MAX), low shocks
= 1.5 to 2.0 or some dirt, moderate speed (30% MAX to 75% MAX), medium shocks and vibration
= 2.0 to 3.0 for heavy dirt and dust, high speeds (>75% MAX) and heavy shocks and vibration

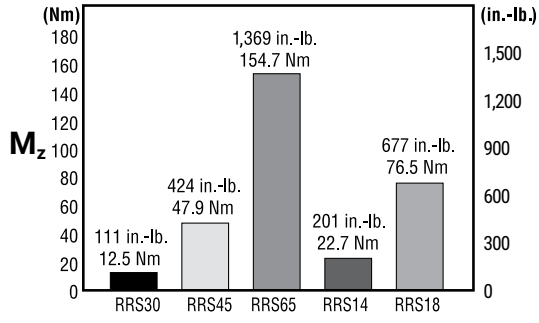
LOAD COMPARISON





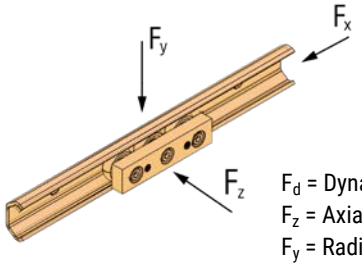






Commercial Rail Linear Guides

	Slider	No. of Rollers	F_d N	F_y N	F_z N
Steel	CR20	3	280	210	160
	CR30	3	800	610	420
	CR45	3	1,740	1,330	930



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity

Features & Benefits

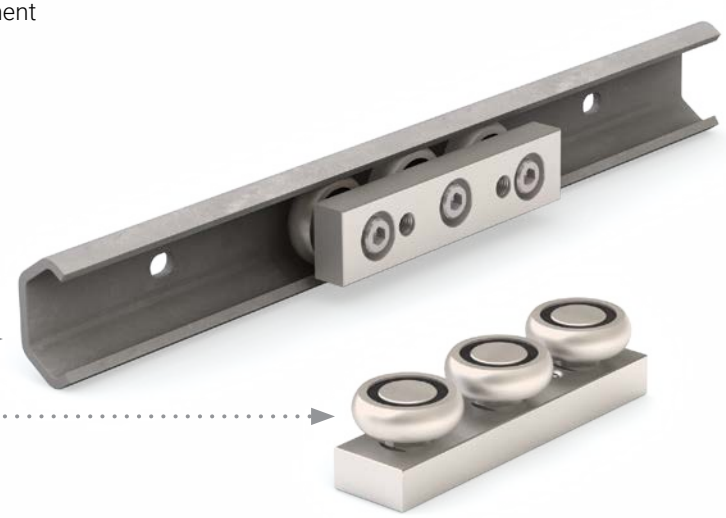
Commercial Rail is a simple and cost effective linear motion solution with high load capacity and corrosion resistance.

- Precision formed rails available in zinc plated carbon steel
- Speeds up to 1.5 m/s (59 in./s)
- Withstands temperatures up to 100°C (212°F)
- Load capability up to 1,330 N (298 lb.)
- Open-end wrench available for preload adjustment

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Link to technical information–page 65

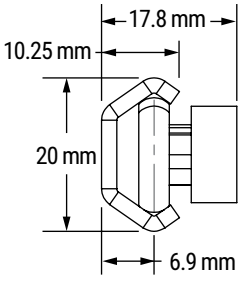


Roll Formed Rail
Is corrosion resistant

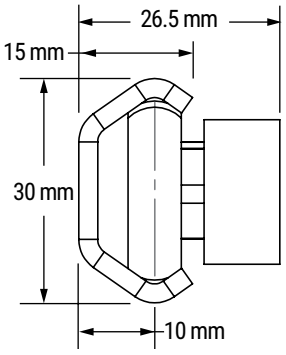
Sealed Roller
Ideal around contaminants

1:1 Scale Dimensions shown in mm

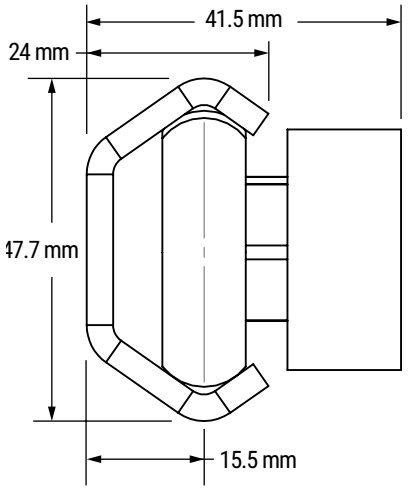
CR20



CR30



CR45



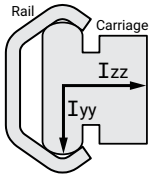
Product Overview

- Roll formed rails made of steel sheet for low cost and corrosion resistance application
- Zinc plated rail length up to 6,000 mm
- Machined slider body made of aluminum alloy and anodized for corrosion resistance
- Steel rollers are made of 52100 chrome steel, hardened and ground, lubricated for life, and sealed against contamination
- Rollers made with thread integrated inner ring for ease of assembly and adjustment of preload
- Custom polymer wipers can be designed and manufactured to improve the smoothness of motion and service life
- Maximum operating temperature of 100°C (212°F)
- Consult with factory for special hole spacing
- Speed up to 1.5 m/s
- Moment loads should be carried by two slides or two parallel rollers

Link to temperature information–page 65

Moments of Inertia

CR Size	I_{zz}		I_{yy}	
	mm^4	in^4	mm^4	in^4
CR20	2,699	0.006484	533.7	0.001282
CR30	11,354	0.027278	2,221.8	0.005338
CR45	59,907	0.143930	13,183.0	0.031673



Material & Finish Specifications

	CR Series Rail
Rail	Carbon steel sheet, Zinc plated
Slide	Aluminum alloy anodized
Rollers	Chrome steel
Hardware	Steel zinc plated

Slide Orientation

The 3-roller slide should be installed in the rail so that the load is shared among the two outside rollers. The orientation marks indicate how to align the slider with the load direction.

Lubrication – Rails & Bearings

The rollers are internally lubricated for life, but the rails must always have a layer of grease. As a guideline, reapply fresh grease every 50,000 cycles.

Preload Adjustment

- To loosen the center roller, use an Allen wrench to untighten the screw while holding the roller still with an open-end wrench
- Turn the center roller to a position to achieve the desired preload
- Move the slide along the length of the rail by hand, and adjust it so that it does not feel loose anywhere
- Tighten the screw while holding the roller flat with an open-end wrench

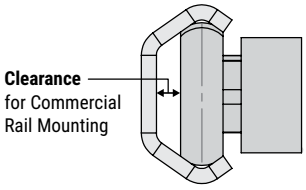
Preload Adjustment	CR20/CRSS20	CR30/CRSS30	CR45
Open-End Wrench	6 mm	10 mm	14 mm
PBC Linear Part Number	6101227	6101226	6101225

Mounting

Slide	CR20/CRSS20	CR30/CRSS30	CR45
Slide mount screws (Socket head cap)	M5	M6	M8
Tightening torque (in/lb.)	25	43	103
Tightening torque (N-m)	3	5	12

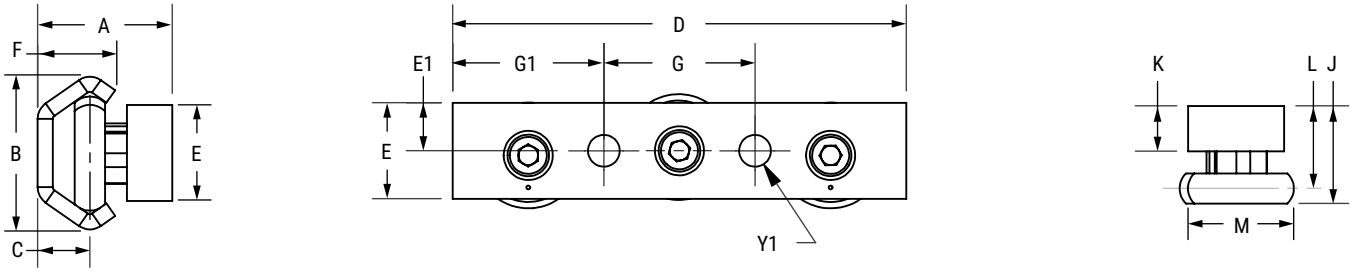
Rail					
	Clearance		Suggested Fastener (Button head cap)	Head Height*	
Size	inches	mm		inches	mm
CR20	0.115	2.9210	M4	0.087	2.20
CR30	0.158	4.0132	M5	0.108	2.75
CR45	0.256	6.5024	M8	0.433	11.00

*Head height dimensions meet ISO 7380



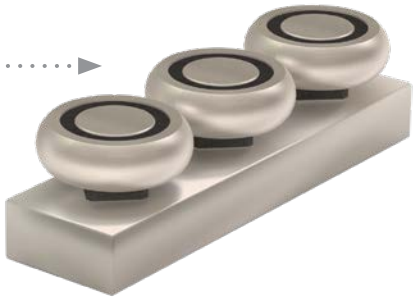
Email an Application Engineer

CARRIAGE DIMENSIONS



Sealed Roller
Ideal around contaminants

Machined Body
Anodized aluminum alloy

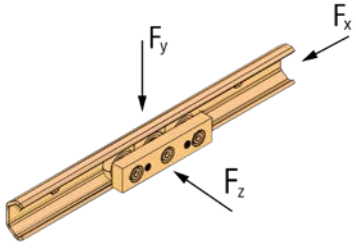


Dimensional Information mm

Part No.	A	B	C	D	E	F	G	G1	J	K	L	M Ø ref	Y1	Thread Pitch	Weight KG
CR20	17.8	20.0	6.9	60	12.7	10.25	20	20.0	12.9	6	10.9	14.0	2x Ø 4.2 thru all	M5 x 0.8	0.022
CR30	26.5	30.0	10.0	80	19.1	15.00	35	22.5	20.0	10	16.5	22.8	2x Ø 5.0 thru all	M6 x 1.0	0.100
CR45	41.5	45.7	15.5	120	31.8	24.00	50	35.0	31.5	15	26.0	35.5	2x Ø 6.8 thru all	M8 x 1.25	0.377

Load Ratings

Part No.		F_d N	F_y N	F_z N
Steel	**CR20**	280	210	160
	CR30	800	610	420
	CR45	1,740	1,330	930



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Carriage Ordering Information

CR — Commercial Rail

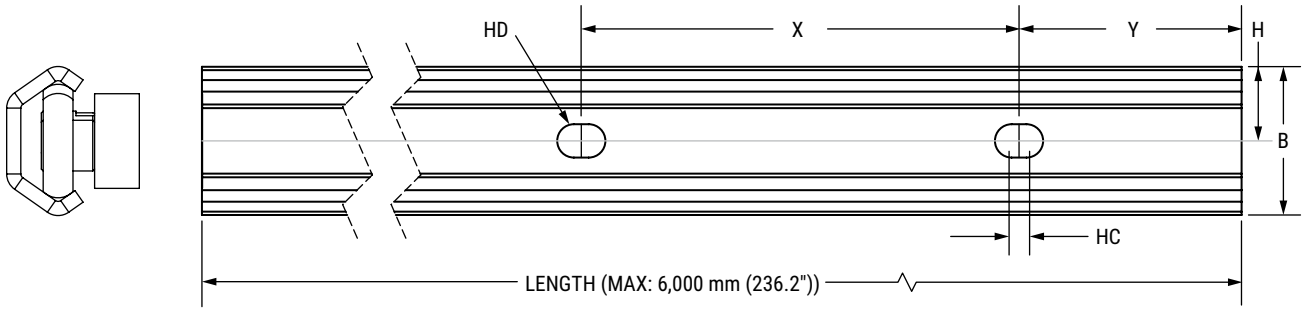
XX — Rail Size
20 = 20 mm
30 = 30 mm
45 = 45 mm

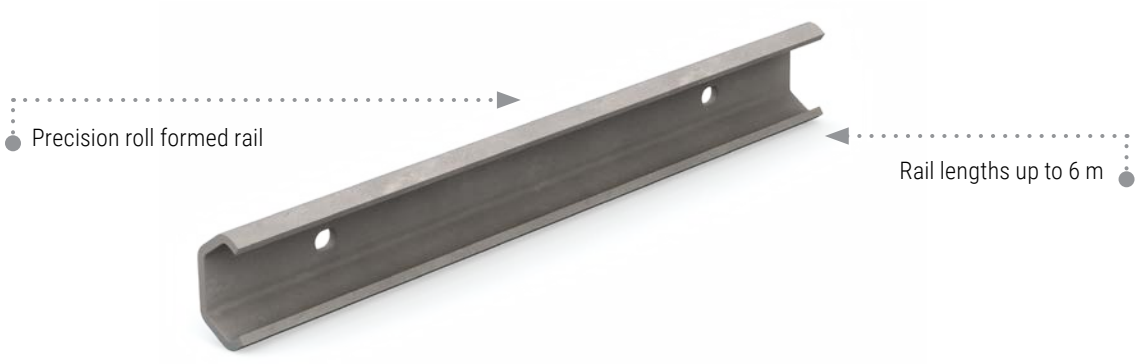
MCA — Type of Body
MCA = Machined Body

Configure Online

Ordering example: CR20MCA

RAIL DIMENSIONS



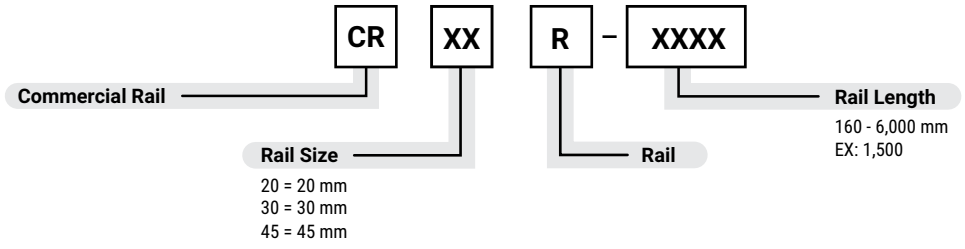


Dimensional Information mm

Part No.	A	B	C	F	H	HC	HD	X	Y	Rail Wt. kg/m
CR20	17.8	20	6.9	10.25	10.0	2	4.5	80	40	0.46
CR30	26.5	30	10	15	15.0	2	5.5	80	40	0.95
CR45	41.5	45.7	15.5	24	22.9	2	9.0	80	40	1.95

Rail Ordering Information

Configure Online



Ordering example: CR20R-1500

Hardened Crown Rollers

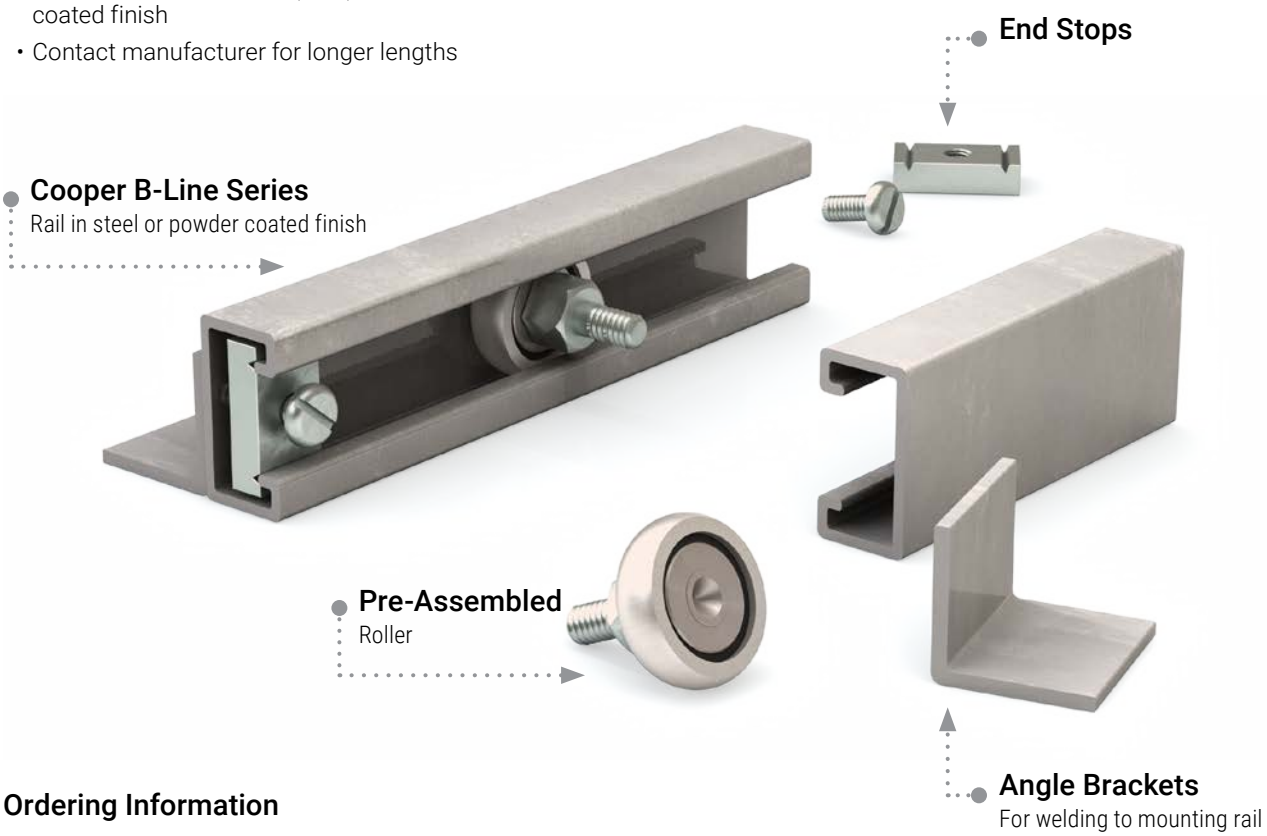
Features & Benefits

Hardened crown rollers are a superb choice for low-cost linear motion. The rollers come pre-assembled and are self-aligning for simple installation. Hardened crown rollers are great for point-to-point applications, and ensure strong, sturdy, and long-lasting linear motion.

- Precision rolling element bearing with polyamide 6/6 seals riding in a Cooper B-Line Series rail
- 9/16" Hex head for easier mounting
- Available with either a 5/16-18 or M8 thread
- Maximum wheel bearing load up to 1,334 N (300 lb.)
- Maximum speed up to 762 mm/s (30 in./s)
- Rails available up to 3 m (10 ft) in steel or powder coated finish
- Contact manufacturer for longer lengths

Accessories Available:

- Angle brackets (for welding to mounting rail)
- End stops



Ordering Information

Part No.	Description
PAC3016	Hardened Crown Roller Bearing
PAC3016M	Hardened Crown Roller Bearing with metric thread
PAC2245	Rail System - unpainted (specify length - priced per foot)
PAC2247	Rail System - black powder coat finish (specify length - price per foot)
PAC2244	Angle Brackets - 1" Steel
PAC2246	End Stops for Rail System (Included: Round head machine screw, ¼"-20 x ¾" Lg, slotted)

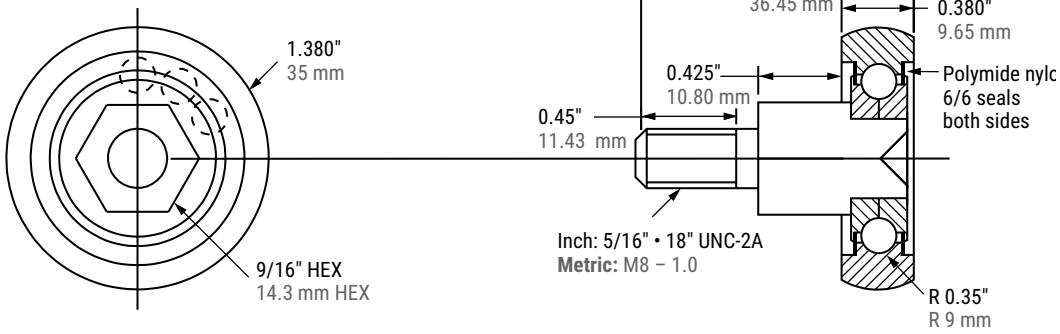
Note: PAC2247 dimensions will vary according to coating thickness.

Configure Online

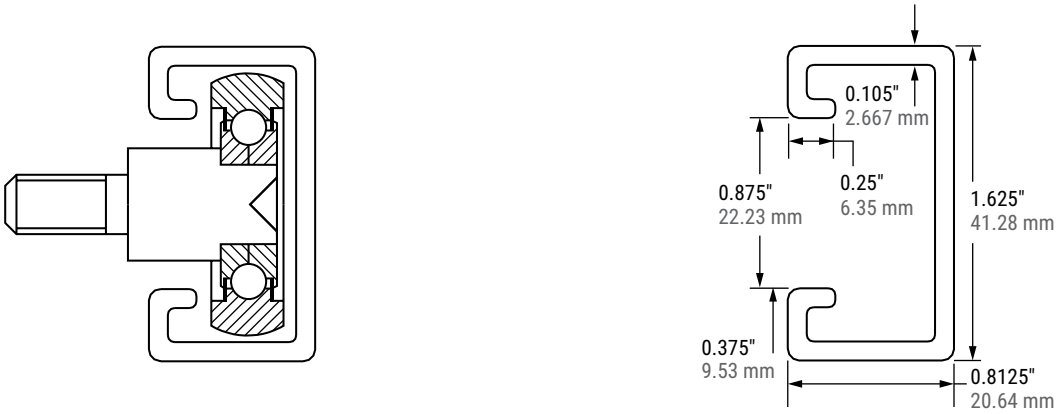
Hardened Crown Rollers

1:1 Scale

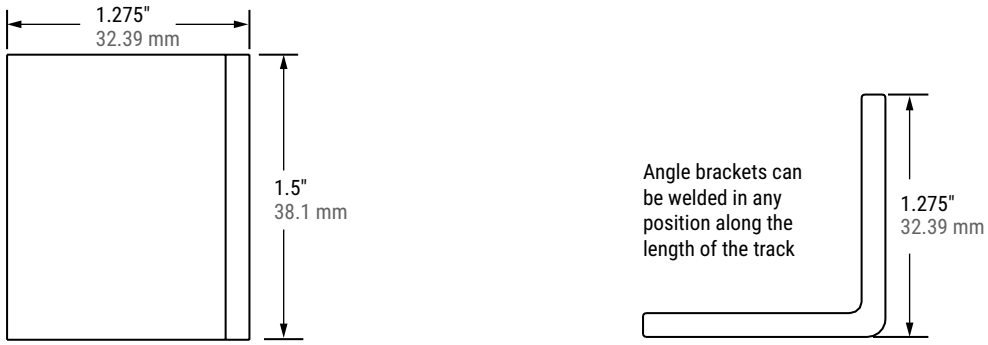
Bearings



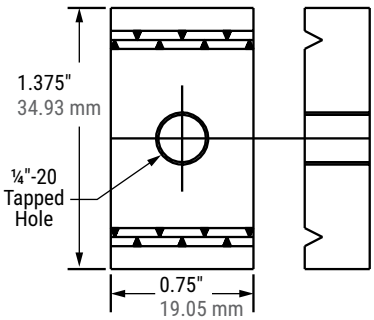
Rails



Angle Bracket

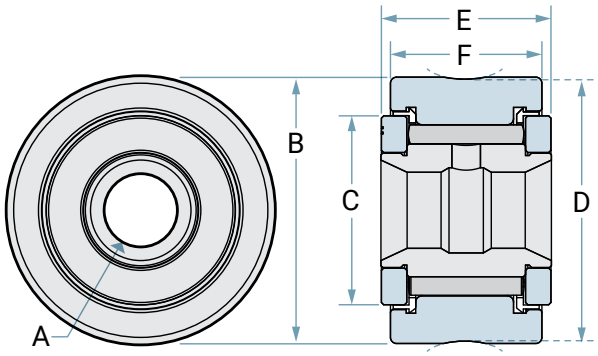


End Stop



Note:All metric dimensions are conversions from inch dimensions.
All parts are manufactured to inch standards.
See ordering information on the previous page.

