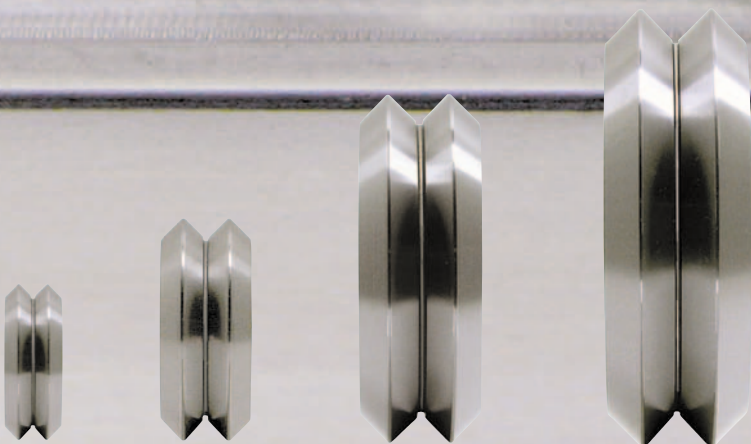




## Schatz Double V Linear Motion Systems



A leading producer  
of high-quality  
ball bearings and  
motion control products.

# SCHATZ BEARING CORPORATION



Schatz Bearing Corporation is a leading producer of high-quality ball bearings and motion control products. The Schatz name has been associated with quality and innovation for nearly a century. Our products are used in demanding applications in numerous industries including Aerospace, Machine Tool, Automation and Robotics, Medical Equipment, and Semiconductor Manufacturing Equipment.

Our product is manufactured in our ISO 9001 certified facility in Poughkeepsie, New York. Our product lines cover a broad range of ball bearing designs:

- Commercial Ball Bearings
- Aircraft Control Bearings
- Linear Motion Guide Wheels, Components, and Systems
- Thin Section Ball Bearings

Our experience and expertise has helped numerous customers solve problems using special bearing designs suited to their specific applications. Our long history allows us to call on previous designs to expeditiously design and develop special bearings to solve problems in demanding applications. Schatz manufactures most types of commercially available ball bearing designs, including radial ball bearings, angular contact bearings, double-row angular contact bearings, duplex angular contact bearings, four point contact bearings, and thrust bearings.

Please contact us for further assistance:

Schatz Bearing Corporation  
10 Fairview Avenue  
Poughkeepsie, New York 12602  
Tel: 845.452.6000  
Fax: 845.452.1660  
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QUALITY  
SYSTEM IS  
ISO 9001:2000  
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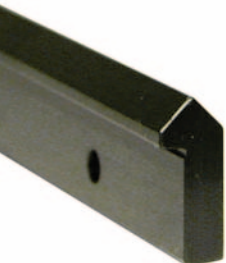
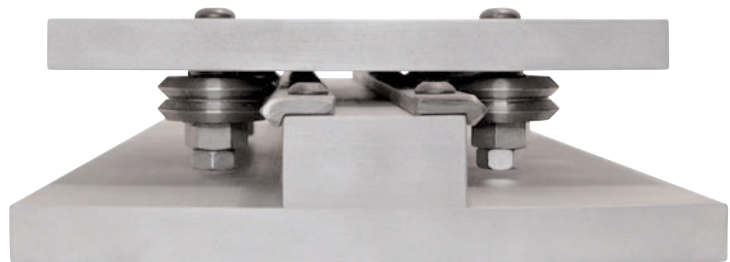
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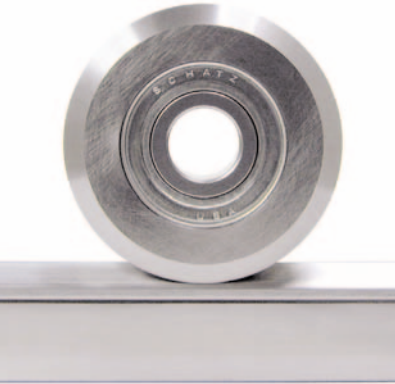
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## Schatz Double V Guide Wheel Bearings

*The superior choice for linear motion applications*

### Maintenance-free operation

- Bearings are “greased for life”
- Track surfaces hardened for long wear life
- High-precision bearings allow for smooth and quiet operation

### Ideal for harsh environments

- Rolling elements are enclosed and safeguarded from contamination (*Other linear bearing systems allow contamination to ingress into rolling elements on raceways creating accelerated wear.*)
- Stainless steel options for resistance to corrosion
- Schatz’s special two-piece seal is highly resistant to contamination
- Lubricant is contained in bearing cavity ensuring long lubrication life

### Flexibility in configuration

Components allow for numerous mounting arrangements:

- Bearings can be mounted vertically or horizontally
- Bearings can be used in linear or rotary systems

### Custom designs can be manufactured to meet your specific needs.

Schatz can design custom bearings based on application needs. (*see page 11 for details on custom guide wheel bearings*) We’ve built our reputation on our ability to design and manufacture ball bearings for difficult applications.