Cam Yoke Rollers



Cam Yoke Rollers are easy to mount and ideal for numerous track roller applications involving moderate loading and shock. Cam Yoke Rollers are composed of high carbon and chromium bearing steel through-hardened and ground outer raceways. Available in chrome plated or stainless steel with a high temp version as an option. These sealed bearings helps to retain lubrication and prevent contamination.

Features/Benefits

- Precision manufacturing to minimize bearing failure which results in costly shutdowns
- Sealed bearings retain lubrication and prevent contamination
- Dimensionally Interchangeable with other standard Cam Yoke Rollers

Lubrication

Cam Yoke Rollers come pre-lubricated. This lubrication is suitable for applications between 5ºF–275ºF (-15ºC–135ºC) and is equipped with corrosion-resistant additives. The rollers can be relubricated via lube holes and lube groove in the inner race bore.

Cam Yoke Roller Installation

To achieve full axial load rating of the Cam Yoke Roller, both sides of the assembly need to be supported. Both end plates should be securely fastened to prevent disassembly. If it is not possible to clamp the bearing endwise, the Cam Yoke Roller can be mounted one-sided with a flat washer added to secure the end plate from disassembly. This method is acceptable but not recommended.

Yoke Roller Standard

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300060	0.1260"	0.432"	0.362"	0.425"	0.404"	0.309"	610	725	4.54
6300061	1.9750"	0.558"	0.470"	0.553"	0.469"	0.430"	680	790	11.34
6300064	0.1975"	0.667"	0.462"	0.663"	0.498"	0.435"	995	1,215	15.88
6300067	0.2499"	0.850"	0.625"	0.845"	0.560"	0.498"	1,660	4,130	34.02

Yoke Roller Sealed

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300069	0.3132"	1.100"	0.7800"	1.096"	0.685"	0.623"	2225	6,120	65.77
6300070	0.6249"	2.000"	1.5625"	1.938"	1.310"	1.248"	8090	21,140	415.04
6300071	0.2500"	0.875"	0.6250"	N/A	0.560"	0.498"	1,660	4,130	34.02
6300072	0.3124"	1.125"	0.7813"	N/A	0.685"	0.623"	2,225	6,120	68.04
6300073	0.4999"	1.750"	1.2500"	N/A	1.060"	0.998"	6,385	15,840	263.08
6300098	0.7500"	2.500"	1.4975"	N/A	1.560"	1.498"	11,720	32,900	814.20

Yoke Roller Sealed - Grooved

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300068	0.2499"	0.875"	0.6250"	0.870"	0.560"	0.498"	1,490	2,100	34.02

Cam Yoke Rollers

Yoke Roller Chrome Plated

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300074	0.1258"	0.432"	0.3620"	0.429"	0.406"	0.310"	610	726	4.54
6300076	0.1975"	0.558"	0.4700"	0.553"	0.469"	0.431"	680	790	11.34
6300082	0.1975"	0.667"	0.4975"	0.663"	0.498"	0.435"	995	1,215	18.14
6300087	0.2499"	0.850"	0.6250"	0.845"	0.560"	0.498"	1,660	4,130	31.75
6300088	0.2499"	0.850"	0.6250"	0.870"	0.560"	0.498"	1,660	4,130	34.02

Yoke Roller Chrome Plated - Sealed

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300090	0.3124"	1.000"	0.7813"	N/A	0.685"	0.623"	2,225	6,120	65.77
6300091	0.2499"	0.875"	0.6250"	N/A	0.560"	0.498"	1,660	4,130	34.02
6300094	0.3124"	1.125"	0.7813"	N/A	0.685"	0.623"	2,225	6,120	68.04

Yoke Roller High Temp*

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300075	0.1258"	0.432"	0.362"	0.429"	0.406"	0.310"	610	726	68.04
6300077	0.1975"	0.558"	0.470"	0.553"	0.469"	0.431"	680	790	11.34

Yoke Roller High Temp* - Sealed

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300118	0.3124"	1.000"	0.78125"	N/A	0.685"	0.623"	2,225	6,120	68.04
6300119	0.3124"	1.125"	0.78125"	N/A	0.685"	0.623"	2,225	6,120	65.77

Yoke Roller Stainless Steel

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300083	0.1975"	0.667"	0.472"	0.663"	0.498"	0.435"	796	972	15.88

Yoke Roller Stainless Steel - Groove

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300089	0.2499"	0.875"	0.625"	0.870"	0.560"	0.498"	1,490	2,100	31.75

Yoke Roller Stainless Steel - Sealed

Part No.	A	B	C	D	E	F	Radial Load X (lb)	Static Load Y (lb)	Weight g
6300092	0.2499"	0.875"	0.6250"	N/A	0.560"	0.498"	1,490	2,100	34.02
6300122	0.3124"	1.000"	0.78125"	N/A	0.685"	0.623"	2,000	5,400	22.68
6300123	0.3124"	1.125"	0.78125"	N/A	0.685"	0.623"	2,225	6,120	68.04

*High Temp Rated Rollers: 5°F–400°F (-15°C–204°C)

Cam Follower Eccentric

Cam Follower Rollers are easy to mount and are ideal for numerous cam or track roller applications involving moderate loading and shock. They are recommended for applications where the stud hole can be accurately machined to within +0.0000" and -0.0005". Eccentric style Cam Followers should be used when these tolerances cannot be held.

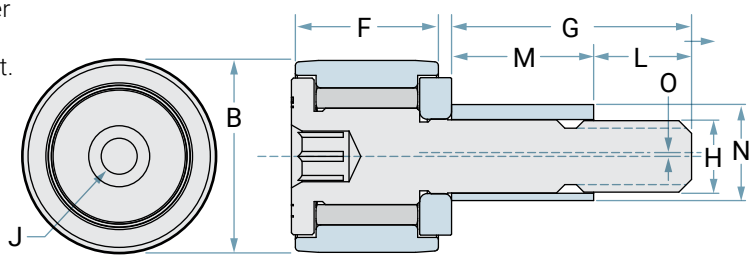
Cam Follower Rollers are composed of high carbon and chromium bearing steel through-hardened and ground outer raceways. The studs and inner races are low carbon alloy steel carburized, and induction hardened.

Both eccentric and concentric are available in chrome plated or 440c stainless steel with a high temp version as an option.

Eccentric Cam Followers are designed for situations where maintaining tight tolerances on the mounting holes may be challenging. It features an eccentric lip that fits with a corresponding lip on the bearing's inner ring.

When the collar is rotated while the shaft and inner ring are held steady, a cam action is created that securely locks the collar and inner ring to the shaft.

Note: Eccentric Cam Followers are not recommended for applications with reversing rotation.



Roller Follower Eccentric Studded

Part No.	Material	B	J	F	G	H	L	M	N	O
6300063	Steel	0.500"	0.125"	0.3725"	0.625"	0.190"	0.255"	0.370"	0.250"	0.010"
6300066	Steel	0.625"	0.125"	0.4350"	0.750"	0.250"	0.318"	0.432"	0.375"	0.015"
6300080	Chrome Plated	0.500"	0.125"	0.3725"	0.625"	0.190"	0.255"	0.370"	0.250"	0.010"
6300081	High Temp*	0.500"	0.125"	0.3725"	0.625"	0.190"	1.255"	0.370"	0.250"	0.010"
6300086	Chrome Plated	0.625"	0.125"	0.4355"	0.750"	0.259"	0.313"	0.432"	0.375"	0.015"
6300093	Stainless Steel	0.625"	0.125"	0.4355"	0.750"	0.250"	0.313"	0.432"	0.375"	0.015"
6300096	Steel	1.125"	0.250"	0.6225"	1.000"	0.438"	0.505"	0.495"	0.625"	0.030"
6300097	Steel	0.875"	0.188"	0.4975"	0.875"	0.375"	0.380"	0.495"	0.500"	0.015"

Part No.	Threads	Radial Load X (lb)	Static Load Y (lb)	Weight G
6300063	10-32 UNF-2A	680	790	11.34
6300066	10-28 UNF-2A	955	1,215	24.95
6300080	10-32 UNF-2A	680	790	11.34
6300081	10-32 UNF-2A	680	790	11.34
6300093	1/4-28 - 3A	796	972	22.68
6300096	7/16-20 UNF 2A	2,225	3,060	104.32
6300097	3/8-24 UNF 2A	1,660	2,065	104.32

*High Temp Rated Rollers: 5°F–400°F (-15°C–204°C)

Cam Follower Concentric

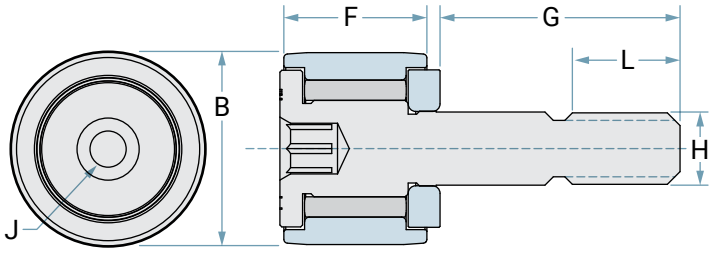
Features/ Benefits

- Precision manufacturing to minimize bearing failure which results in costly shutdowns
- Sealed bearings retain lubrication and prevent contamination
- Dimensionally Interchangeable with other standard Cam followers

Lubrication

Cam Followers come pre-lubricated. This lubrication is suitable for applications between 5ºF–275ºF (-15ºC–135ºC) and is equipped with corrosion-resistant additives. The rollers can be relubricated via lube holes and lube groove in the inner race bore.

Concentric Cam Followers include a concentric collar which acts as a locking mechanism. The collar centers the bearing bore which reduces vibration and prevents shaft run out during operation.



Roller Follower Concentric Studded

Part No.	Material	B	J	F	G	H	L
6300062	Steel	0.500"	0.125"	0.3725"	0.625"	0.191"	0.250"
6300065	Steel	0.625"	0.125"	0.4350"	0.750"	0.251"	0.313"
6300078	Stainless Steel	0.500"	0.125"	0.3725"	0.625"	0.191"	0.250"
6300079	High Temp*	0.500"	0.125"	0.3725"	0.625"	0.191"	0.250"
6300084	Chrome Plated	0.625"	0.125"	0.4355"	0.750"	0.251"	0.313"
6300085	Stainless Steel	0.625"	0.125"	0.4350"	0.750"	0.251"	0.313"

Part No.	Threads	Radial Load X (lb)	Static Load Y (lb)	Weight G
6300062	10-32 UNF-2A	680	790	11.34
6300065	10-28 UNF-2A	955	1,215	20.41
6300078	10-32 UNF-2A	300	610	11.34
6300079	10-32 UNF-2A	680	790	11.34
6300084	1/4-28 - 3A	995	1,215	20.41
6300085	10-28 UNF-2A	796	972	20.41
6300086	1/4-28 - 3A	995	1,215	22.68

*High Temp Rated Rollers: 5°F–400°F (-15°C–204°C)

V-Guide Wheels, Rails & Bushings

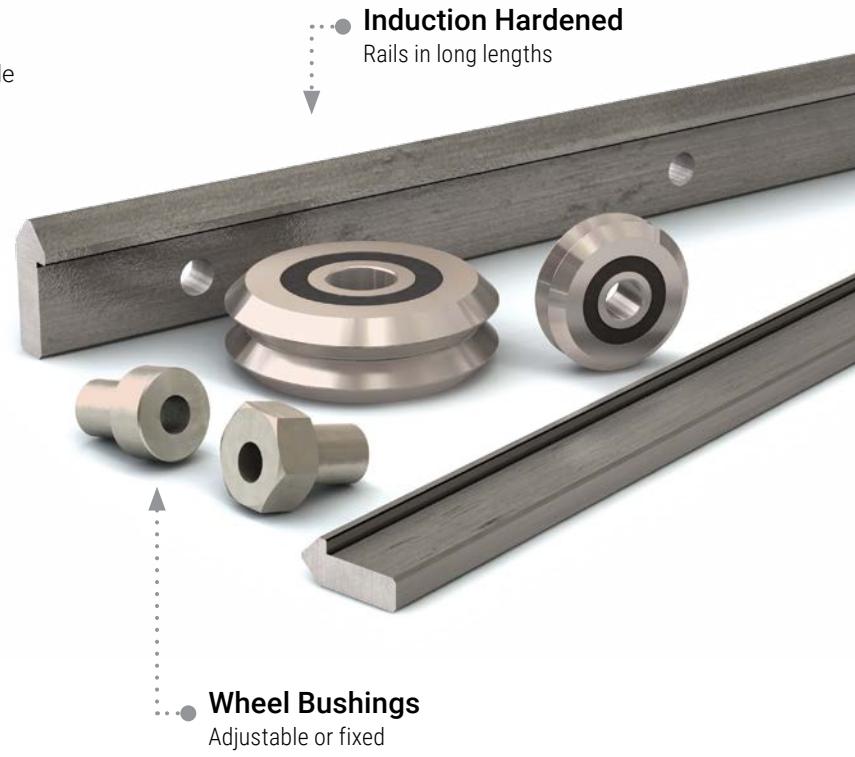
V Guide Wheel		Size		Per Wheel					
				Weight		Radial Load		Axial Load	
		mm	in.	G	oz.	N	lb.	N	lb.
Size 1	VW1	20	3/4	12	0.42	1,260	283	297	67
Size 2	VW2	30	1 1/4	40	1.41	2,730	614	632	142
Size 3	VW3	45	1 3/4	136	4.79	6,166	1,386	1,448	326
Size 4	VW4	60	2 1/4	285	10	9,991	2,246	2,313	520

Configure Online

FEATURES & BENEFITS

V-Guide systems are an industry standard for linear motion, and offer features that make them an ideal solution for a wide range of motion control applications.

- Radial loads up to 9.9 kN (2,246 lb.) per wheel
- Axial loads up to 2.3 kN (520 lb.) per wheel
- Precision dual row angular contact design
- Operating temperature range from -20°C to 80°C (-4°F to 176°F)
- Concentric or eccentric wheel bushings in inch and metric sizing



V-Guide Wheels

V-Guide wheels are precision ground, dual row angular contact ball bearings with hardened outer way surfaces that provide low friction guidance for linear motion applications. They can be used with internal or external 90-degree ways – or used with round shafts.

- Four sizes
- Permanently sealed and lubricated
- Precision dual row bearing construction
- Available in 52100 bearing steel or 420 stainless steel construction
- 304 stainless steel shields or nitrile rubber seals

V-Guide Rail

Rails are induction hardened, ground, and polished. The track body is left soft for easy drilling of mounting holes. Four sizes are designed to correspond with wheel sizes.

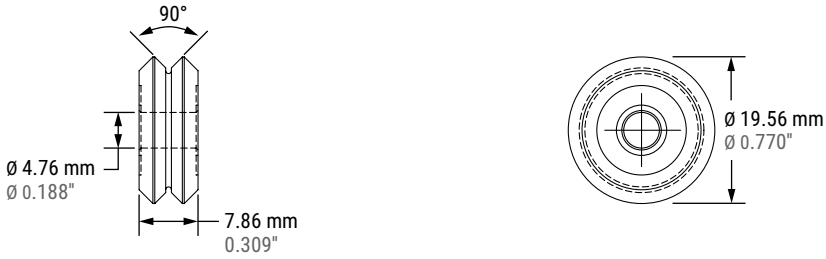
- Has shoulder for simple mounting and alignment
- Induction hardened way surface
- 1045 carbon steel or 400 series stainless steel
- Optional black oxide finish
- Rails are cut to length, MAX length up to 5,486.4 mm (216")

Wheel Bushings

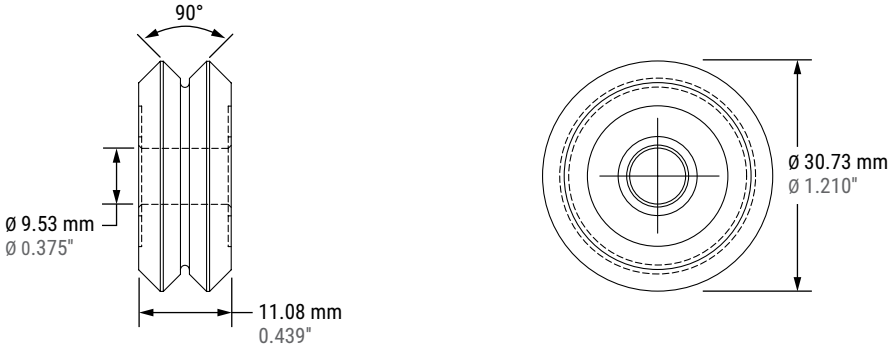
- 303 stainless steel construction
- Inch or metric hardware
- Adjustable bushings allow adjustable fit and preload
- Fixed bushings are used in the primary radial load direction

1:1 Scale

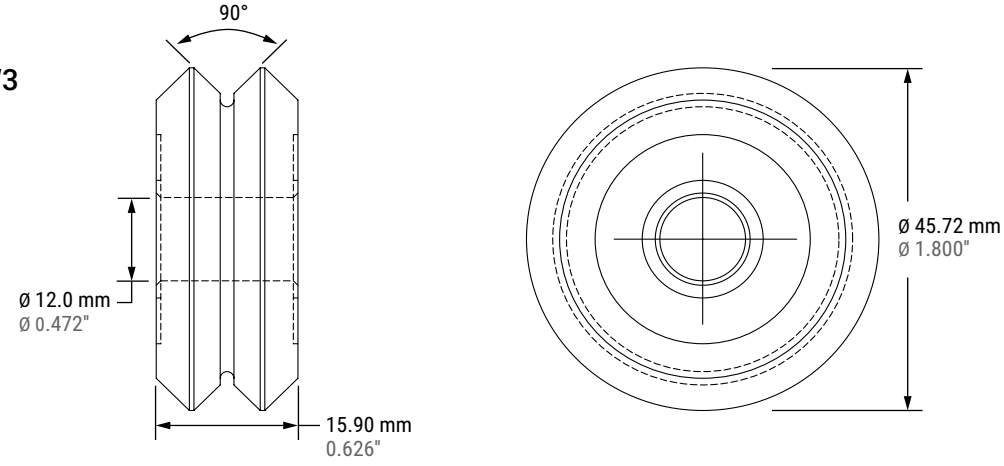
Size 1: VW1



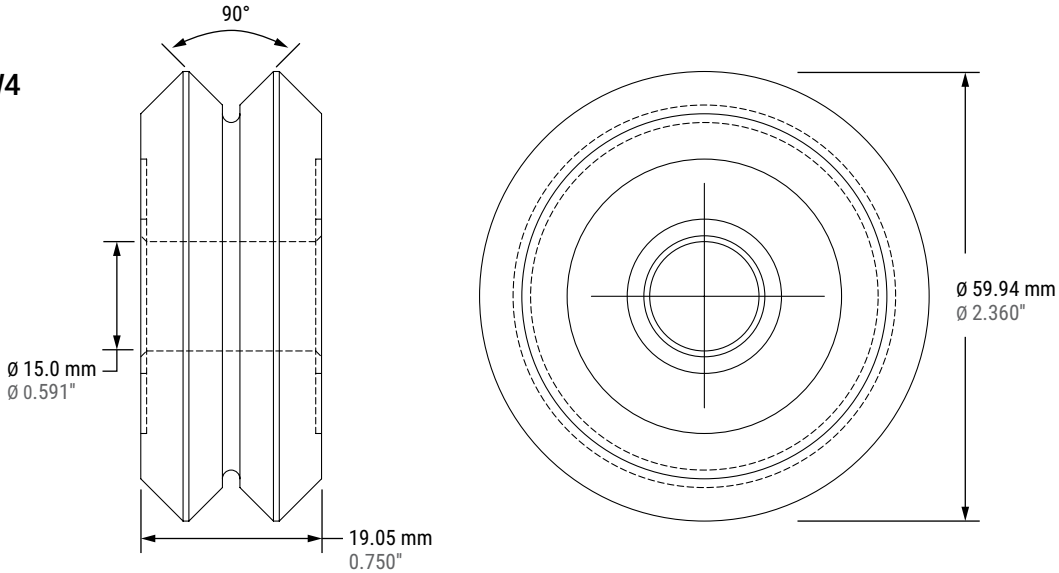
Size 2: VW2



Size 3: VW3



Size 4: VW4

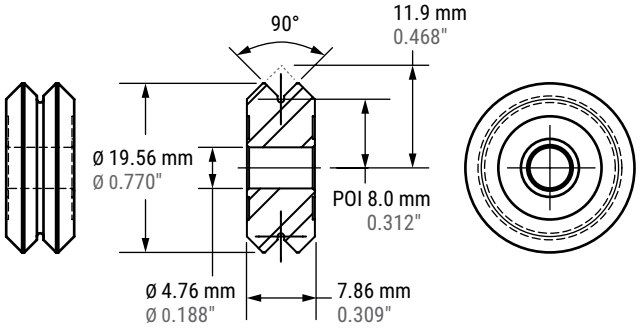


V-Guide Size 1 · 20 mm (3/4")

Radial loads up to 283 lb. (1,260 N) per wheel
Axial loads up to 67 lb. (297 N) per wheel
Wheel weight: .42 oz. (12 g)
Speed rating: 16,000 rpm MAX (13.23 m/s MAX)

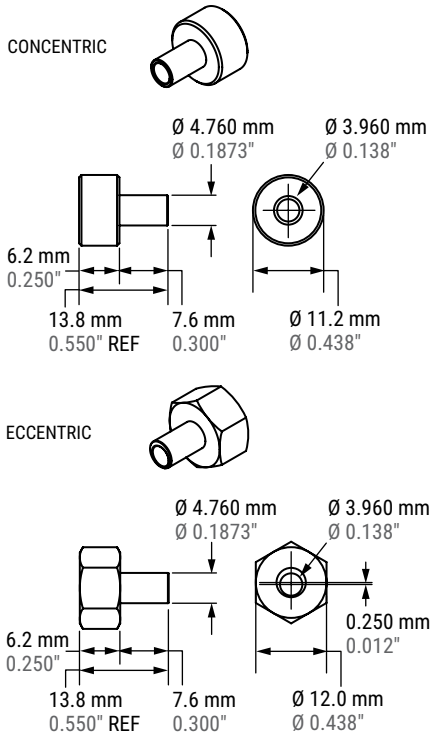
V-Guide Wheels

VW1	Shielded Bearing
VWS1	Sealed Bearing
VWSS1	Sealed Stainless Bearing



Wheel Bushings

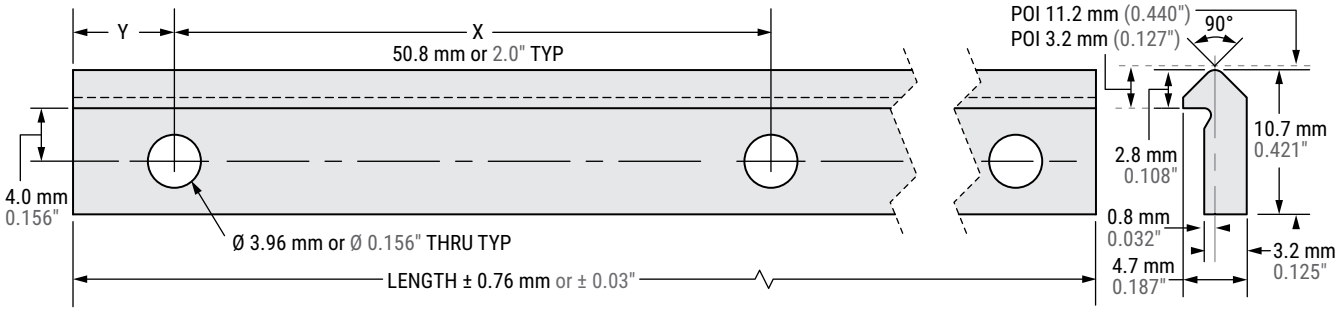
Inch Series	
VB1	Concentric Fixed Bushing
VBA1	Eccentric Adjustable Bushing
Metric Series	
MVB1	Concentric Metric Fixed Bushing
MVBA1	Eccentric Metric Adjustable Bushing



V-Guide Rail

Carbon Steel		Stainless Steel	
VR1-xxx.xxx	undrilled rail, MAX length 216" (5,486.4 mm)	**VRS1-xxx.xxx**	undrilled rail, MAX length 216" (5,486.4 mm)
VRD1-xxx.xxx	drilled rail	**VRSD1-xxx.xxx**	drilled rail

Note: Non-heat treated rails available in all sizes, contact factory.
POI = Point of intersection



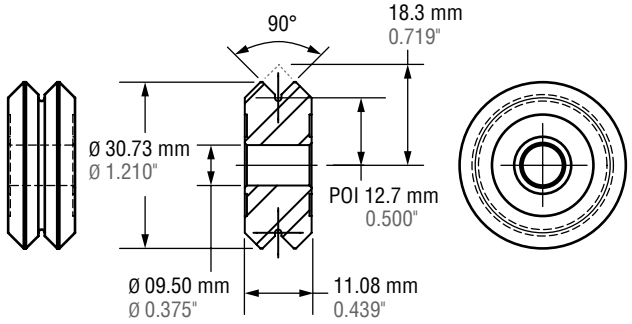
Specify Y dimension (hole to end) at time of order

V-Guide Size 2 • 30 mm (1-1/4”)

Radial loads up to 614 lb. (2,730 N) per wheel
Axial loads up to 142 lb. (632 N) per wheel
Wheel weight: 1.3 oz. (38 g)
Speed rating: 9,600 rpm MAX (12.76 m/s MAX)

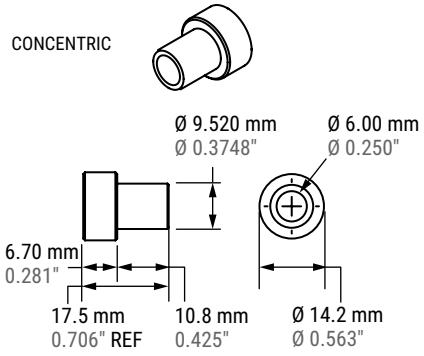
V-Guide Wheels

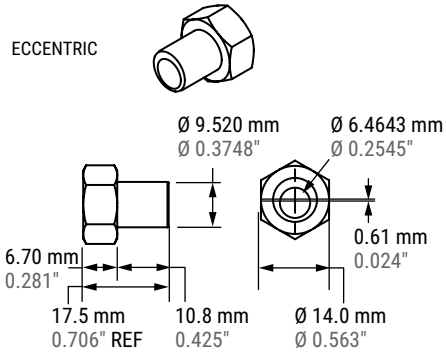
VW2	Shielded Bearing
VWS2	Sealed Bearing
VWSS2	Sealed Stainless Bearing



Wheel bushings

Inch Series	
VB2	Concentric Fixed Bushing
VBA2	Eccentric Adjustable Bushing
Metric Series	
MVB2	Concentric Metric Fixed Bushing
MVBA2	Eccentric Metric Adjustable Bushing

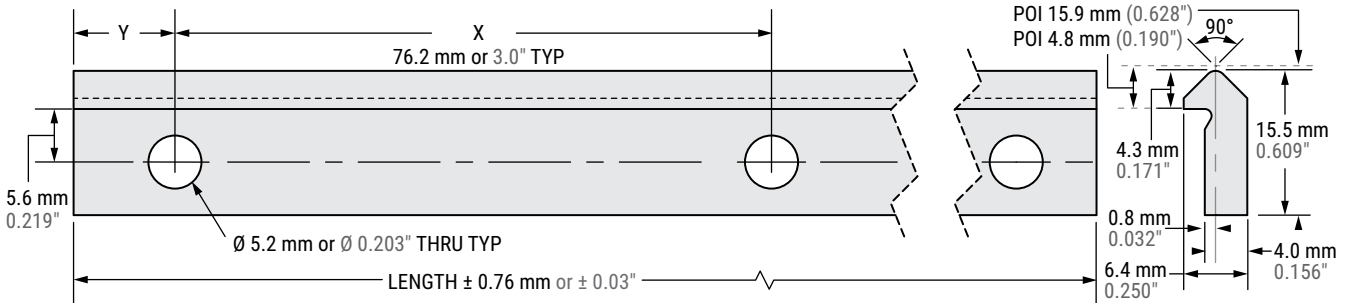




V-Guide Rail

Carbon Steel		Stainless Steel	
VR2-xxx.xxx	undrilled rail, MAX length 216” (5,486.4 mm)	**VRS2-xxx.xxx**	undrilled rail, MAX length 216” (5,486.4 mm)
VRD2-xxx.xxx	drilled rail	**VRSD2-xxx.xxx**	drilled rail

Note: Non-heat treated rails available in all sizes, contact factory.
POI = Point of intersection



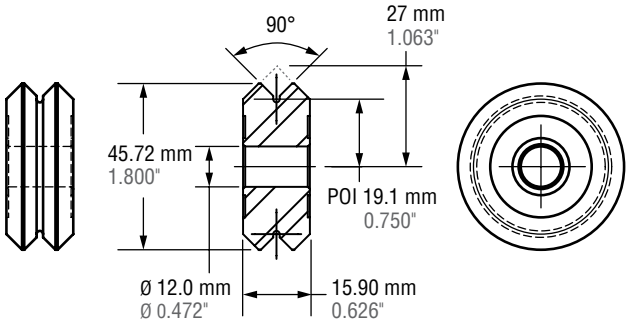
Specify Y dimension (hole to end) at time of order

V-Guide Size 3 • 45 mm (1-3/4")

Radial loads up to 1,386 lb. (6,166 N) per wheel
Axial loads up to 326 lb. (1,448 N) per wheel
Wheel weight: 4.6 oz. (131 g)
Speed rating: 8,000 rpm MAX (16.00 m/s MAX)

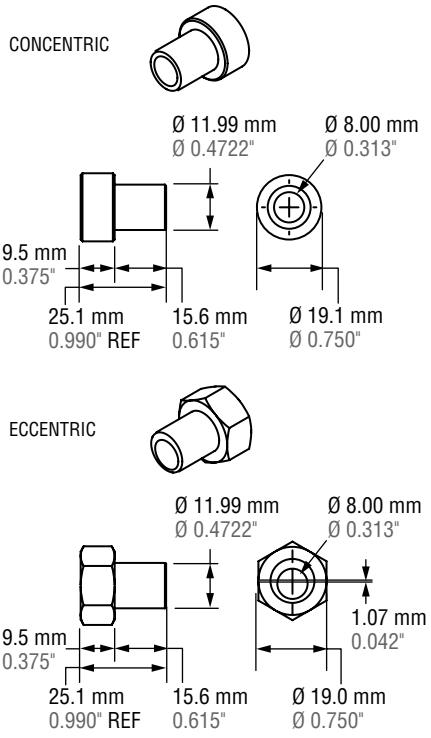
V-Guide Wheels

VW3	Shielded Bearing
VWS3	Sealed Bearing
VWSS3	Sealed Stainless Bearing



Wheel bushings

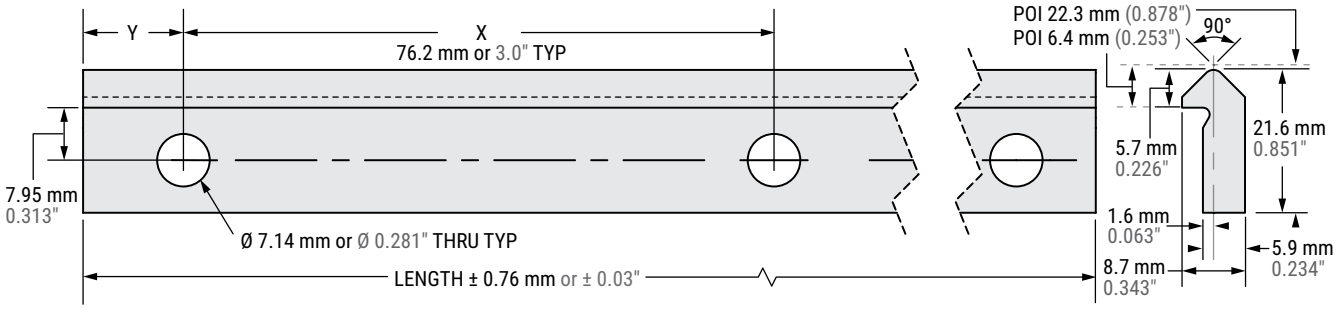
Inch Series	
VB3	Concentric Fixed Bushing
VBA3	Eccentric Adjustable Bushing
Metric Series	
MVB3	Concentric Metric Fixed Bushing
MVBA3	Eccentric Metric Adjustable Bushing



V-Guide Rail

Carbon Steel		Stainless Steel	
VR3-xxx.xxx	undrilled rail, MAX length 216" (5,486.4 mm)	VRS3-xxx.xxx	undrilled rail, MAX length 216" (5,486.4 mm)
VRD3-xxx.xxx	drilled rail	VRSD3-xxx.xxx	drilled rail

Note: Non-heat treated rails available in all sizes, contact factory.
POI = Point of intersection



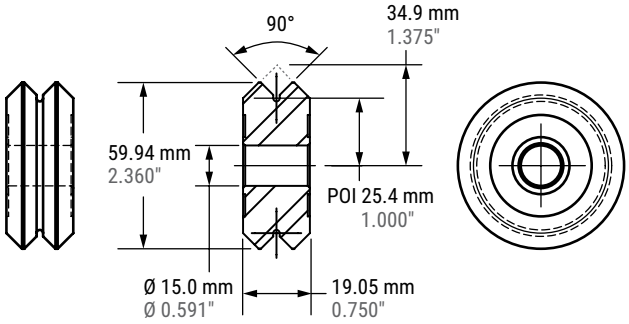
Specify Y dimension (hole to end) at time of order

V-Guide Size 4 • 60 mm (2-1/4”)

Radial loads up to 2,246 lb. (9,991 N) per wheel
Axial loads up to 520 lb. (2,313 N) per wheel
Wheel weight: 10 oz. (281 g)
Speed rating: 5,000 rpm MAX (13.30 m/s MAX)

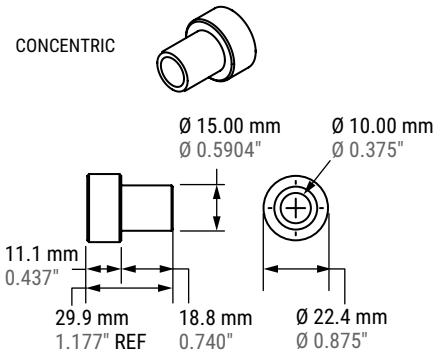
V-Guide Wheels

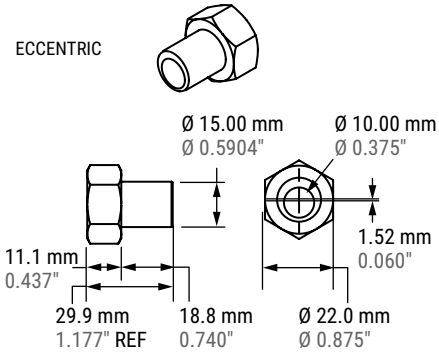
VW4	Shielded Bearing
VWS4	Sealed Bearing
VWSS4	Sealed Stainless Bearing



Wheel bushings

Inch Series	
VB4	Concentric Fixed Bushing
VBA4	Eccentric Adjustable Bushing
Metric Series	
MVB4	Concentric Metric Fixed Bushing
MVBA4	Eccentric Metric Adjustable Bushing

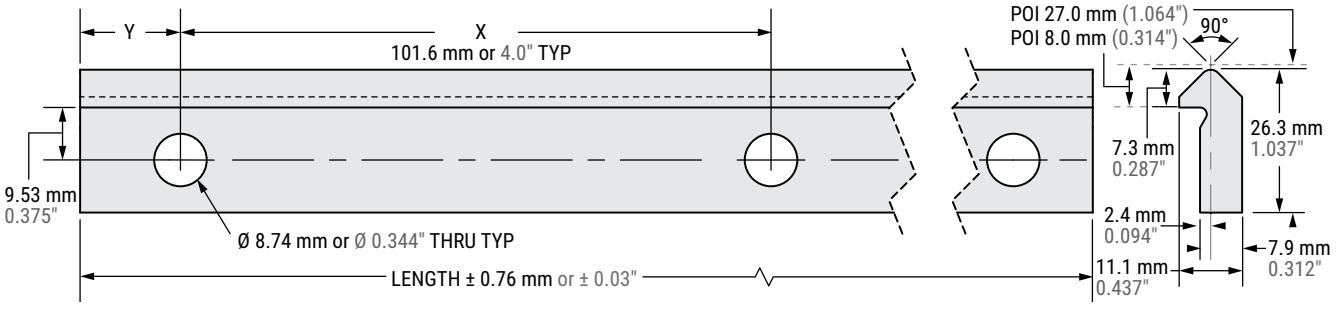




V-Guide Rail

Carbon Steel		Stainless Steel	
VR4-xxx.xxx	undrilled rail, MAX length 216” (5,486.4 mm)	VRS4-xxx.xxx	undrilled rail, MAX length 216” (5,486.4 mm)
VRD4-xxx.xxx	drilled rail	VRSD4-xxx.xxx	drilled rail

Note: Non-heat treated rails available in all sizes, contact factory.
POI = Point of intersection



Specify Y dimension (hole to end) at time of order

Hevi-Rail®

Combined Hevi-Rail Bearing		Rail		Flange Plate	Clamp Flange	Bearing with welded flange plate*		System MAX Static Load** kN		General Dimensions*** mm				
Fixed	Adjustable	U-Channel	I-channel			fixed	adjustable	Radial	Axial	A	B	C	D	E
HVB-053	–	HVR-S	–	HVPS-1	–	HVB-053/HVPS	–	5.23	1.68	52.5	30	33.0	65.0	30.0
HVB-054	HVBEA-454	HVR-0	–	HVP0-1	HVC-0	HVB-054/HVP0	HVBEA-454/HVP0	10.30	3.20	62.0	30	37.5	86.5	36.0
HVB-055	HVBEA-455	HVR-1	HVRI-07	HVP1-1	HVC-1	HVB-055/HVP1	HVBEA-455/HVP1	12.40	3.87	70.1	35	44.0	103.2	40.0
HVB-056	HVBEA-456	HVR-2	–	HVP2-1	HVC-2	HVB-056/HVP2	HVBEA-456/HVP2	12.90	4.00	77.7	40	48.0	121.3	41.0
HVB-057	HVBEA-457	–	HVRI-08	HVP2-1	–	HVB-057/HVP2	HVBEA-457/HVP2	12.90	4.00	77.7	40	40.7	113.9	66.0
HVB-058	HVBEA-458	HVR-3	HVRI-09	HVP3-1	HVC-3	HVB-058/HVP3	HVBEA-458/HVP3	22.40	7.00	88.4	45	57.0	135.4	53.0
HVB-059	HVBEA-459	–	HVRI-10	–	–	–	–	22.00	7.00	101.2	50	46.0	140.3	69.9
HVB-060	HVBEA-460	–	HVRI-11	–	–	–	–	23.80	7.44	107.7	55	53.0	152.4	83.0
HVB-061	HVBEA-461	HVR-4	–	HVP4-1	HVC-4	HVB-061/HVP4	HVBEA-461/HVP4	23.80	7.44	107.7	60	69.0	157.2	61.2
HVB-062	HVBEA-462	HVR-5	–	HVP4-1	–	HVB-062/HVP4	HVBEA-462/HVP4	33.90	10.60	123.0	60	72.3	175.0	66.2
HVB-063	HVBEA-463	HVR-6	–	HVP6-1	–	HVB-063/HVP6	HVBEA-463/HVP6	59.20	18.50	149.0	60	78.5	201.5	71.2

*For flange plate oriented 90 degrees to either fixed or adjustable, add -90 to the end of the part number (ex. HVB-053/HVPS-90).
**System MAX static loads are achievable when used with shown rails. ***Detailed dimensions can be found on each product page.

FEATURES & BENEFITS

The economical Hevi-Rail® guide systems offer a lifetime of durability under continuous use. The easily interchangeable bearing components provide even dispersion of forces in the rails for longer system life and stability.

Linear Bearings

- Outer ring made of case-hardened steel
- Handles very high axial and radial loads
- Easily interchangeable components for less down-time
- Fixed and adjustable combined bearings available

Rails

- Standard length up to 6 meters
- Sand blasted or lightly oiled options available
- U-channel or I-channel available

Clamp Flanges

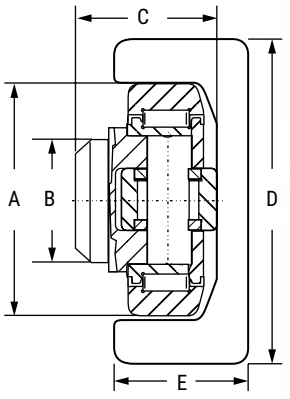
- Eliminates need for welding and straightening
- Easily adjustable parallelism

Flange Plates

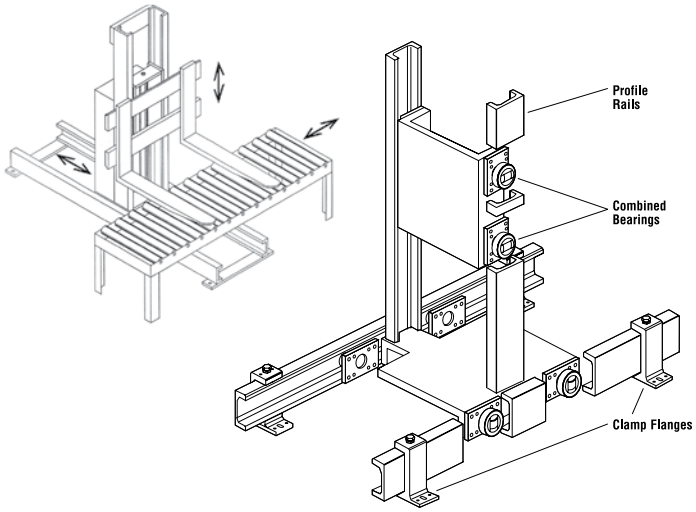
- Simple mounting for bearings
- Can be ordered pre-welded to bearing

Ordering example: HVB-054/HVPO-1

Configure Online



Sample Hevi-Rail Configurations



Hevi-Rail® HVB-053 • 0.58 US Ton-Force

Axial Bearing – Fixed HVB-053

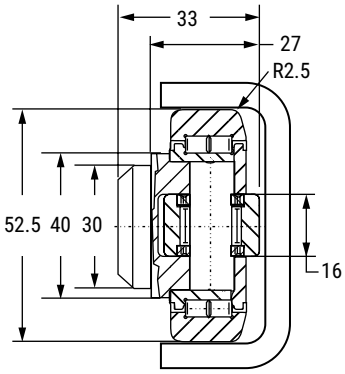
Weight = 0.36 kg

Maximum Bearing Loads:

Radial: Dynamic = 24.50 kN; Static = 32.50 kN

Axial: Dynamic = 7.50 kN; Static = 7.50 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



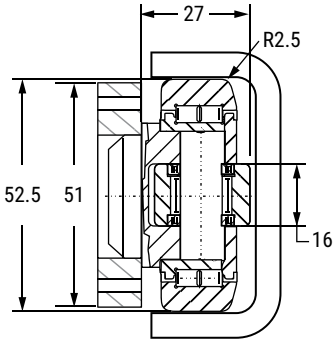
System Maximum Static Loads:

Radial: 5.23 kN/0.58 US Ton-Force

Axial: 1.68 kN/0.18 US Ton-Force

Note: Above loads are achievable when used with shown rails.

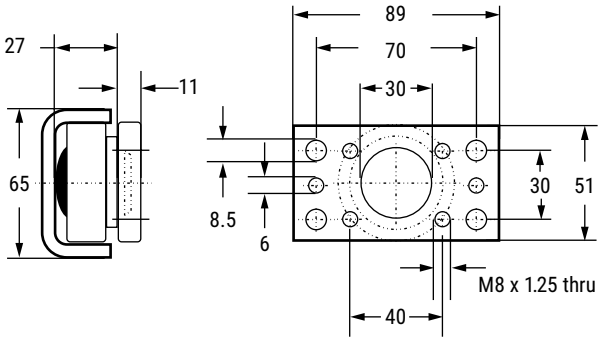
Axial Bearing – Fixed HVB-053/HVPS with welded Flange plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Flange Plate HVPS-1

For ordering separate flange plate only



Rail – U Channel HVR-S

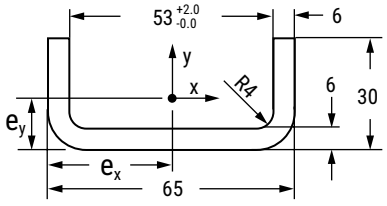
Weight = 5.3 kg/m

Moment of Inertia: I_x = 5.2 cm^4; I_y = 38.8 cm^4

Moment of Resistance: W_x = 2.50 cm^3; W_y = 11.90 cm^3

Radius of Inertia: i_x = 0.80 cm; i_y = 2.40 cm

Distance to Center of Gravity: e_y = 0.94 cm; e_x = 32.50 cm



Ordering Information

Part NO.	Description
HVB-053	Fixed axial bearing
HVB-053/HVPS	Fixed axial bearing with welded flange plate
HVPS-1	Flange plate
HVR-S	U-channel profile rail for -53 bearings

Units of Measurement mm

Email an Application Engineer

Link to video "Hevi-Rail Top 5 Design Tips"

Hevi-Rail® HVB-054 • 1.15 US Ton-Force

Axial Bearing – Fixed HVB-054

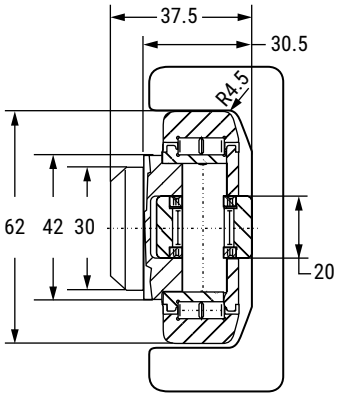
Weight = 0.53 kg

Maximum Bearing Loads:

Radial: Dynamic = 31 kN; Static = 35.5 kN

Axial: Dynamic = 11.50 kN; Static = 11.50 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



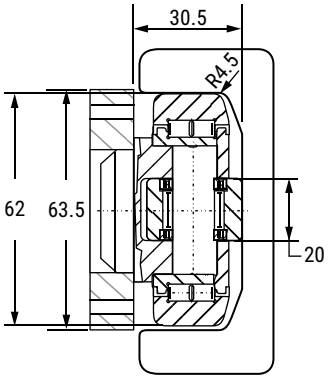
System Maximum Static Loads:

Radial: 10.3 kN/1.15 US Ton-Force

Axial: 3.2 kN/0.35 US Ton-Force

Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-054/HVP0 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-454

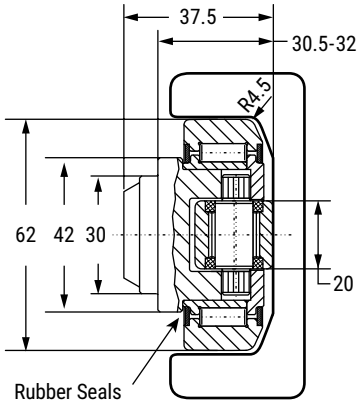
Weight = 0.53 Kg

Maximum Bearing Loads:

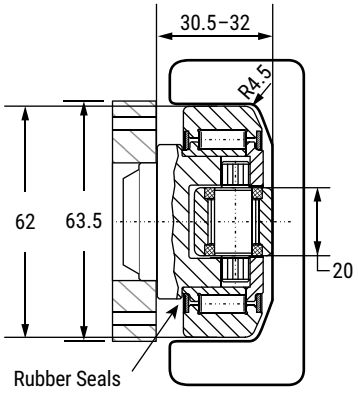
Radial: Dynamic = 31 kN; Static = 35.5 kN

Axial: Dynamic = 11 kN; Static = 11 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-454/HVP0 with welded Flange plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-054 • 1.15 US Ton-Force

Rail – U Channel HVR-0

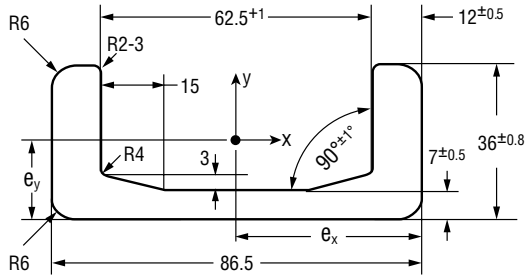
Weight = 10.5 kg/m

Moment of Inertia: I_x = 15.35 cm^4; I_y = 137.05 cm^4

Moment of Resistance: W_{xmin} = 6.64 cm^3;
W_{xmax} = 11.93 cm^3; W_y = 31.69 cm^3

Radius of Inertia: i_x = 1.07 cm; i_y = 3.20 cm

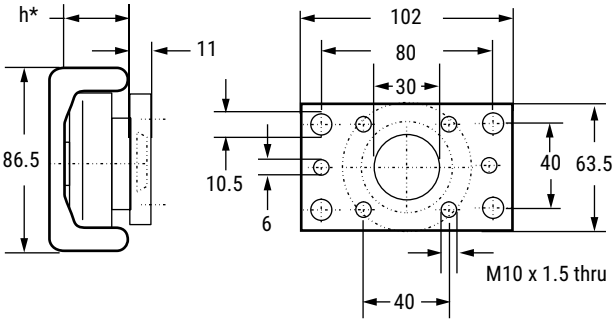
Distance to Center of Gravity: e_y = 1.29 cm; e_x = 4.33 cm



Hevi-Rail Bearings
Can be ordered with pre-welded flange plate

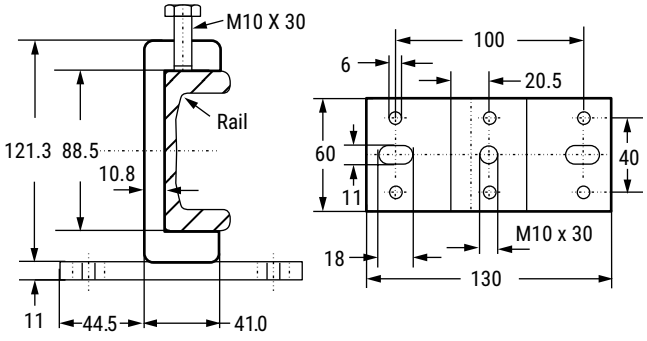
Flange Plate HVP0-1

For ordering separate flange plate only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-054) or eccentric adjustable bearing (HVBEA-454).

Clamp Flange HVC-0



Ordering Information

Part NO.	Description
HVB-054	Fixed axial bearing
HVB-054/HVP0	Fixed axial bearing with welded flange plate
HVBEA-454	Eccentric adjustable axial bearing
HVBEA-454/HVP0	Eccentric adjustable axial bearing with welded flange plate
HVP0-1	Flange plate
HVR-0	U-channel rail for -54 bearings
HVC-0	Clamp flange

Units of Measurement mm

Hevi-Rail® HVB-055 • 1.39 US Ton-Force

Axial Bearing Fixed – HVB-055

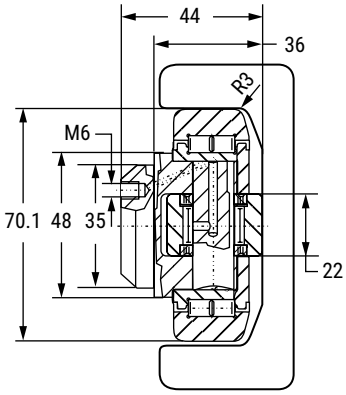
Weight = 0.80 kg

Maximum Bearing Loads:

Radial: Dynamic = 56 kN; Static = 93 kN

Axial: Dynamic = 17 kN; Static = 25 kN

Note: Above loads achievable when used with a hardened rail HRC 58-62 minimum 2.54 mm deep.



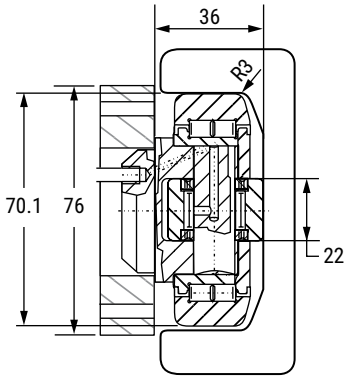
System Maximum Static Loads:

Radial: 12.4 kN/1.39 US Ton-Force

Axial: 3.87 kN/0.43 US Ton-Force

Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-055/HVP1 with welded Flange plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-455

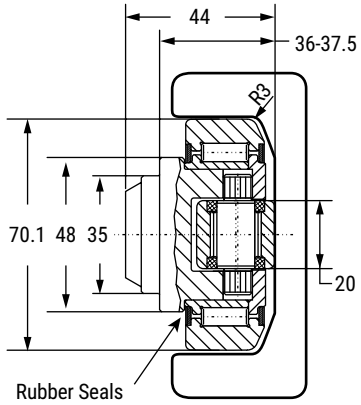
Weight = 0.80 kg

Maximum Bearing Loads:

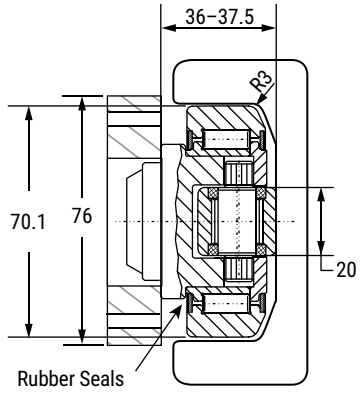
Radial: Dynamic = 45.5 kN; Static = 51 kN

Axial: Dynamic = 13 kN; Static = 14 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-455/HVP1 with welded Flange plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-055 • 1.39 US Ton-Force

Rail – U Channel HVR-1

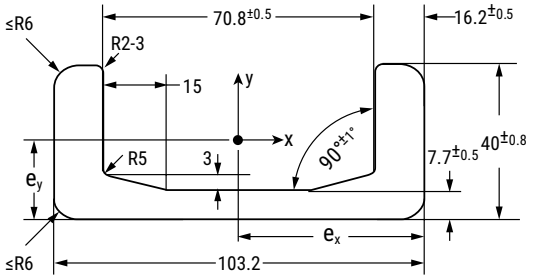
Weight = 14.8 kg/m

Moment of Inertia: I_x = 27.29 cm^4; I_y = 273.50 cm^4

Moment of Resistance: W_{xmin} = 10.91 cm^3; W_{xmax} = 18.20 cm^3; W_y = 53.00 cm^3

Radius of Inertia: i_x = 1.20 cm; i_y = 3.81 cm

Distance to Center of Gravity: e_y = 1.50 cm; e_x = 5.16 cm



Rail – I Channel HVRI-07

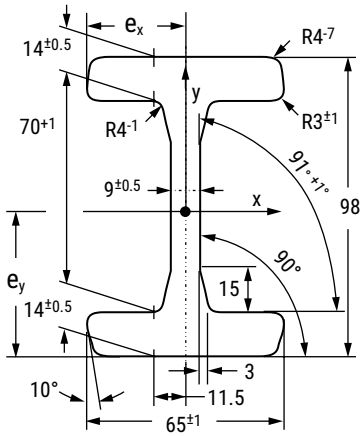
Weight = 19.4 kg/m

Moment of Inertia: I_x = 344.29 cm^4; I_y = 57.63 cm^4

Moment of Resistance: W_x = 70.26 cm^3; W_y = 17.73 cm^3

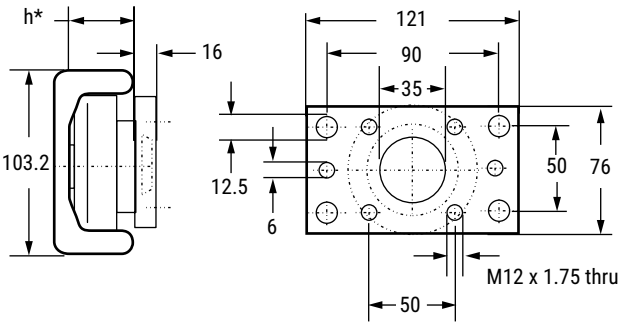
Radius of Inertia: i_x = 3.73 cm; i_y = 1.52 cm

Distance to Center of Gravity: e_y = 4.90 cm; e_x = 3.25 cm



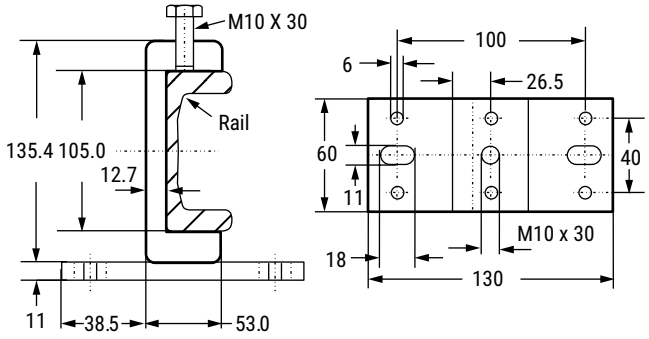
Flange Plate HVP1-1

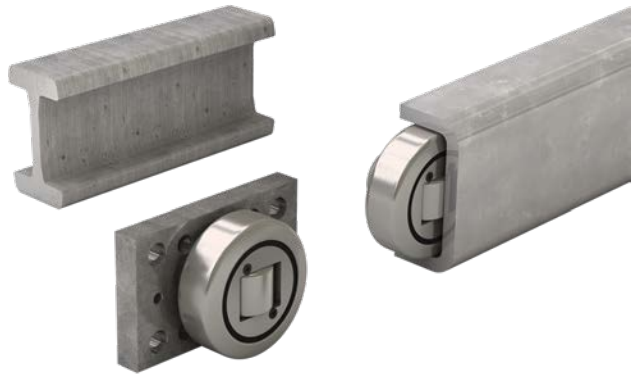
For ordering separate flange plate only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-055) or eccentric adjustable bearing (HVBEA-455).

Clamp Flange HVC-1





Units of Measurement mm

Ordering Information

Part NO.	Description
HVB-055	Fixed axial bearing
HVB-055/HVP1	Fixed axial bearing with welded flange plate
HVBEA-455	Eccentric adjustable axial bearing
HVBEA-455/HVP1	Eccentric adjustable axial bearing with welded flange plate
HVP1-1	Flange plate
HVR-1	U-channel rail for -55 bearings
HVRI-07	I-channel rail for -55 bearings
HVC-1	Clamp flange

Hevi-Rail® HVB-056 • 1.45 US Ton-Force

Axial Bearing – Fixed HVB-056

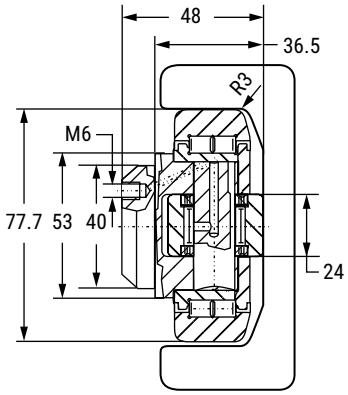
Weight = 1.00 kg

Maximum Bearing Loads:

Radial: Dynamic = 48 kN; Static = 60.8 kN

Axial: Dynamic = 16 kN; Static = 18 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



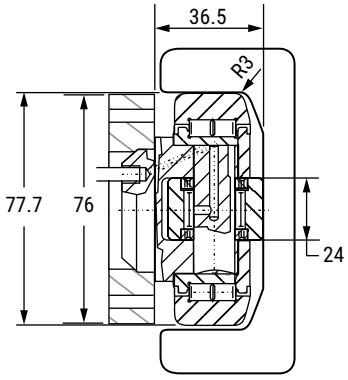
System Maximum Static Loads:

Radial: 12.9 kN/1.45 US Ton-Force

Axial: 4.0 kN/0.44 US Ton-Force

Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-056/HVP2 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-456

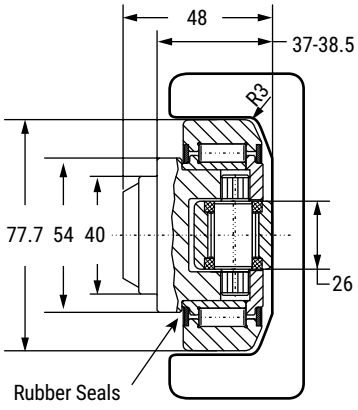
Weight = 1.00 kg

Maximum Bearing Loads:

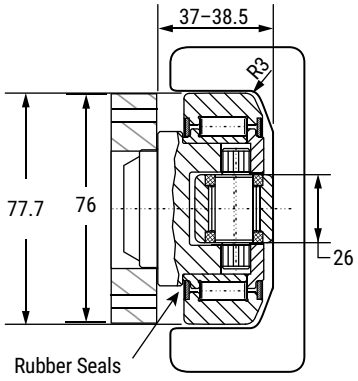
Radial: Dynamic = 48 kN; Static = 56.8 kN

Axial: Dynamic = 18 kN; Static = 18 kN

Note: Above loads achievable when used with a Hardened Rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-456/HVP2 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-056 • 1.45 US Ton-Force

Rail – U Channel HVR-2

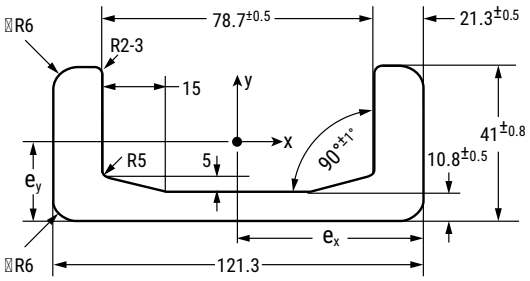
Weight = 20.9 kg/m

Moment of Inertia: I_x = 37.92 cm^4; I_y = 493.58 cm^4

Moment of Resistance: W_{xmin} = 14.83 cm^3;
W_{xmax} = 24.58 cm^3; W_y = 81.38 cm^3

Radius of Inertia: i_x = 1.19 cm; i_y = 4.30 cm

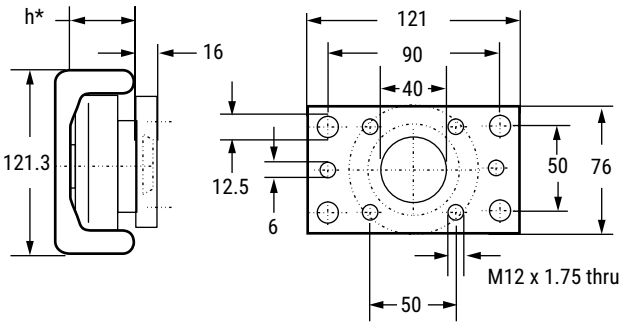
Distance to Center of Gravity: e_y = 1.54 cm; e_x = 6.07 cm



Hevi-Rail Bearings
Can be ordered with pre-welded flange plate

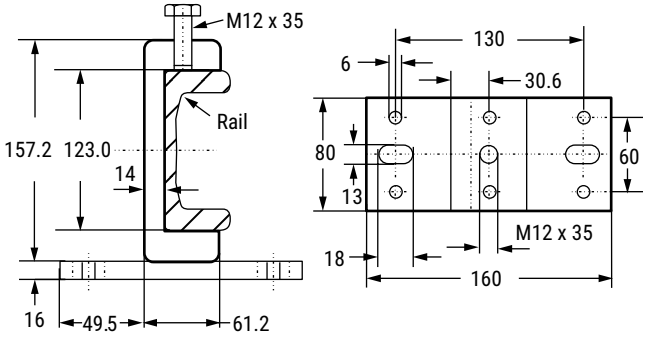
Flange Plate HVP2-1

For Ordering Separate Flange Plate Only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-056) or eccentric adjustable bearing (HVBEA-456).

Clamp Flange HVC-2



Ordering Information

Part NO.	Description
HVB-056	Fixed axial bearing
HVB-056/HVP2	Fixed axial bearing with welded flange plate
HVBEA-456	Eccentric adjustable axial bearing
HVBEA-456/HVP2	Eccentric adjustable axial bearing with welded flange plate
HVP2-1	Flange plate
HVR-2	U-channel rail for -56 bearings
HVC-2	Clamp flange

Units of Measurement mm

Hevi-Rail® HVB-057 • 1.45 US Ton-Force

Axial Bearing – Fixed HVB-057

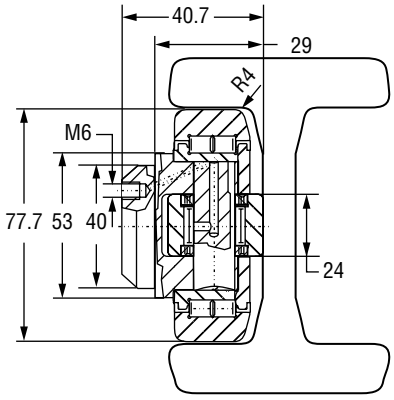
Weight = 0.90 kg

Maximum Bearing Loads:

Radial: Dynamic = 58 kN; Static = 102 kN

Axial: Dynamic = 21 kN; Static = 32 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-457

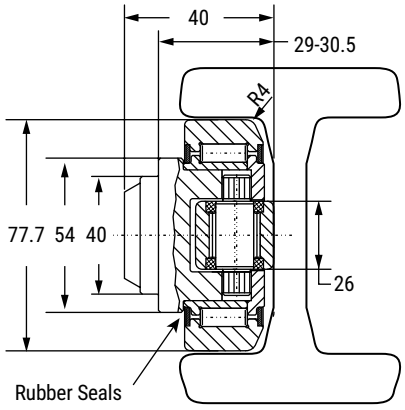
Weight = 0.87 kg

Maximum Bearing Loads:

Radial: Dynamic = 48 kN; Static = 56.8 kN

Axial: Dynamic = 18 kN; Static = 18 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



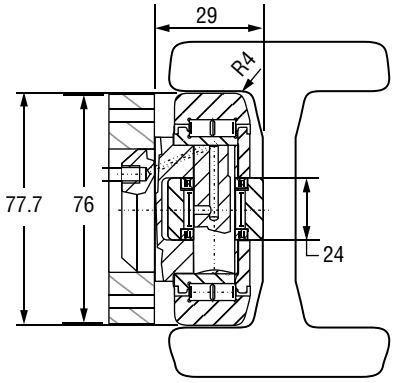
System Maximum Static Loads:

Radial: 12.9 kN/1.45 US Ton-Force

Axial: 4.0 kN/0.44 US Ton-Force

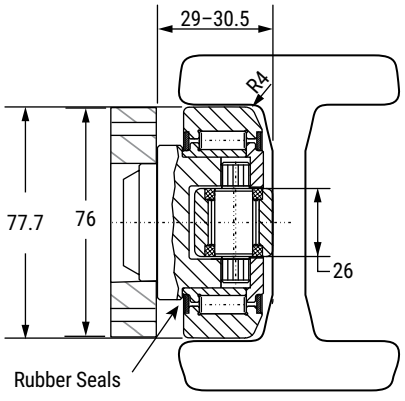
Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-057/HVP2 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-457/HVP2 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-057 • 1.45 US Ton-Force

Rail – I Channel HVRI-08

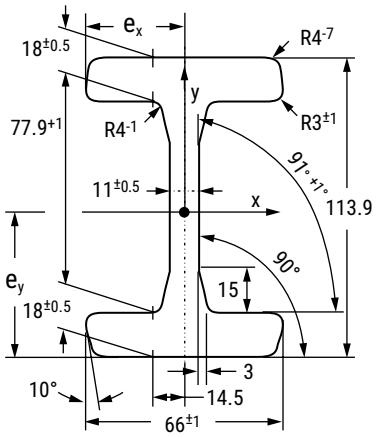
Weight = 25.3 kg/m

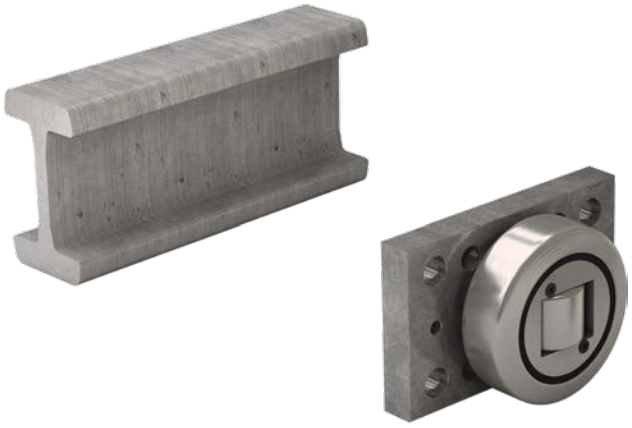
Moment of Inertia: I_x = 597.54 cm^4; I_y = 76.79 cm^4

Moment of Resistance: W_x = 104.92 cm^3; W_y = 23.27 cm^3

Radius of Inertia: i_x = 4.24 cm; i_y = 1.54 cm

Distance to Center of Gravity: e_y = 5.70 cm; e_x = 3.30 cm

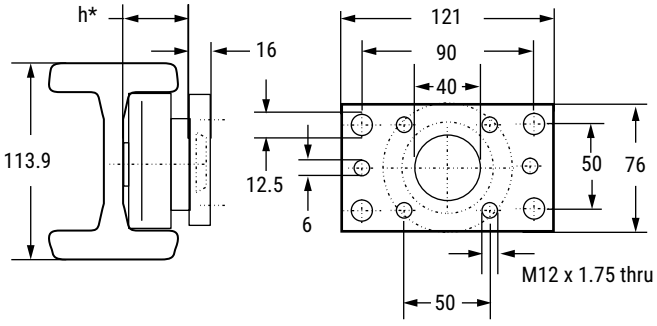




Hevi-Rail Bearings
Can be ordered with
pre-welded flange plate

Flange Plate HVP2-1

For Ordering Separate Flange Plate Only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-057) or eccentric adjustable bearing (HVBEA-457).

Ordering Information

Part NO.	Description
HVB-057	Fixed axial bearing
HVB-057/HVP2	Fixed axial bearing with welded flange plate
HVBEA-457	Eccentric adjustable axial bearing
HVBEA-457/HVP2	Eccentric adjustable axial bearing with welded flange plate
HVP2-1	Flange plate
HVRI-08	I-channel rail for -57 bearings

Units of Measurement mm

Hevi-Rail® HVB-058 • 2.51 US Ton-Force

Axial Bearing – Fixed HVB-058

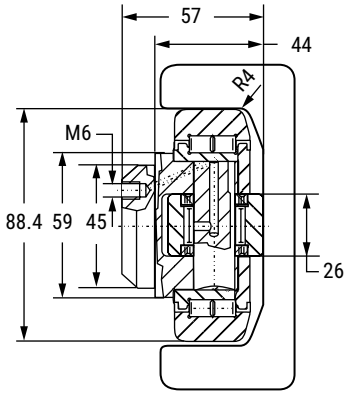
Weight = 1.62 kg

Maximum Bearing Loads:

Radial: Dynamic = 60 kN; Static = 72 kN

Axial: Dynamic = 23 kN; Static = 40 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-458

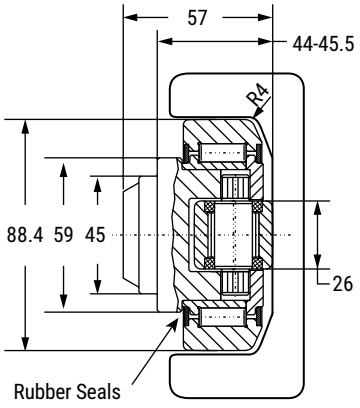
Weight = 1.62 kg

Maximum Bearing Loads:

Radial: Dynamic = 68 kN; Static = 72 kN

Axial: Dynamic = 23 kN; Static = 23 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



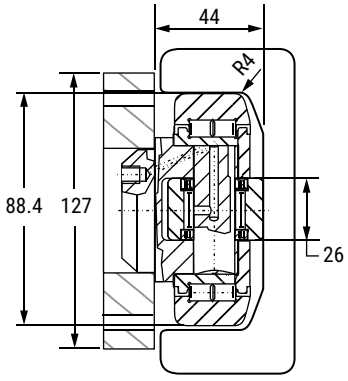
System Maximum Static Loads:

Radial: 22.4 kN/2.51 US Ton-Force

Axial: 7.0 kN/0.78 US Ton-Force

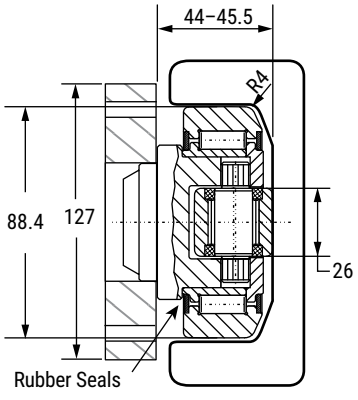
Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-058/HVP3 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-458/HVP3 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-058 • 2.51 US Ton-Force

Rail – U Channel HVR-3

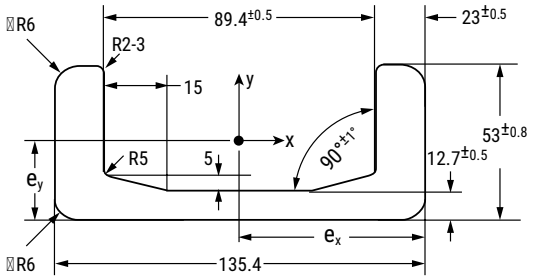
Weight = 28.6 kg/m

Moment of Inertia: I_x = 89.47 cm⁴; I_y = 865.23 cm⁴

Moment of Resistance: W_{xmin} = 27.03 cm³; W_{xmax} = 44.96 cm³; W_y = 127.80 cm³

Radius of Inertia: i_x = 1.57 cm; i_y = 4.87 cm

Distance to Center of Gravity: e_y = 1.99 cm; e_x = 6.77 cm



Rail – I Channel HVRI-09

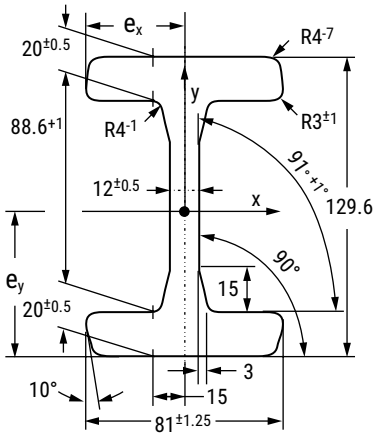
Weight = 34.1 kg/m

Moment of Inertia: I_x = 1037.22 cm⁴; I_y = 161.89 cm⁴

Moment of Resistance: W_x = 160.07 cm³; W_y = 39.97 cm³

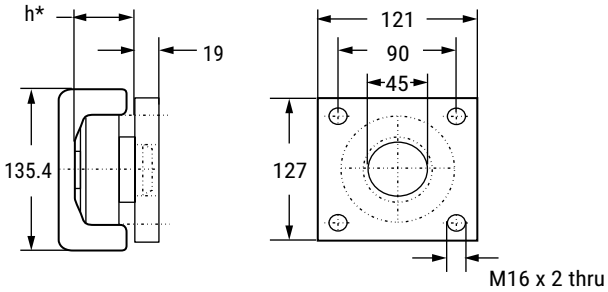
Radius of Inertia: i_x = 4.89 cm; i_y = 1.93 cm

Distance to Center of Gravity: e_y = 6.48 cm; e_x = 4.05 cm



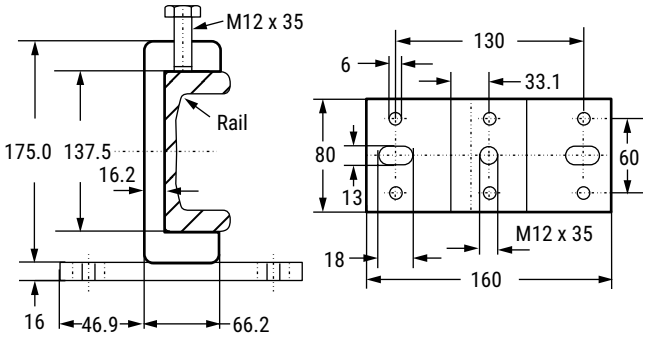
Flange Plate HVP3-1

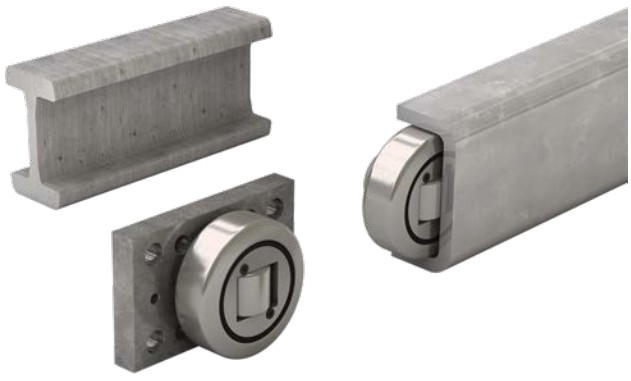
For Ordering Separate Flange Plate Only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-058) or eccentric adjustable bearing (HVBEA-458).

Clamp Flange HVC-3





Units of Measurement mm

Ordering Information

Part NO.	Description
HVB-058	Fixed axial bearing
HVB-058/HVP3	Fixed axial bearing with welded flange plate
HVBEA-458	Eccentric adjustable axial bearing
HVBEA-458/HVP3	Eccentric adjustable axial bearing with welded flange plate
HVP3-1	Flange plate
HVR-3	U-channel rail for -58 bearings
HVRI-09	I-channel rail for -58 bearings
HVC-3	Clamp flange

Hevi-Rail® HVB-059 • 2.47 US Ton-Force

Axial Bearing – Fixed HVB-059

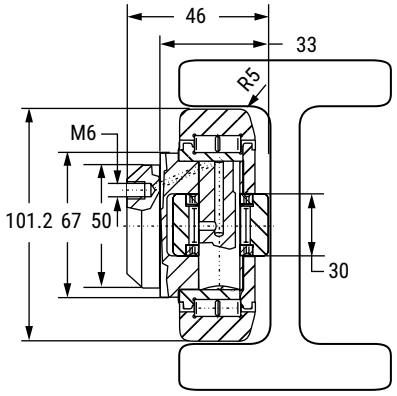
Weight = 1.80 kg

Maximum Bearing Loads:

Radial: Dynamic = 73 kN; Static = 82 kN

Axial: Dynamic = 25 kN; Static = 27 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-459

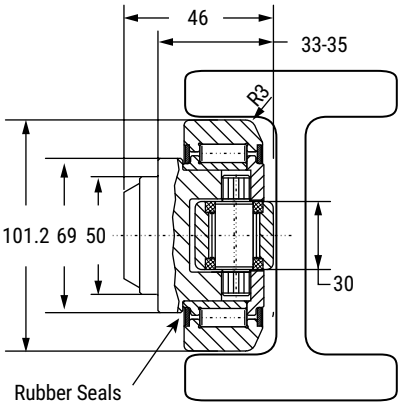
Weight = 1.74 kg

Maximum Bearing Loads:

Radial: Dynamic = 73 kN; Static = 82 kN

Axial: Dynamic = 25 kN; Static = 27 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



System Maximum Static Loads:

Radial: 22 kN/2.47 US Ton-Force

Axial: 7.0 kN/0.78 US Ton-Force

Note: Above loads are achievable when used with shown rails.

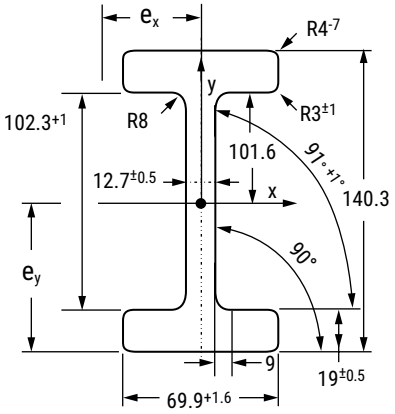
Rail – I Channel HVRI-10

Weight = 30.9 kg/m

Moment of Inertia: Ix = 1078.01 cm^4; Iy = 104.38 cm^4

Moment of Resistance: Wx = 154.33 cm^3; Wy = 29.89 cm^3

Distance to Center of Gravity: ey = 6.99 cm; ex = 3.49 cm



Ordering Information

Part NO.	Description
HVB-059	Fixed axial bearing
HVBEA-459	Eccentric adjustable axial bearing
HVRI-10	I-channel profile rail

Units of Measurement mm

Axial Bearing – Fixed HVB-060

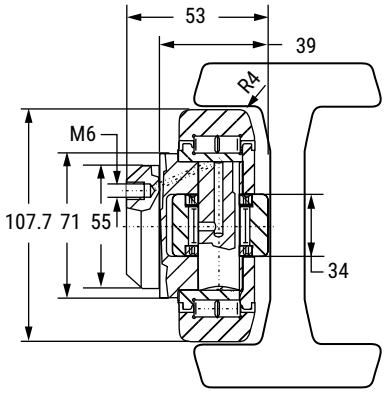
Weight = 2.30 kg

Maximum Bearing Loads:

Radial: Dynamic = 81 kN; Static = 95 kN

Axial: Dynamic = 31 kN; Static = 36 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-460

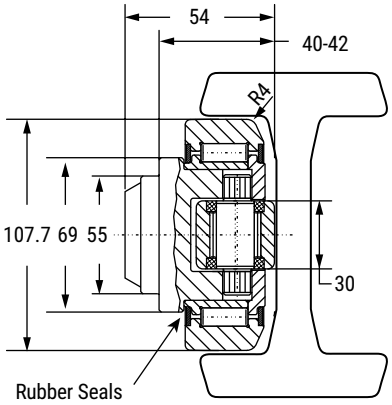
Weight = 2.27 kg

Maximum Bearing Loads:

Radial: Dynamic = 81 kN; Static = 95 kN

Axial: Dynamic = 31 kN; Static = 36 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



System Maximum Static Loads:

Radial: 23.8 kN/2.67 US Ton-Force

Axial: 7.44 kN/0.83 US Ton-Force

Note: Above loads are achievable when used with shown rails.

Rail – I Channel HVRI-11

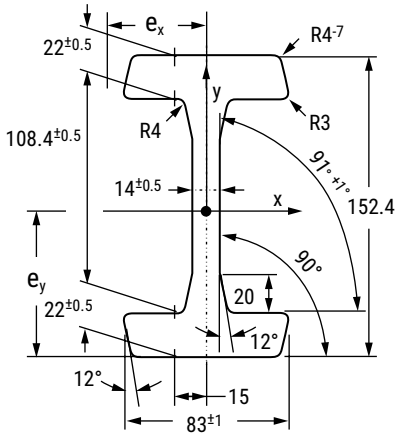
Weight = 40.5 kg/m

Moment of Inertia: I_x = 1670.08 cm⁴; I_y = 184.52 cm⁴

Moment of Resistance: W_x = 219.17 cm³; W_y = 44.46 cm³

Radius of Inertia: i_x = 5.69 cm; i_y = 1.91 cm

Distance to Center of Gravity: e_y = 7.62 cm; e_x = 4.15 cm



Ordering Information

Part NO.	Description
HVB-060	Fixed axial bearing
HVBEA-460	Eccentric adjustable axial bearing
HVRI-11	I-channel profile rail

Units of Measurement mm

Hevi-Rail® HVB-061 • 2.67 US Ton-Force

Axial Bearing – Fixed HVB-061

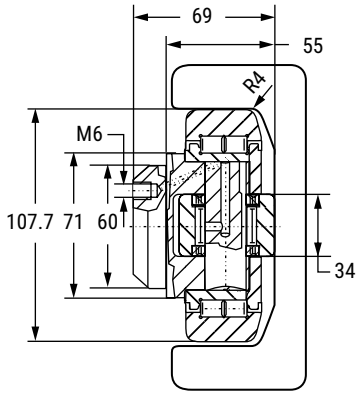
Weight = 2.82 kg

Maximum Bearing Loads:

Radial: Dynamic = 81 kN; Static = 95 kN

Axial: Dynamic = 31 kN; Static = 36 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



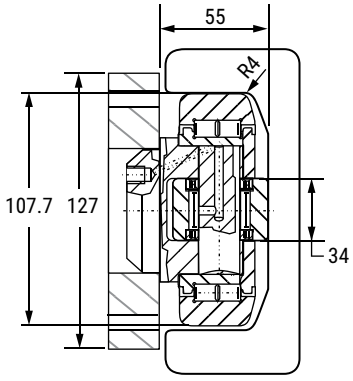
System Maximum Static Loads:

Radial: 23.8 kN/2.67 US Ton-Force

Axial: 7.44 kN/0.83 US Ton-Force

Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-061/HVP4 with Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-461

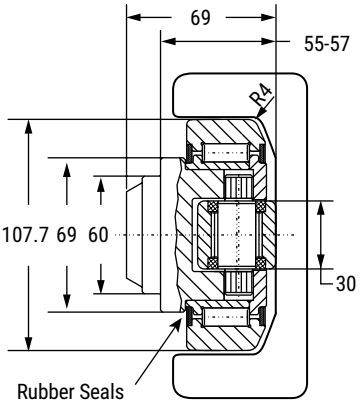
Weight = 2.82 kg

Maximum Bearing Loads:

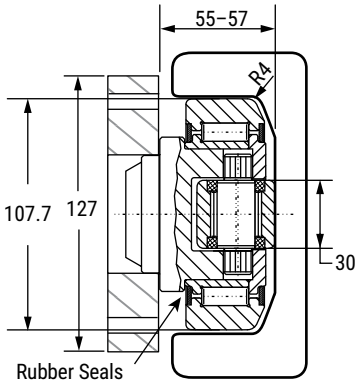
Radial: Dynamic = 81 kN; Static = 95 kN

Axial: Dynamic = 31 kN; Static = 36 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-461/HVP4 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-061 • 2.67 US Ton-Force

Rail – U Channel HVR-4

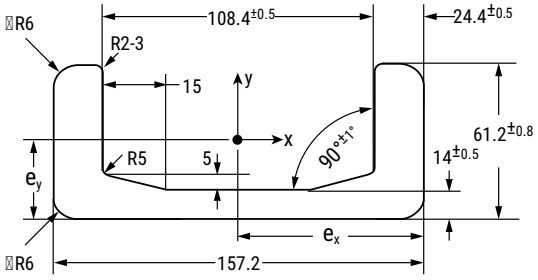
Weight = 35.9 kg/m

Moment of Inertia: I_x = 150.98 cm^4; I_y = 1494.32 cm^4

Moment of Resistance: W_{xmin} = 39.00 cm^3;
W_{xmax} = 67.13 cm^3; W_y = 190.12 cm^3

Radius of Inertia: i_x = 1.82 cm; i_y = 5.72 cm

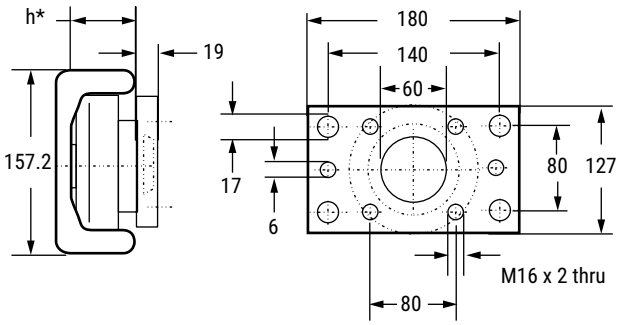
Distance to Center of Gravity: e_y = 2.25 cm; e_x = 7.86 cm



Hevi-Rail Bearings
Can be ordered with pre-welded flange plate

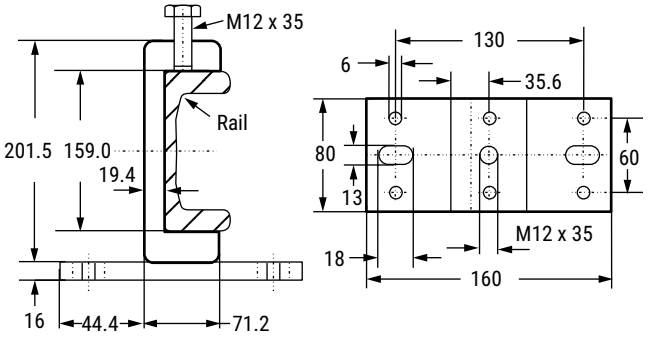
Flange Plate HVP4-1

For Ordering Separate Flange Plate Only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-061) or eccentric adjustable bearing (HVBEA-461).

Clamp Flange HVC-4



Ordering Information

Part NO.	Description
HVB-061	Fixed axial bearing
HVB-061/HVP4	Fixed axial bearing with welded flange plate
HVBEA-461	Eccentric adjustable axial bearing
HVBEA-461/HVP4	Eccentric adjustable axial bearing with welded flange plate
HVP4-1	Flange plate
HVR-4	U-channel rail for -61 bearings
HVC-4	Clamp flange

Units of Measurement mm

Hevi-Rail® HVB-062 • 3.81 US Ton-Force

Axial Bearing – Fixed HVB-062

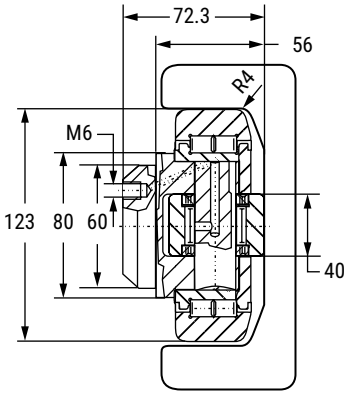
Weight = 4.50 kg

Maximum Bearing Loads:

Radial: Dynamic = 134.5 kN; Static = 242 kN

Axial: Dynamic = 44.7 kN; Static = 74.2 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-462

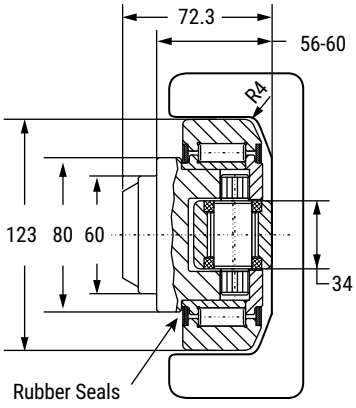
Weight = 3.90 kg

Maximum Bearing Loads:

Radial: Dynamic = 110 kN; Static = 132 kN

Axial: Dynamic = 43 kN; Static = 50 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



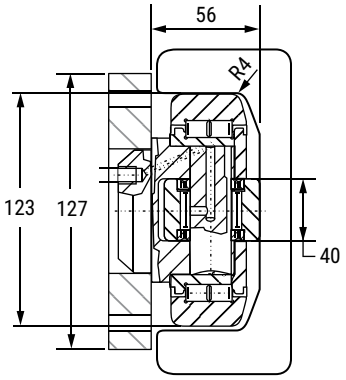
System Maximum Static Loads:

Radial: 33.9 kN/3.81 US Ton-Force

Axial: 10.6 kN/1.19 US Ton-Force

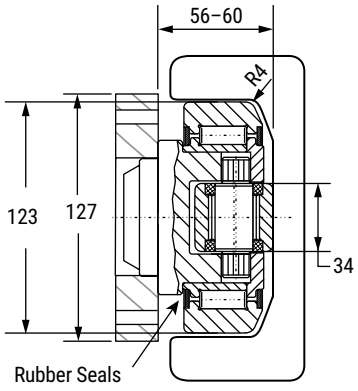
Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-062/HVP4 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-462/HVP4 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-062 • 3.81 US Ton-Force

Rail – U Channel HVR-5

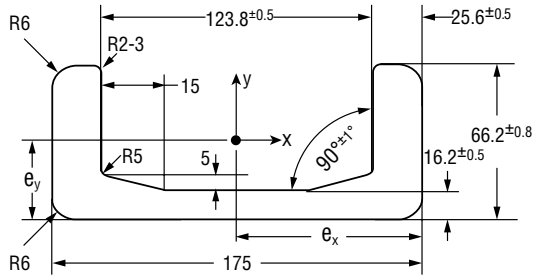
Weight = 42.9 kg/m

Moment of Inertia: I_x = 205.84 cm^4; I_y = 2185.32 cm^4

Moment of Resistance: W_{xmin} = 48.42 cm^3;
W_{xmax} = 86.89 cm^3; W_y = 249.75 cm^3

Radius of Inertia: i_x = 1.94 cm; i_y = 6.32 cm

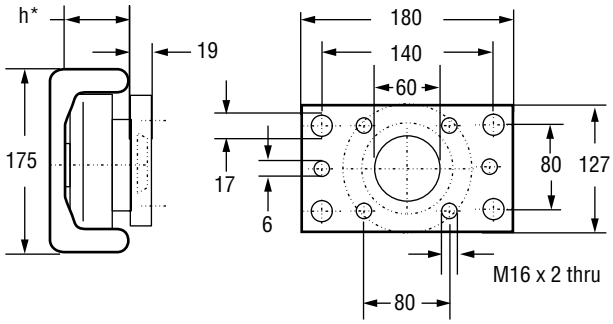
Distance to Center of Gravity: e_y = 2.37 cm; e_x = 8.75 cm



Hevi-Rail Bearings
Can be ordered with pre-welded flange plate

Flange Plate HVP4-1

For Ordering Separate Flange Plate Only



***Note:** "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-062) or eccentric adjustable bearing (HVBEA-462).

Ordering Information

Part NO.	Description
HVB-062	Fixed axial bearing
HVB-062/HVP4	Fixed axial bearing with welded flange plate
HVBEA-462	Eccentric adjustable axial bearing
HVBEA-462/HVP4	Eccentric adjustable axial bearing with welded flange plate
HVP4-1	Flange plate
HVR-5	U-channel rail for -62 bearings

Units of Measurement mm

Hevi-Rail® HVB-063 • 6.65 US Ton-Force

Axial Bearing – Fixed HVB-063

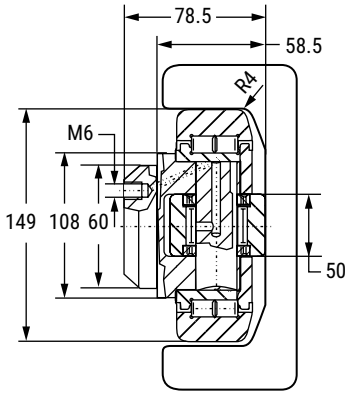
Weight = 6.52 kg

Maximum Bearing Loads:

Radial: Dynamic = 188 kN; Static = 370 kN

Axial: Dynamic = 68 kN; Static = 71 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



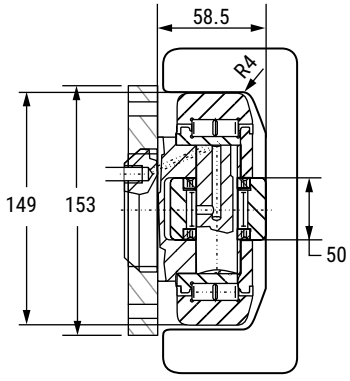
System Maximum Static Loads:

Radial: 59.2 kN/6.65 US Ton-Force

Axial: 18.5 kN/2.07 US Ton-Force

Note: Above loads are achievable when used with shown rails.

Axial Bearing – Fixed HVB-063/HVP6 with Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Eccentric Adjustable HVBEA-463

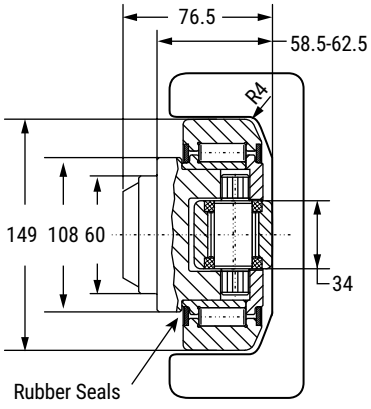
Weight = 6.50 kg

Maximum Bearing Loads:

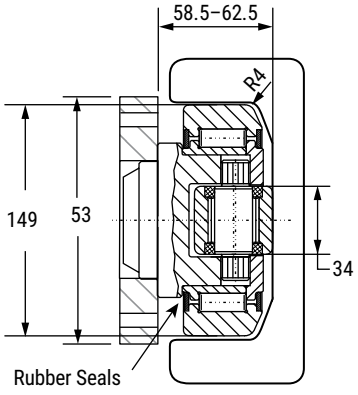
Radial: Dynamic = 151 kN; Static = 192 kN

Axial: Dynamic = 68 kN; Static = 71 kN

Note: Above loads achievable when used with a hardened rail HRC 55 minimum 2.54 mm deep.



Eccentric Adjustable HVBEA-463/HVP6 With Welded Flange Plate



Note: Above values do not include stack up tolerances for flange plate and bearing assembly.

Units of Measurement mm

Hevi-Rail® HVB-063 • 6.65 US Ton-Force

Rail – U Channel HVR-6

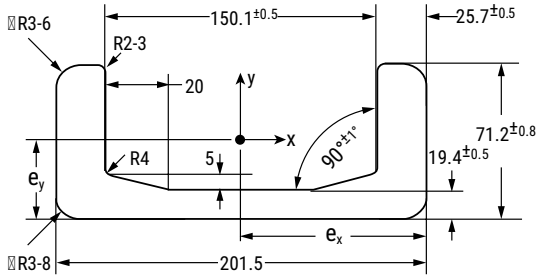
Weight = 52.3 kg/m

Moment of Inertia: I_x = 269.52 cm^4; I_y = 3423.08 cm^4

Moment of Resistance: W_{xmin} = 57.15 cm^3;
W_{xmax} = 112.11 cm^3; W_y = 339.76 cm^3

Radius of Inertia: i_x = 2.01 cm; i_y = 7.17 cm

Distance to Center of Gravity: e_y = 2.40 cm; e_x = 10.08 cm

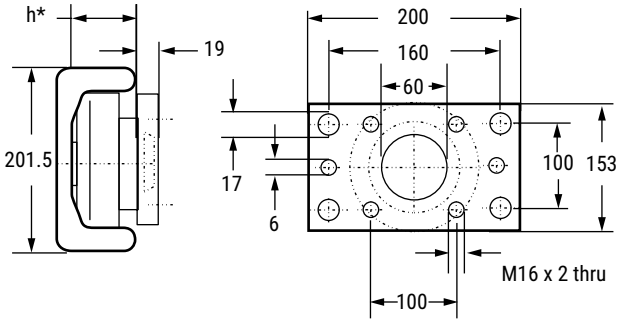


Hevi-Rail Bearings

Can be ordered with pre-welded flange plate

Flange Plate HVP6-1

For Ordering Separate Flange Plate Only



***Note:**: "h" refers to the depth of the axial bearing. This dimension depends on the choice of fixed axial bearing (HVB-063) or eccentric adjustable bearing (HVBEA-463).

Ordering Information

Part NO.	Description
HVB-063	Fixed axial bearing
HVB-063/HVP6	Fixed axial bearing with welded flange plate
HVBEA-463	Eccentric adjustable axial bearing
HVBEA-463/HVP6	Eccentric adjustable axial bearing with welded flange plate
HVP6-1	Flange plate
HVR-6	U-channel rail for -63 bearings

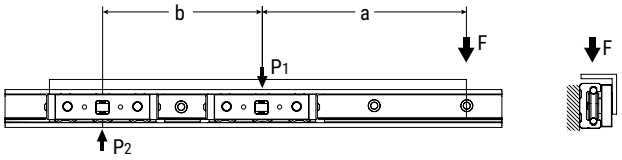
Units of Measurement mm

The load applied to a linear system can vary in many ways. Factors such as the center of gravity, drive or thrust location, forces of inertia at start and stop, need to be calculated to ensure the proper rail, and carriage are applied.

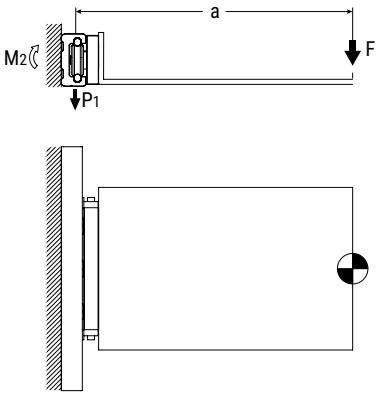
Horizontal Motion – Single Rail

Load on the sliders:

$P_1 = P_2 + F$ $\quad P_2 = F \cdot \frac{a}{b}$

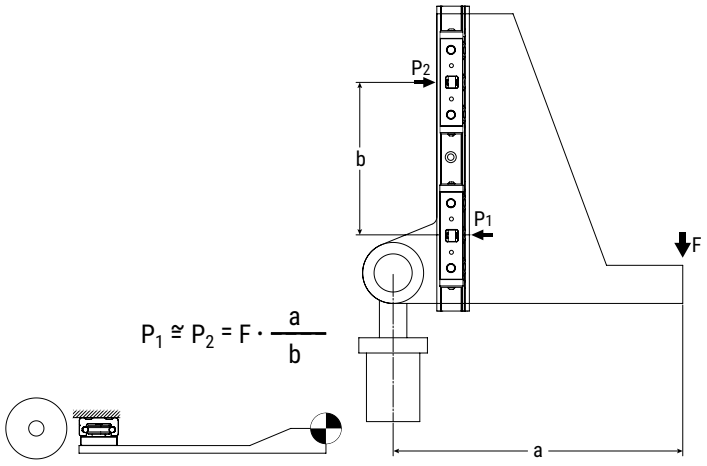


Horizontal Motion – Single Rail



$P_1 = F$ $\quad M_2 = F \cdot a$

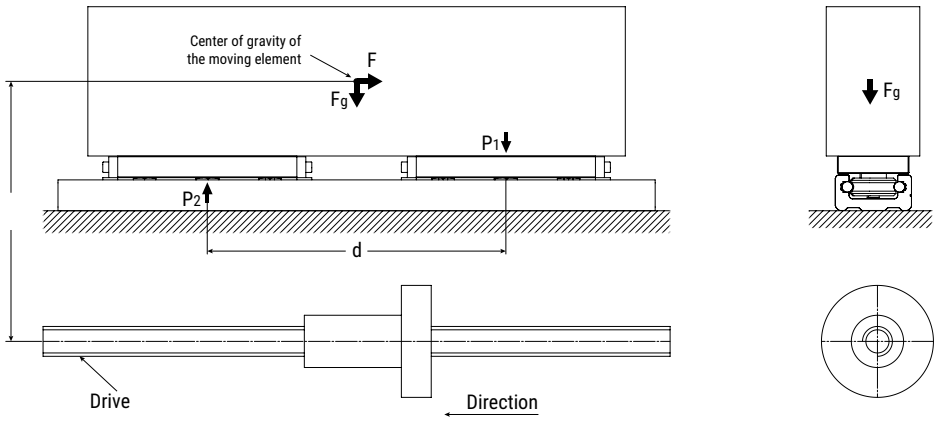
Vertical Motion – Single Rail



$P_1 \cong P_2 = F \cdot \frac{a}{b}$

Horizontal Motion – Single Rail

Verification when change of direction affects inertial forces



Explanation of the calculation formula

F	=	effective force (N)
F_g	=	weight-force (N)
P_1, P_2, P_3, P_4	=	effective load on the slider (N)
M_1, M_2	=	effective moment (N-m)
m	=	mass (kg)
a	=	acceleration (m/s^2)

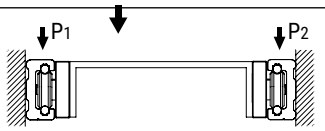
Inertial force

$F = m \cdot a$

Slider load at time of reverse

$P_1 = \frac{F \cdot l}{d} + \frac{F_g}{2}$ $\quad P_2 = \frac{F_g}{2} - \frac{F \cdot l}{d}$

Horizontal Motion – Parallel Rails/2 Carriages

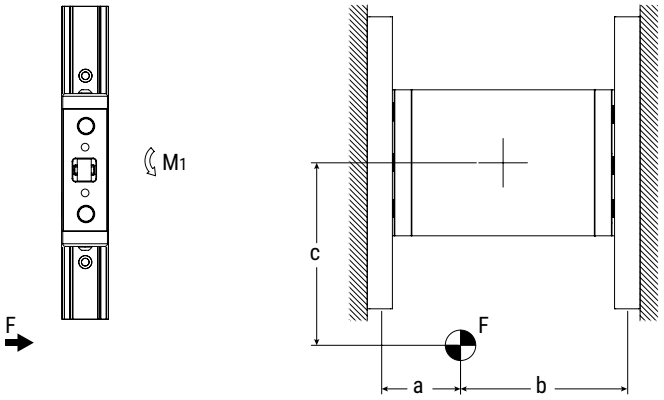


Load on the sliders:

$$P_1 = F \cdot \frac{b}{a+b} \qquad P_2 = F - P_1$$

Additional moment load on slider:

$$M_1 = \frac{F}{2} \cdot c$$



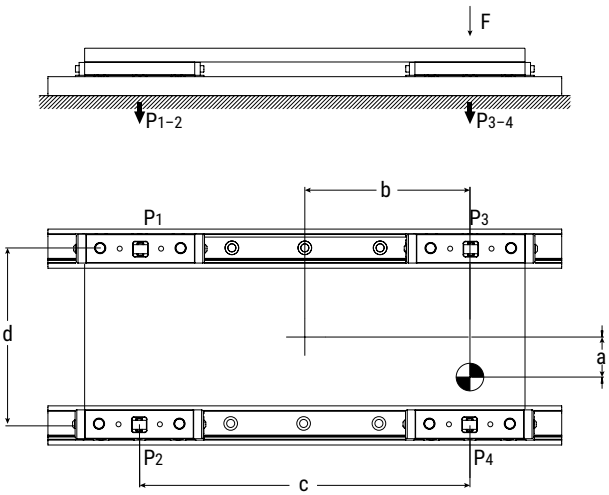
Horizontal Motion – Parallel Rails/4 Carriages

$$P_1 = \frac{F}{4} - \left(\frac{F}{2} \cdot \frac{b}{c}\right) - \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

$$P_2 = \frac{F}{4} - \left(\frac{F}{2} \cdot \frac{b}{c}\right) + \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

$$P_3 = \frac{F}{4} + \left(\frac{F}{2} \cdot \frac{b}{c}\right) - \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

$$P_4 = \frac{F}{4} + \left(\frac{F}{2} \cdot \frac{b}{c}\right) + \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$



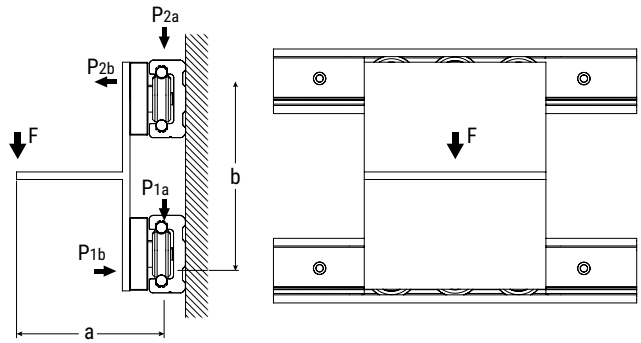
Note: Carriage #4 (P4) should always be nearest to the point of the load

Horizontal Motion – Parallel Rails/2 Carriages

Load on the carriages:

$$P_{1a} = P_{2a} = \frac{F}{2}$$

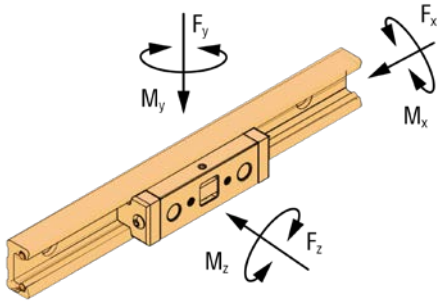
$$P_{2b} = P_{1b} = F \cdot \frac{a}{b}$$



Use the values from the static load maximums given in the charts beginning on page 6 in the calculations below to verify acceptable loading conditions.

Calculation Factors:

- F_{za} and F_{ya} are the axial and radial results of external forces in newtons (N)
- M_{xa}, M_{ya}, and M_{za} are the external moments being applied in newton-meters (N-m)
- F_y, F_z, M_x, M_y, and M_z are the load ratings for various directions and moments
- s.f. is the relative safety factor as applied from the table below



Single Load Force Calculations

$$\frac{F_{za}}{F_z} < \frac{1}{s.f.} \qquad \frac{F_{ya}}{F_y} < \frac{1}{s.f.} \qquad \frac{M_{xa}}{M_x} < \frac{1}{s.f.} \qquad \frac{M_{ya}}{M_y} < \frac{1}{s.f.} \qquad \frac{M_{za}}{M_z} < \frac{1}{s.f.}$$

Multiple Load Force Calculation

$$\frac{F_{za}}{F_z} + \frac{F_{ya}}{F_y} + \frac{M_{xa}}{M_x} + \frac{M_{ya}}{M_y} + \frac{M_{za}}{M_z} < \frac{1}{s.f.}$$

Calculation Factors

Use the following variables with the equations below to calculate the approximate travel life of Redi-Rail® carriages under various loading conditions.

- L = Estimated travel life in meters (m)
- F_{za} and F_{ya} are the axial and radial results of applied external forces in newtons (N)
- M_{xa}, M_{ya}, and M_{za} are the external moments being applied in newton-meters (Nm)
- F_d is the dynamic slider capacity constant from the charts beginning on page 6
- F_y, F_z, M_x, M_y, and M_z are the load ratings for various directions and moments as found beginning on page 6
- s.f. is the relative safety factor from the table below

Weqv is the total radial load found from the equation:

$$W_{eqv} = F_z \cdot \left(\frac{F_{za}}{F_z} + \frac{M_{xa}}{M_x} + \frac{M_{ya}}{M_y} + \frac{M_{za}}{M_z} \right) + F_{ya}$$

Life Calculation:

$$L = \left(F_d / W_{eqv} \cdot s.f. \right)^3 \times 100{,}000 \text{ meters}$$

Safety Factor

- Use the "s.f." to adjust for dynamic forces and conditions particular to the application

Application Condition	S.F.
Consistently smooth motion with low frequency of travel reversal, slow speed (<30% MAX), no shock load or vibration, no elastic yield or deformation, clean environment	1–1.5
Normal assembly or shop floor conditions, moderate speed (30% MAX to 75% MAX), normal shock or vibration conditions	1.5–2
Frequent reversal of travel, high speeds (>75% MAX), shock loads and/or vibration present, high elastic yield or deformation, heavy dirt and dust in environment	2–3.5

Load Calculations

L	=	applied load/number of wheel pairs
L_R	=	wheel radial load
L_O	=	wheel load from moment
A	=	load offset dimension
B	=	track width dimension
FA	=	.5 for light duty, well lubricated use
FA	=	1 for normal lubricated use
FA	=	2 for dry, or harsh environments

Horizontal Motion – Center Loaded

$Lo_1 = \frac{L \cdot (B - A) \cdot FA}{B}$ $Lo_2 = (L \cdot FA) - Lo_1$

Compare the greater of these loads to the rated moment and radial load capacities

Example:

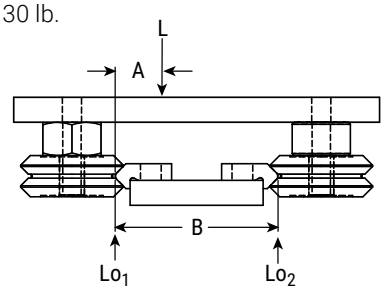
Load is 100 lb. on 4 wheel carriage:

L = 100/2 pair wheels = 50 lb.

A = 4", B = 10", FA = 1

$Lo_1 = \frac{50 \cdot (10 - 4)}{10} \cdot 1 = 30$ lb.

$Lo_2 = 50 - 30 = 20$ lb.



Horizontal Motion – Overhung Load

$Lo_1 = \frac{L \cdot A \cdot FA}{B}$ $Lo_2 = (L \cdot FA) + Lo_1$

Compare the greater of these loads to the rated moment and radial load capacities

Example:

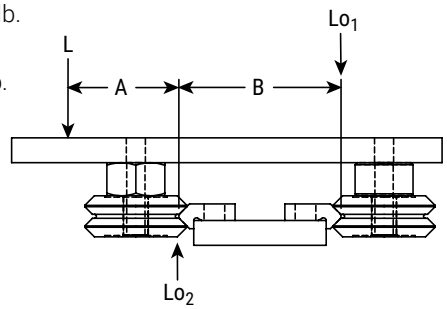
Load is 100 lb. on 4 wheel carriage:

L = 100/2 pair wheels = 50 lb.

A = 4", B = 6", FA = 1

$Lo_1 = \frac{50 \cdot 4 \cdot 1}{6} = 33$ lb.

$Lo_2 = 50 + 33 = 83$ lb.



Vertical Motion

$Lo_1 = \frac{L \cdot A \cdot FA}{B}$ $L_R = (L \cdot FA) + Lo_1$ $Lo_1 = Lo_2$

Compare the greater of these loads to the rated moment and radial load capacities

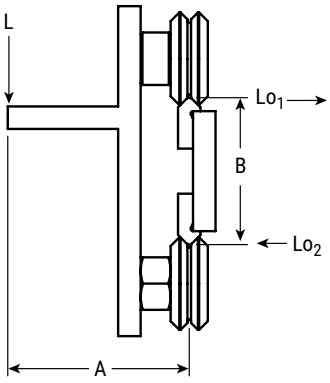
Example: Load is 100 lb. on 4 wheel carriage:

L = 100/2 pair wheels = 50 lb.

A = 4", B = 6", FA = 1

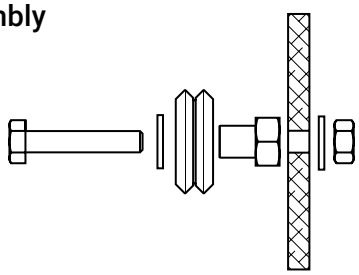
$Lo_1 = \frac{50 \cdot 4 \cdot 1}{6} = 33$ lb.

$L_R = (50 \cdot 1) + 33 = 83$ lb.



Wheel/Bushing Assembly

Use SAE series N flat washers and lock washers to secure the wheel bushing assemblies



Bushings			
Inch		Metric	
VB1	#6	MVB1	M4
VB2	1/4	MVB2	M6
VB3	5/16	MVB3	M8
VB4	3/8	MVB4	M10
V-Rail			
VR1	#6, M3	VR3	1/4", M6
VR2	#10, M6	VR4	5/16", M8

TECHNICAL

Technical Specifications

Linear Bearing for Axial & Radial Loads

Prior to welding, disassemble bearing components. To avoid cracks in welded joints, please use welding electrodes and core weld for unalloyed steel.

Outer ring – Case-hardened steel En 31 - SAE 52100 hardened at 60+2 HRc.

Inner ring – Hardened steel En 31 - SAE 52100 hardened at 62-2 HRc.

Cylindrical rollers – Flat ground heads are hardened steel, En 31 - SAE 52100, hardened at 59-64 HRC.

Bolt tolerance – 0.05 mm:

Profile rails – High quality S450J2 MOD. steel at standard lengths of 6 m (19.7 ft). Yield point of 420 n/mm², tensile strength of 550-700 N/mm^2. Rails are not hardened but have a Brinell hardness of 150-190. The guide ways in the rails should be lightly greased and not painted.

Clamp flange – Low carbon steel, adjustable clamp.

Flange plate – Low carbon steel. Special designs available, contact manufacturer.

Seals – **Fixed Axial Bearings** (HVB-053 to HVB-063): Radial roller has steel labyrinth and axial roller has rubber seals. **Eccentric Adjustable Axial Bearings** (HVBEA-454 to HVBEA-463) Both radial roller and axial roller have rubber seals. Rubber seals are RS type.

Lubrication – Bearings are supplied lubricated with grease grade 3. Bearings from HVB-055 to HVB-063 can be re-lubricated with grease zerk. Adjustable bearings are not available with zerk.

Bearing coefficient of frictions – 0.010 static, 0.005 dynamic.

Temperature – Resistant from -30°C to 120°C (-22°F to 248°F).

Bearing Life Calculations:

$$L10 = \left(\frac{16{,}667}{n}\right) \cdot \left(\frac{C}{P}\right)10/3 \cdot (\text{Hours})$$

C = Dynamic load rating (kN)

P = Automatic dynamic load (kN)

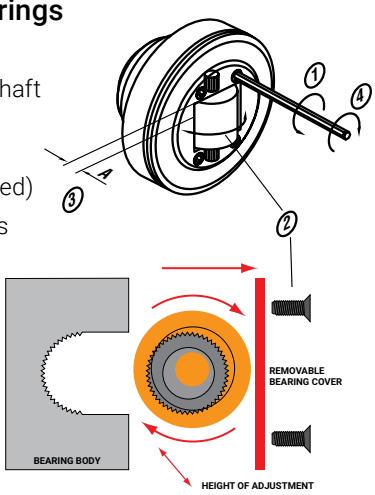
n = Revolutions per minute (rpm)

Note: Above calculation formula is for predicting life expectance with 90% reliability level. Customers shall use their discretion to determine the reduction factor based on the actual operation needs and conditions such as reliability level, load, speed, impact, and environments.

Link to video "How to Adjust Hevi-Rail Bearing Systems"

Adjusting Axial Bearings

1. Remove front screws
2. Rotate axial bearing shaft (see diagram below)
3. Check dimension A (repeat step 2, if needed)
4. Re-install front screws
5. Recommend use of a breakable Loctite®



Calculation of fmax for cantilevered loads

Q = Load capacity (N)

L = Load distance to suspension point (mm)

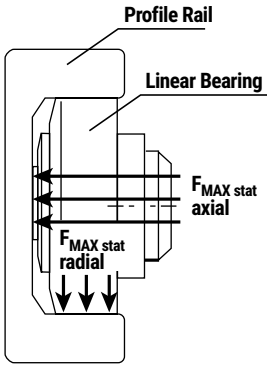
P = Suspension point

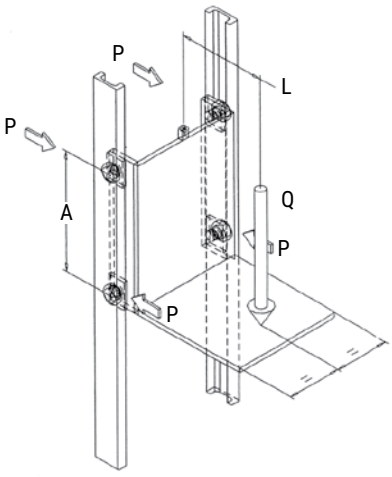
A = Bearing distance (mm) recommended 500 mm to 1,000 mm

Formula: $F_{MAX\ stat\ radial}\ [N] = \frac{Q \cdot L}{2 \cdot A}$

MAX Hertzian = 850 N/mm² for all profile rails

Indicated here are $F_{MAX\ stat}$ radial + axial for each bearing

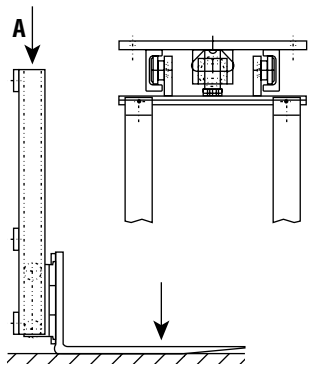




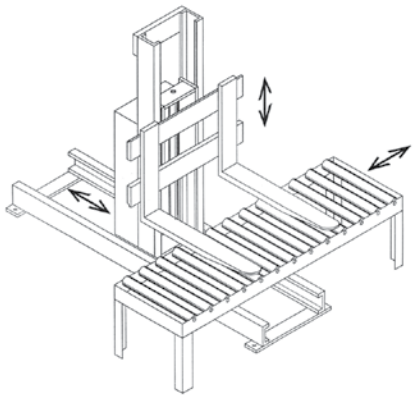
TECHNICAL

Mounting Configurations

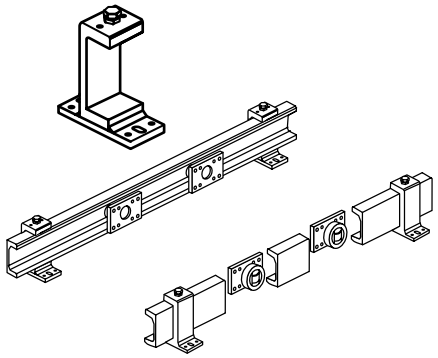
Lifting Units



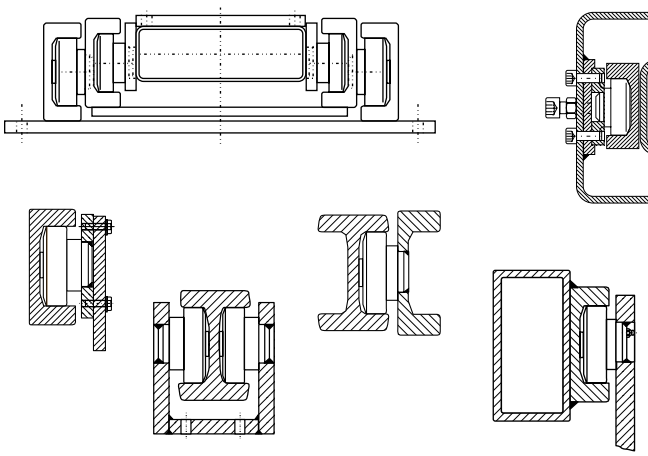
Handling Units

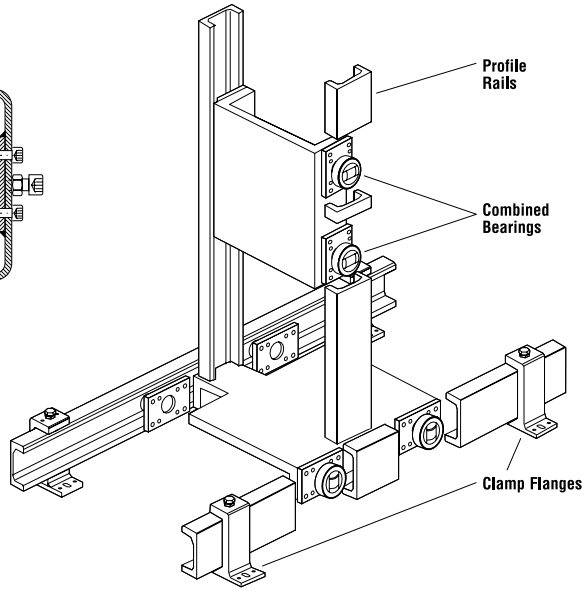


Adjustable Clamp System



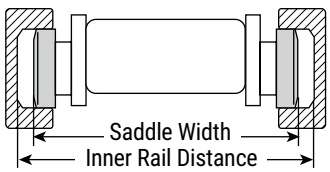
Horizontal Telescope



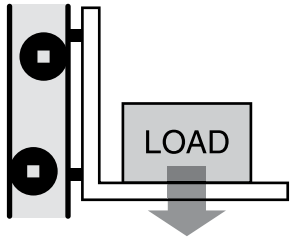


Mounting Instructions

1. The overall system clearance should be 1.524 mm to 3.048 mm Inner Rail Distance = Saddle Width + (1.524 mm to 3.048 mm)



2. Verify that the axial bearing is aligned parallel to the rail; especially in vertical operations



Important Notice about Lifetime Calculations

There is no known formula for accurately and reliably calculating the actual lifetime of a linear or rotary bearing system.

The formulas within this section are solely based upon the statistical probability of success. It is important to recognize and distinguish between formulas of absolute certainty and probability.

Even though these formulas are not absolutely certain, they have been generally accepted as the best available method for determining bearing lifetime by the International Organization for Standardization (ISO), as well as its membership bodies; including, but not limited to: American National Standards Institute (ANSI), Deutsches Institut für Normung (DIN) & Japanese Industrial Standards Committee (JISC).

Static & Dynamic Load Ratings

PBC Linear uses the two internationally accepted methods for calculating the Rated Lifetime, Static, and Dynamic Capacities. Per the international standard, all lifetimes are calculated to an L10 life of 100 km (105 meters or ≈ 3.94 million inches). The two standards used are:

- ISO76 Rolling Bearings – Static Load Ratings
- ISO281 Rolling Bearings – Dynamic Load Ratings & Rating Life

Note: Some suppliers may choose to rate their bearings based upon a useful life of less than 100 km or a probability of success less than 90%. This causes their bearings to falsely appear to have a higher static and dynamic load capacity. If a catalog does not specifically note L10 = 100 km, caution should be used when comparing load capacity or life values between suppliers. The most commonly used values are L10 = 50 km and L25 = 50 km. For comparison, at L10 = 100 km, an example bearing has a maximum static load of 1,000 N. That exact same bearing as an L10 = 50 km maximum static load of ≈2,300 N and an L25 = 50 km maximum static load of ≈4,600 N!

In summary, the static load ratings are defined as the maximum applied load (or moment) which will result in the permanent deformation which does not exceed 1/10,000 of the diameter of the rolling element (ball or rod) within the bearing. The basic dynamic load rating, C, is the load of a constant magnitude and direction, which a sufficiently large number of apparently identical bearings can endure for a basic rating life of one million revolutions. It's important to note that both the static and dynamic values are determined though ISO-Approved formulas. These formulas take into account several factors, including the design, internal geometry, material type, material quality, and lubrication type.

Note: Additional factors are provided so that the estimated lifetime (default = 100 km) and/or the probability of success (default = 90%) can be changed from their default value to any desired value.

Operating Lifetime

The Operating Life (or Operating Lifetime) is the actual life achieved by a rolling bearing. The actual lifetime typically varies from the calculated lifetime, sometimes significantly. It is not possible to accurately and reliably determine the actual Operating Life through calculations due to the large variety of operating and installation conditions. The most reliable method to achieve an approximation is by comparing the current application to similar applications. Primary factors which can negatively affect the life and are generally not included in calculations are:

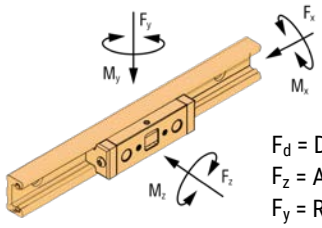
- Contamination within the application
- Inadequate or improper lubrication
- Operational conditions different from calculated values, including unexpected forces and moments
- Insufficient and/or excessive operating clearance between the roller and guideway
- Excessive interference between roller and guideway (typically due to misalignment or excessive preload)
- Temperature out of range
- High shock loads (exceeding static load capacity)
- Vibration (which causes false brinelling resulting from fretting)
- Short stroke reciprocating motion (also causes False Brinelling)
- Damage caused during installation or from improper handling
- Improper mating surface hardness (when not used with a PBC Linear rail)

Terms, Definitions & Symbols

The following variables are used within the equations listed on the following pages:

$F_{y\,app}$ = Force applied in the Y direction (radial force), N
$F_{z\,app}$ = Force applied in the Z direction (axial force), N
$M_{x\,app}$ = Moment applied about the X axis, N
$M_{y\,app}$ = Moment applied about the Y axis, N
$M_{z\,app}$ = Moment applied about the Z axis, N
F_{MAX} = Maximum allowable force in the Y direction (radial force), N
$F_{z\,MAX}$ = Maximum allowable force in the Z direction (axial force), N
$M_{x\,MAX}$ = Maximum allowable moment about the X axis, N • m
$M_{y\,MAX}$ = Maximum allowable moment about the Y axis, N • m
$M_{z\,MAX}$ = Maximum allowable moment about the Z axis, N • m
D_a = Rolling contact diameter, from product tables, mm
f_h = Shaft (rail)hardness reduction factor
f_l = Required Lifetime (km) reduction factor
f_r = Reliability reduction factor
f_{ss} = Short stroke reduction factor
L10 = Basic rating life, km (103 m)
Pr = Equivalent radial (F_y) load, N
s.f = safety factor

Note: PBC Linear has chosen to depart from the nomenclature standards used by ISO. Instead, PBC Linear uses a convention that is more in line with other PBC Linear products. This ensures that all PBC Linear products use the same naming conventions, making it easier to compare multiple products from different product families. The Y direction (radial force) and Z direction (axial force) are dependant upon the orientation of the wheel bearing.



F_d = Dynamic capacity (LC)
F_z = Axial capacity
F_y = Radial capacity
M_x, M_y, M_z = Moment capacities

Conversions

newton (N) • 0.2248 = lb.
(lb) meter • 0.0397 = inch
newton - meter (N-m) • 8.851 = in.-lb.

Derivation

The lifetime formula within ISO 281 gives the life in millions of revolutions. The conversion from rotary life to linear life is done using the conversion factors listed in the following three equations. This derivation applies to both individual rollers and carriages. Lrev and Ldistance represent the lifetime of the bearing in revolutions and linear distance, respectively.

Note: Attention must be paid to units of measure, especially when considering products from different manufacturers. All of the lifetime formulas within this section yield results in kilometers; however, not all companies follow the same standard. Some companies may express life in meters or 100's of kilometers.

$$L_{Distance}\,[1 \cdot 10^5 m] = L_{rev}\,[1{,}000{,}000\ rev] \cdot \left(3.14\ D_a \left[\frac{mm}{rev}\right]\right) \cdot \left(\frac{1 \cdot 10^5\, m}{1{,}000{,}000} \left[\frac{m}{mm}\right]\right) \quad \text{Eq. 1}$$

$$L_{Distance}\,[1 \cdot 10^5 m] = L_{rev} \cdot (0.0314\ D_a) \quad \text{Eq. 2}$$

$$L_{Distance}\,[km] = 100 \cdot L_{rev} \cdot (0.0314\ D_a) = 3.14 \cdot D_a \cdot L_{rev} \quad \text{Eq. 3}$$

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Link to whitepaper "The Facts About Roller Bearing Life Calculations"

Individual Rollers – All products except Hevi-Rail Rollers

Most of the individual rollers within this catalog are Radial Ball Bearings. The following formulas should be used for all individual bearings except Hevi-Rail bearings (which are roller bearings). This formula calculates the basic rating life (L10 life), which does not take into account any reduction factors based upon the application.

$$L_{10}\,[km] = 3.14 \cdot D_a \cdot \left(f_L \cdot f_H \cdot f_{SS} \cdot \frac{F_{y\,max}}{P_r} \right)^3 \cdot (f_R) \qquad \text{Eq. 4}$$

$$P_r = X \cdot F_{y\,app} + Y \cdot F_{z\,app} \qquad \text{Eq. 5}$$

The values for X & Y can be found using the table listed below.

Values of X & Y for Radial Ball Bearing Life Formula

Product	$\frac{F_{z\_app}}{F_{y\_app}} \leq \epsilon$		$\frac{F_{z\_app}}{F_{y\_app}} > \epsilon$		ϵ
	X	Y	X	Y	
Commercial Rail (all sizes)	**1**	**0**	**0.41**	**0.87**	**0.68**
Hardened Crown Rollers	1	0	0.41	0.87	0.68
Integral-V (IVT) (Compact Linear Guides)	1	0.78	0.63	1.24	0.80
Integral-V (IVT) (all other sizes & types)	1	0.78	0.63	1.24	0.80
Redi-Rail (all sizes & types)	1	0.78	0.63	1.24	0.80
Steel-Rail (all sizes & types)	1	0.78	0.63	1.24	0.80
V-Rail (all sizes)	1	0.78	0.63	1.24	0.80

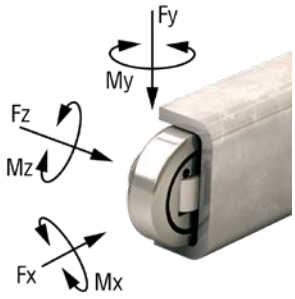
Individual Rollers – Hevi-Rail Rollers

Hevi-Rail bearings are roller bearings, as opposed to radial ball bearings. The formulas are very similar to the formulas shown above, with only some minor changes.

Note: Hevi-Rail rollers are combined bearings. Essentially two bearings combined into one. Life calculations should be performed for both the radial and the axial bearing.

$$L_{r\_10}\,[km] = 3.14 \cdot D_a \cdot \left(f_L \cdot f_H \cdot f_{SS} \cdot \frac{F_{ymax}}{F_{y\,app}} \right)^{\frac{10}{3}} \cdot (f_R) \qquad \text{Eq. 6}$$

$$L_{a\_10}\,[km] = 3.14 \cdot D_a \cdot \left(f_L \cdot f_H \cdot f_{SS} \cdot \frac{F_{zmax}}{F_{z\,app}} \right)^{\frac{10}{3}} \cdot (f_R) \qquad \text{Eq. 7}$$



Carriage Assemblies

Formulas for calculating the estimated lifetime for carriage assemblies are fundamentally similar to the calculations for the individual rollers. The most accurate method for determining the life of a carriage assembly is to create a free body diagram for the carriage and determine the axial, radial, and moment load applied to each individual roller. This method is cumbersome and is usually only required in the most severe of circumstances. In most cases, the carriage assembly can be treated as a rigid body and calculations can be completed based upon the load ratings for the entire carriage:

$$L_{10}\,[km] = 100 \cdot \left(f_L \cdot f_H \cdot f_{SS} \cdot \left(\frac{1}{\frac{F_{y\,app}}{F_{y\,max}} + \frac{F_{z\,app}}{F_{z\,max}} + \frac{M_{x\,app}}{M_{x\,max}} + \frac{M_{y\,app}}{M_{y\,max}} + \frac{M_{z\,app}}{M_{z\,max}}} \right)^3 \cdot (f_R) \right) \qquad \text{Eq. 8}$$

Redi-Rail® | Commercial Rail | Hardened Crown Roller | V-Guide | Hevi-Rail®

Safety Factor

All individual rollers and carriages are subject to use a balancing formula, which ensures an adequate product life. The following formulas should be used for all CRT products:

$$\text{Carriages } \frac{1}{s.f.} \geq \frac{F_{y\,app}}{F_{y\,max}} + \frac{F_{z\,app}}{F_{z\,max}} + \frac{M_{x\,app}}{M_{x\,max}} + \frac{M_{y\,app}}{M_{y\,max}} + \frac{M_{z\,app}}{M_{z\,max}} \qquad \text{Eq. 9}$$

$$\text{Individual Bearings } \frac{1}{s.f.} \geq \frac{F_{y\,app}}{F_{y\,max}} + \frac{F_{z\,app}}{F_{z\,max}} \qquad \text{Eq. 10}$$

Where the safety factor value can be determined using the following table.

Recommended Safety Factor (s.f.)

Duty	Shock/Vibration	Reverse Frequency	Contamination	S.F.
Very Light	None	Smooth & Low	None	1.0 – 1.2
Light	Light	Light	Light	1.2 – 1.5
Medium	Medium	Medium	Medium	1.5 – 2.0
Heavy	Heavy	High & Fast	Heavy	2.0 – 3.5

Note: The table above contains suggested safety factors based upon the most commonly encountered adjustment criteria. Additional criteria may require raising the safety factor.

Minimum Load Notice

It is possible to apply too small of a load to a bearing/carriage. In this case, there is a possibility of the outer ring slipping or the roller lifting off the track. This can cause unexpected vibration or skidding, which reduces the life of the bearing. Therefore, the following condition should be met under dynamic load conditions:

There is no minimum load requirement under static conditions.

$$\textit{Minimum Dynamic Load} \rightarrow \frac{F_{y\,max}}{F_{y\,app}} \leq 50 \qquad \text{Eq. 11}$$

Heavy Load Notice

It is also possible to over load the bearings. Extra-heavy loads can cause unexpected stress concentrations in the bearing or railway, which reduce the actual lifetime below the minimally acceptable level. These stress concentrations typically come from unexpected vibrations within the application or unexpectedly high preload forces caused by misalignment, damage, or thermal expansion. In these cases, a larger safety factor should be used.

$$Use\ Caution \rightarrow P_{re} > 0.5\ C_r \qquad \text{Eq. 12}$$

Note: Although typically applying to linear motion rolling bearings, ISO 14728-1 states that the above equation should be followed. It should be treated as a rule as opposed to a guideline.

If the product under consideration is a carriage (slider) assembly and Pr > 0.5 • Cr, then it is recommended to consider the axial, radial and moment load applied to each individual roller to ensure each roller still has an adequate safety factor.

Shaft/Rail Hardness Factor, f_H

It is possible to use a softer rail material in combination with PBC Linear CRT products; however, it is necessary to reduce the static and dynamic load capacities of each product. The reduced load capacity is known as the "Effective Load Capacity", which can be calculated using the formula below. The reduction factor, f_H, can be determined using the table below.

For easy reference, some of the most common materials have been plotted on the on the table below:

$$Dynamic \rightarrow F_{Y\,Eff} = F_Y \cdot f_H \qquad \text{Eq. 13}$$

$$Static \rightarrow F_{0Y\,Eff} = F_{0Y} \cdot f_H \qquad \text{Eq. 14}$$

Approximate Comparison of Common International Materials

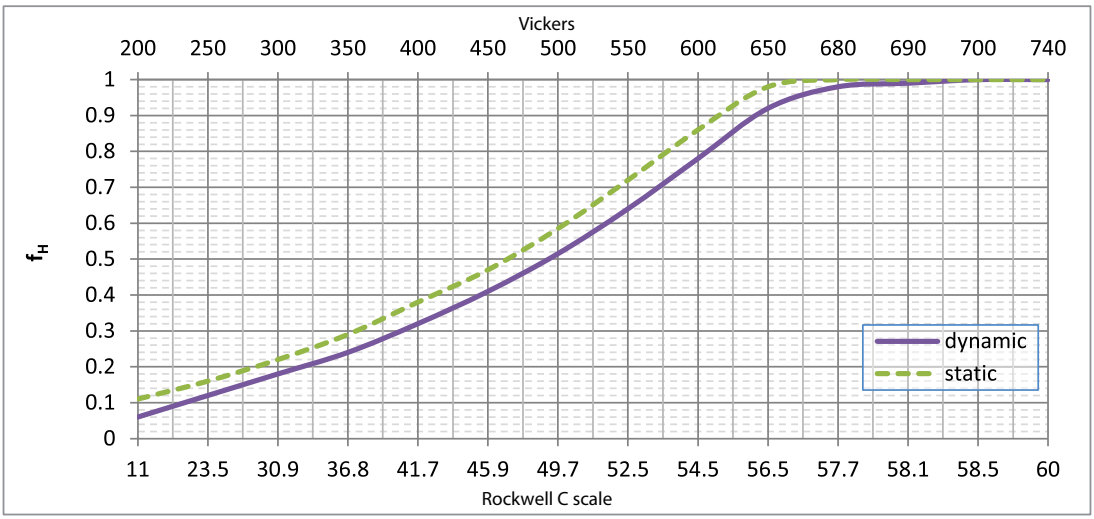
For easy reference, some of the most common materials have been plotted on the table below:

#	TYPE	EN NAME	EN #	ASTM/ AISI	TYPICAL HARDNESS2	f_H
1	Steel	C60	1.0601	1060	60-62	1.0
2	Steel	52-3	1.0570	1024	19-22	0.1
3	Stainless Steel	X46 Cr13	1.4034	420	51-53	0.7
4	Stainless Steel	X90 CrMoV18	1.4112	440B	53-55	0.8
5	Stainless Steel	X105 CrMo17	1.4125	440C	59-61	0.95-1.0

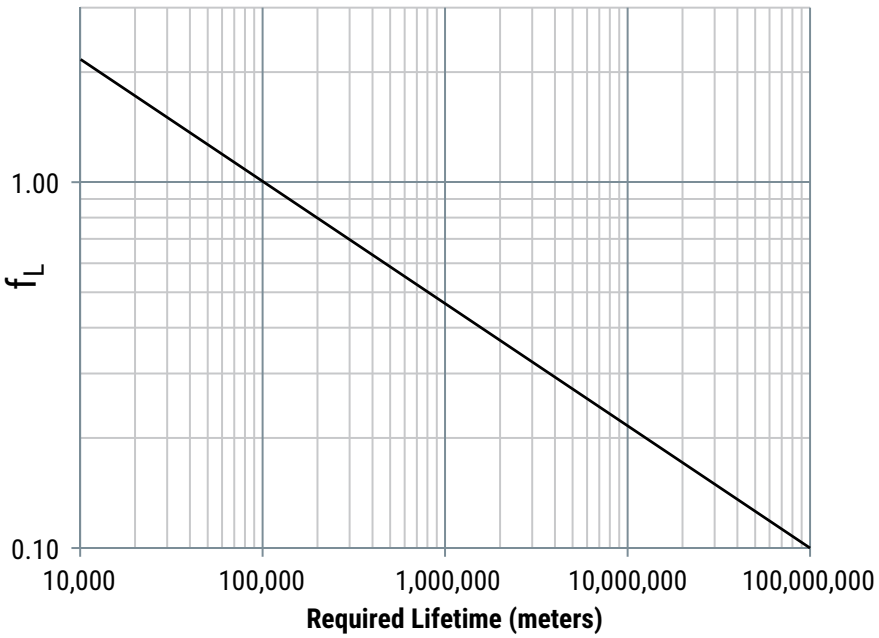
Note: The values listed in the above table should be considered for reference only. It is critical that individual suppliers are contacted to ensure an accurate hardness rating. Depending upon the supplier, "hardness" can actually be the minimum, maximum, or average value. The wrong interpretation can have unexpected consequences for the application. When given the choice, PBC Linear recommends using the "minimum hardness" when determining the reduction factor as this is the most conservative method.

1. Material Types may not be an exact match. PBC Linear has carefully reviewed the material standards and has determined that if there is not an exact match, the listed materials are the closest approximation. A material specialist should be consulted before translating one material type to another.
2. Different suppliers may have alternate ranges for material hardness, depending upon their heat treating process. Consult manufacturer's specifications for a more exact number/range.

Static & Dynamic Reduction Factors for Lower Raceway Hardness



Required Lifetime (km) Factor, f_L



The standard lifetime formulas listed within this catalog describe an L10 life based upon 100 km, in accordance to the applicable ISO standards. Sometimes 100 km is either excessive or shy of the target life of a machine and the required lifetime needs to be adjusted. An appropriate adjustment factor can be found using the chart.

Reliability Factor, f_R

Reliability	L_n	f_R
50%	L_{50}	5.04
60%	L_{40}	3.83
70%	L_{30}	2.77
80%	L_{20}	1.82
90%	L_{10}	1.0
95%	L_5	0.64
96%	L_4	0.55
97%	L_3	0.47
98%	L_2	0.37
99%	L_1	0.25
99.2%	$L_{0.8}$	0.22
99.4%	$L_{0.6}$	0.19
99.6%	$L_{0.4}$	0.16
99.8%	$L_{0.2}$	0.12
99.9%	$L_{0.1}$	0.093
99.92%	$L_{0.08}$	0.087
99.94%	$L_{0.06}$	0.080
99.95%	$L_{0.05}$	0.077

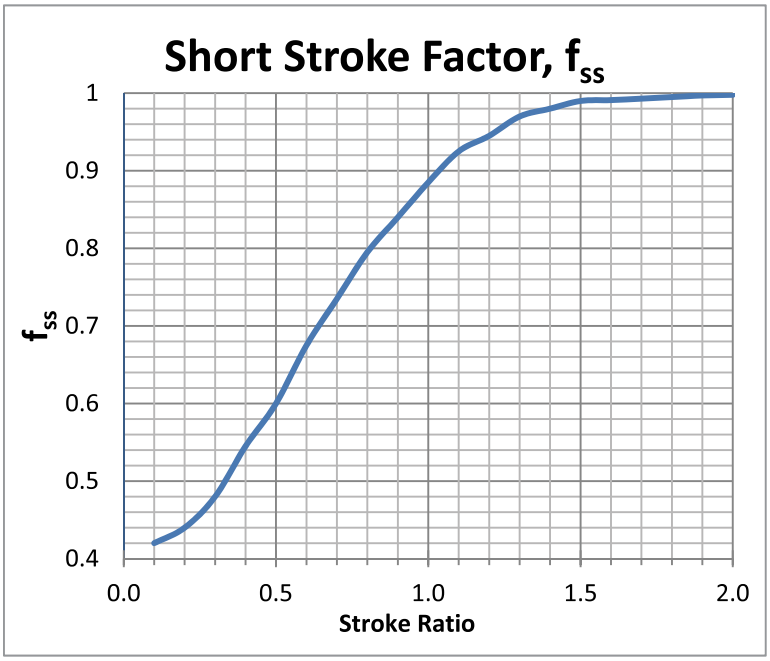
The L10 Life Formulas are a statistical probability formula with a success rate of 90%. Sometimes an L10 life (90% success) is just not good enough and the formulas need to be modified in order to have a higher probability of success. In this case, choose the desired reliability rate and insert the fR value into the life equation.

Short Stroke Factor, fss

In the case that the travel distance is low, a short stroke reduction factor must be included. In general, this factor only applies when the stroke is less than 2x the carriage length. In the case of individual bearings, use two full revolutions of the bearing.

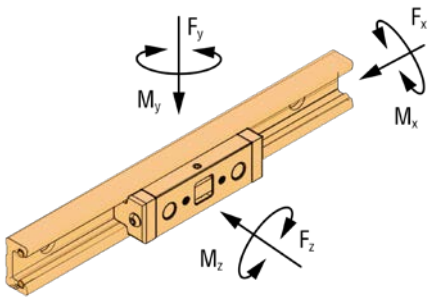
$$\text{Stroke ratio, carriage (slider)} = \frac{\text{stroke [mm]}}{\text{carriage length [mm]}} \qquad \text{Eq. 15}$$

$$\text{Stroke ratio, individual bearing} = \frac{\text{stroke [mm]}}{\pi\, D_p\ \text{[mm]}} \qquad \text{Eq. 15}$$



General Installation

As a general rule, all of the products within the catalog have a higher radial (F_y) than axial (F_z) load capacity. Whenever possible, designers should attempt to orient the bearings so the primary applied load is in the radial direction.



Commercial Rail

Commercial Rail is typically used in applications which require low to moderate accuracy. It is generally not necessary to use any advanced manufacturing or assembly techniques to secure this rail system into place.

Note: If an assembly plan requires Commercial Rail to be installed with dial indicators, calipers, or other sensitive measuring equipment, then likely this product has probably been over-specified for an application. Consider using a more accurate product for these applications, such as the V-Guide System, Redi-Rail, Integral-V (IVT), or Steel Rail.

Hardened Crown Roller Rail

Note: If an assembly plan requires Hardened Crown Roller rails to be installed with dial indicators, calipers, or other sensitive measuring equipment, then it is likely this product has probably been over-specified for an application. Consider using a more accurate product in these applications, such as the V-Guide System, Integral-V (IVT), Redi-Rail, or Flexible Steel Rail.

Redi-Rail

The Redi-Rail product is very versatile and can be used in applications that require low accuracy or moderate-high accuracy. In applications that require low accuracy, no special installation, and alignment procedures are needed. In applications that require moderate to high accuracy, use advanced assembly techniques similar to those used for installing profile rail guideways.

Note: Refer to the PRT (Profile Rail Technology) catalog for more detailed information related to advanced assembly techniques.

Hevi-Rail

Hevi-Rail is typically used in applications that require moderate accuracy. There are two common methods for installing Hevi-Rail: Welding & Clamp Flanges.

Welding

The preferred method of welding Hevi-Rail, Flange Plates, and Hevi-Rail Clamp Flanges is MIG Welding. Please follow the guidelines listed below when MIG welding Hevi-Rail, Flange Plates and Hevi-Rail Clamp Flanges.

1. Use a metal brush or grinder to remove rust or paint from surface to be welded.
2. Bevel joint edges on metals thicker than 3/8" to ensure the weld fully penetrates to the base of the metal. (HVR-2, HVR-3, HVR-4, HVR-5 HVR-6, HVRI-08, HVRI-09, HVRI-10, and HVRI-11).
3. Ensure that grounding clamp is engaged in clean metal.
4. When welding HVR-S, HVR-0, HVR-1, and HVRI-07 sections of Hevi-Rail it is recommended to use 0.03" diameter wire. A preferable grade wire for mild steel is ER70S-3.
5. When welding thick sections of Hevi-Rail, it is recommended to use 0.035"–0.045" ER70S-3 wire. Weld at a higher heat level to obtain a deep penetration. This is recommended for HVR-2, HVR-3, HVR-4, HVR-5 HVR-6, HVRI-08, HVRI-09, HVRI-10, and HVRI-11.
6. A 75% Argon/25% Carbon Dioxide mix is a preferable general purpose shielding gas when welding mild steels like Hevi-Rail.
7. Know your load calculations, when in doubt meet with your structural or mechanical engineer.
8. Destructive testing facilities are recommended for testing weld strength. Periodic destructive testing ensures that the welding equipment and welding practices are yielding safe and strong welds.
9. Never weld a mild steel Hevi-Rail product to a dissimilar metal such as cast iron or stainless steel.

Clamp Flanges

When using bolts to hold a Clamp Flange to Hevi-Rail HVR1, HVR-2, HVR-3, HVR-4, HVR-5, or HVR-6, it is recommend to drill a detent in the top of the rail where the screw seats. Many customers use a drill point smaller than the minor diameter of the tap diameter to put a point in the rail. This is preferred in systems that have vibrations and harmonics in its environment. Some customers use bolts to align and assemble the system, then weld the clamp to the rail.

V-Guide

V-Rail is typically used in applications that require low to moderate accuracy. The installation accuracy is primarily limited by the accuracy of the mounting surface. It is possible to successfully install V-Rail onto as-extruded bars and plates, or to rolled metal bars and plates. These materials typically do not have very tight dimensional, parallelism, flatness, and straightness tolerances. The loose tolerances add to the overall tolerance stack-up, which reduces the installation accuracy.

A higher grade of accuracy can be achieved by machining the mounting plate, typically through a milling or grinding process. It is possible to achieve an accuracy rating as high as ± 0.025 mm (± 0.001 in.) using machine tool design and assembly techniques. In this case, the mounting surface must be meticulously prepared, and reference edge or dowel pins should be used for alignment purposes.

Note: Integral-V (IVT) products eliminate this alignment process. If an application requires two parallel rails, PBC Linear highly recommends the consideration of the IVT products. Customers have reported significant Total Installed Cost (TIC) savings that have been achieved through the use of IVT products.

General Notes

Handling

Proper handling of PBC Linear products is critical to ensure specified product performance, product life, and to prevent accidental injury. Some products come from the factory with a clearance type preload. These carriages will freely slide if the rail is not kept horizontal. Special attention must be paid when installing the rail overhead or in a vertical orientation.

Special care must also be given to long length units. Single point lifting some products may cause enough bend as to result in permanent, plastic deformation to the railway. Always use suitable lifting equipment that provides enough support to minimize deflection.

Storage

Proper storage is critical in order to maintain an adequate product shelf life. If immediate installation is not possible or practical, it is best to store the product within the package provided by (or designated by) PBC Linear. The product and package should be stored in a horizontal orientation and environmental extremes (high temperature, low temperature, and high humidity) should be avoided. It may be necessary to lubricate steel components during prolonged storage in order to prevent corrosion.

Securing Fasteners

PBC Linear makes no specific recommendation as to whether or not thread-locking fluid (i.e. Loctite®), lock nuts, lock washers, etc., should be used within a given application. Sound engineering fundamentals and company policies should dictate the use of anti-vibration components and technology. Some common reference materials include, but are not limited to:

- Your company's policies and/or engineering specifications
- Marks's Standard Handbook for Mechanical Engineers, published by McGraw-Hill (English)
- Machinery's Handbook, published by Industrial Press (English)
- Roloff/Matek Maschinenelemente, published by Vieweg (German)

Fastener Quantity

It may not be necessary to use a fastener within every supplied fixing hole. This is especially true for applications carrying a light load (high factor of safety). Engineering statics equations can be used to determine the amount of deflection within a rail if not all fixing holes are used. Modern tools, such as FEA, can also be used to speed up this process.

Welding

The recommendations and guidelines listed herein are recommendations only. Always follow your specific company's policies, welding equipment manufacturer's instructions, guidelines established by national standards agencies (i.e. ANSI/DIN) and city/state/federal laws or civil guidelines related to proper welding practices. Improper application or installation of PBC Linear products can result in property damage, death, or serious bodily injury.

Note: Improper installation of carriages with spring-loaded lubricators can permanently damage the lubricator material. Damage caused by improper installation is not covered by PBC Linear warranty.

Initial Lubrication

After installation, follow the initial lubrication instructions located within this catalog or at pbclinear.com. All products are shipped with a preservative material, which should not be considered a true performance lubricant. Lubricant should be added before initial use.

Painting/Powder Coating

Most PBC Linear products can be painted or powder coated after installation to match the aesthetic appearance of the parent structure. It is highly recommended that the bearing's raceway be masked during this process. These coatings will typically not withstand the pressure of a typical operation and will flake off. These flakes will act as bumps causing the rollers to experience unplanned vibration. This can cause an unexpected shortening of the life of the rollers/carriage.

Roller Lubrication

All smaller rollers (in the Redi-Rail, IVT, V-Guide, Commercial Rail, Hardened Crown Roller families, and smaller diameter Hevi-Rail bearings) are lubricated internally for long life. No additional lubrication is necessary. The rollers are sealed (or shielded) against the operating environment to prevent egress of lubricant, and prevent ingress of contaminants. Some larger rollers (in the Hevi-Rail family) are supplied with a grease access point and can be re-lubricated using a zerk fitting.

Raceway/Guideway Lubrication

To ensure long life, it is necessary to have a thin film of lubrication on the Raceway/Railway at all times. When properly applied, lubrication:

- Reduces wear
- Reduces stress on the contact surfaces
- Reduces friction (and therefore heat buildup)
- Allows for operation at specifications in this catalog (de-rating is required for un-lubricated applications)
- Helps protect the metal surfaces against corrosion (rust and fretting corrosion)

Lubrication Type

Technical, environmental, ecological, and economic factors will determine whether oil or grease should be used in an application. One of the most significant factors in the lubrication selected is the environmental conditions. If extreme conditions are expected, it is highly recommended that a representative from a lubrication company is consulted. This includes heavy contamination when the expected particle size is smaller than 0.1 mm (0.005 in.) as small particles can more easily bypass seals and wipers.

CAUTION! The compatibility of lubricants must always be checked! This check should be done under both static and dynamic conditions and within the operating environment. Some lubricants may have unexpected, negative reactions with the plastics, elastomers or non-ferrous metals within the products. It is possible to draw upon previous and practical experience or guidelines from the lubricant manufacturer. When in doubt, consult the lubricant manufacturer.

Initial Lubrication (during installation)

PBC Linear Guides and Raceways are shipped with a preservative lubrication applied to the raceway. During installation, it is necessary to apply additional lubrication. Provided there are no application conflicts, PBC Linear recommends high quality lithium soap grease as the initial lubricant. This grease should be applied to the entire raceway, not just the portion used during normal operation. Oil or grease may be used for re-lubrication.

Note: Coated/Plated rails, Commercial Rail, Hardened Crown Roller, and Hevi-Rail rails are typically shipped without any preservative lubrication. See the Hevi-Rail section for more details: sandblast and lightly oiled option is available for Hevi-Rail.

Periodic Lubrication/Maintenance

The lubrication interval is dependent on many operating and environmental conditions, such as load, stroke, velocity, acceleration, mounting position/orientation, type of lubrication used, temperature, humidity, UV exposure, etc. The actual lubrication interval should be determined by tests conducted under actual application conditions.

While the actual lubrication intervals are application specific and determined only through testing, the following guidelines can typically be used as a starting reference point under normal conditions:

- Re-lubrication every 1,000 km; 50,000 cycles or six months (whichever occurs first).

Oil Filled Polymer Lubricator

Some PBC Linear products offer a high quality polymer lubricator. PBC Linear uses an advanced, oil filled porous polymer, which has been tested to show better performance and longer life than similar wiper/lubricators made of oil or grease filled felt. In some applications, this special lubricator will last the life of the application without additional re-lubrication.

This lubricant within the polymer is NSF Registered for both H1 & H2 applications (Direct and Indirect contact with food). It can also be used for wash down and industrial applications. The lubrication within the polymer contains corrosion inhibitors, anti-oxidants, and extreme pressure (E.P.) additives. The table below shows some specific properties for the lubricant.

Properties for Lubrication in Advanced Oil-Filled Plastic Properties for Lubrication in Advanced Oil-Filled Plastic

Upper Temp Limit	Lower Temp Limit	Specific Gravity	Viscosity at 40°C cSt	Viscosity at 100°C CST
99° (210°F)	-40° (-40°F)	0.86	150	16.5

Used Lubricants

Used lubricants should be disposed of using environmentally-friendly methods. Most lubricant manufacturers have guidelines regarding their allowable storage, use, and disposal. In addition, some countries have regulations regarding storage, use, and disposal of lubricants for occupational safety and/or environmental protection. Furthermore, some companies may have adopted internationally accepted quality and standards policies (i.e. ISO14001), which will further regulate the use of lubricants within an application.

These guidelines and regulations must be followed. Care should be exercised as to not specify a lubricant which is forbidden.

Lubrication Failure

Contamination and lack of lubrication are the two primary causes of (ball based) linear guide failures. Lack of lubrication will cause fretting corrosion, which can cause permanent system damage and eventually lead to system failure. As it applies to this product, fretting corrosion is a form of damage caused as a combination of corrosion and abrasive wear. Fretting corrosion can typically be seen as a reddish discoloration on either mating raceway (track or roller). Fretting corrosion can sometimes be confused with rust. Both are signs that additional lubrication is necessary and the re-lubrication period must be decreased.

Operation in an Un-Lubricated State

While not recommended, it is possible to run most systems without lubrication; however, there will be significant reductions to maximum load, maximum speed, and expected life. The table below shows that a typical un-lubricated system will have a significantly reduced maximum load and a reduced maximum speed when compared to a properly lubricated system.

Typical Reductions for Max Load & Speed for Un-Lubricated Systems

Product			Lubricated	Un-Lubricated	Reduction
A	Max Load	kg	100	25	75%
	Max Speed	m/s	2	1.5	25%

In addition to significant reductions in maximum load and speed, un-lubricated system will also experience an extreme reduction in expected life. The table below shows the expected life for both a lubricated and un-lubricated system for two different products with two different applied loads. The approximate reduction in lifetime has also been calculated.

Typical Life Reductions for Un-Lubricated Systems

Product			Lubricated	Un-Lubricated	Reduction
B	Applied Load 1	kg	45.4	45.4	–
	Life 1	m	5,410,200	88,900	≈ 98%
	Applied Load 2	kg	22.7	22.7	–
	Life 2	m	22,860,000	533,400	≈ 98%
C	Applied Load 3	kg	45.4	45.4	–
	Life 3	m	50,800,000	863,600	≈ 98%
	Applied Load 4	kg	90.7	90.7	–
	Life 4	m	8,382,000	152,400	≈ 98%

Note: Actual performance will vary depending upon specific application conditions. PBC Linear has removed the actual product name from the examples listed above as the results may not be repeatable, depending upon specific application conditions. While these values are typical, specific reductions should be determined by tests conducted under actual application conditions.

Operating Temperature

The Cam Roller products shown in the catalog have a wide operating temperature limit. All of the products within this catalog can be used within the following range: -20°C to +80°C (-4°F to 176°F). For applications outside of this range, first refer to the specifications for individual products. If a wider range is still needed, please contact our applications engineering group using the contact information below.

The temperature range for these products is limited by the lubricant, engineered polymer wipers, and composite cover materials. In most cases, changing the lubricant or the engineered polymer will extend the operating temperature limit for the product.

Velocity & Acceleration

For maximum velocities, check the product specifications. The maximum velocities will range from 0.76 m/s up to 12 m/s. Higher speeds may be possible, but may not be sustainable. Please contact our applications engineering group for sustained speeds above 12 m/s (33 ft/s).

Unless otherwise noted, the maximum possible acceleration of all CRT products is approximately 5 G's (50 m/s2, 160 ft/s2). Higher accelerations are possible, but may not be sustainable. Please contact our applications engineering group for sustained accelerations above 5 G's.

Contact Information

If you need to contact our applications engineering group, please use one of the following methods:

Phone: +1.800.962.8979 (inside USA)

Phone: +1.815.389.5600 (outside USA)

Email: application.engineering@pbclinear.com

Safety guidelines

Product Safety

PBC Linear products are designed and manufactured to the most current level of technology and research. If the bearing (or linear guide) arrangement is designed, handled, installed, and maintained correctly, then they do not give rise to any known or direct hazards. Misapplication, improper handling, improper installation, or improper maintenance may lead to premature product failure, which may have unintended consequences.

Read & Follow Instructions

This publication describes standard products. Since these are used in numerous applications, PBC Linear cannot make a judgment as to whether any malfunctions will cause harm to persons or property. It is always, and fundamentally, the responsibility of the designer and user to ensure that all specifications are observed, and that all necessary safety information is communicated to the end user. This applies in particular to applications in which product failure and/or malfunction may constitute a hazard to human beings.

Symbols

This publication uses several hazard, warning and notification symbols which are defined in accordance to ANSI Z535.6-2006.

Notifications

The data and specifications in this publication have been carefully compiled and are believed to be accurate and correct. However, it is the responsibility of the user to determine and ensure the suitability of PBC Linear products for a specific application. PBC Linear makes no warranty, expressed or implied, regarding the non-infringement, merchantability, or fitness for a particular purpose of the products. No liability is assumed with respect to the use or misuse of the information contained herein. The only obligation on part of PBC Linear will be to repair or replace without charge, any defective components if returned promptly. No liability is assumed beyond such replacement. The appearance, specifications, and other information are subject to change without notice to improve reliability, function, performance, etc.

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