Schatz has a long history of specializing in solutions for:

- High Speed Applications
- High Load Capacity Applications
- High Temperature Applications
- Special O.D. Requirements

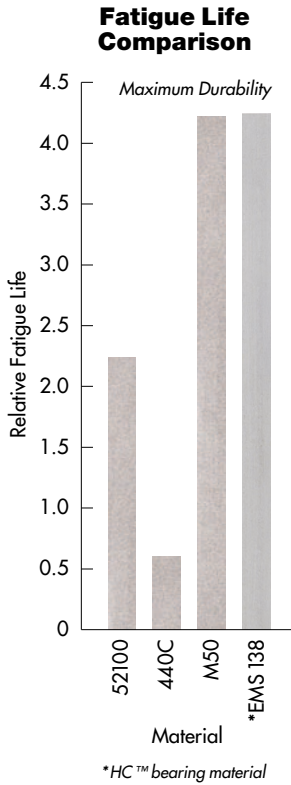


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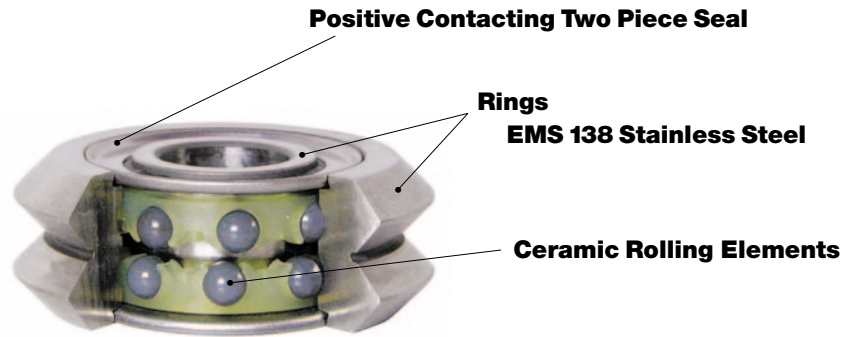
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## LINEAR BEARINGS FOR HARSH ENVIRONMENTS

### Applications:

- Aerospace and Defense
- Medical Equipment
- Semiconductor Equipment
- Food and Packaging Equipment

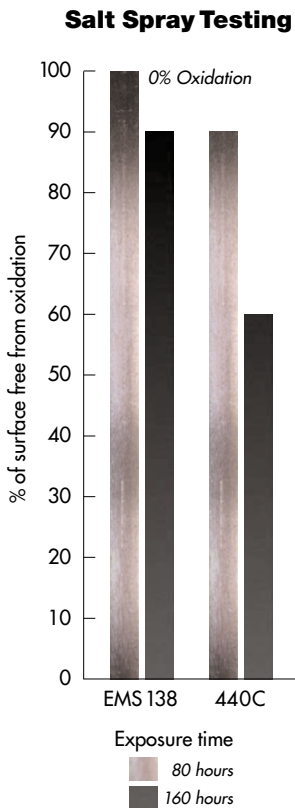


### Extremely high corrosion resistance and long fatigue life

Superior corrosion-resistance combined with excellent fatigue-resistance makes the Schatz HC™ the superior choice for demanding linear applications. Typical corrosion-resistant bearings utilize 440C for the material. Although 440C has better corrosion-resistance than standard non-stainless bearing materials, the use of the 440C results in a significant loss of fatigue or wear life. The material composition of the steel used in HC™ bearings allows the bearings to be produced with a unique combination of high fatigue-resistance and extremely high corrosion-resistance.

Schatz HC™ Guide Wheel bearings utilize EMS138 stainless steel for the inner and outer rings with silicon nitride (ceramic) balls.

Schatz HC™ linear track utilizes EMS138 stainless steel. The V section of the track is hardened to Rc53 min.



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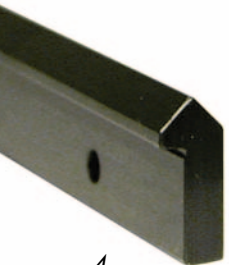
### Basic Bearing Sizes

Guide wheels above are shown at actual size.

**Closures** FF- Two non-contacting metal shields  
 LL- Two face contacting Buna N seals supported by a metal shroud

**Bearing Material** — — (blank) – Rings and balls made from SAE 52100 bearing steel  
 SS- Rings and balls made from AISI 440C stainless steel  
 HC- Rings made from EMS138 stainless steel, ceramic balls

1 2 3 **Special feature designation** These numerals designate a special design feature, such as grease, or a bearing geometry, or a bearing suitable for high temperature applications, etc.

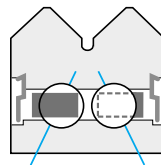


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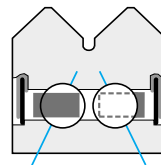
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shielded



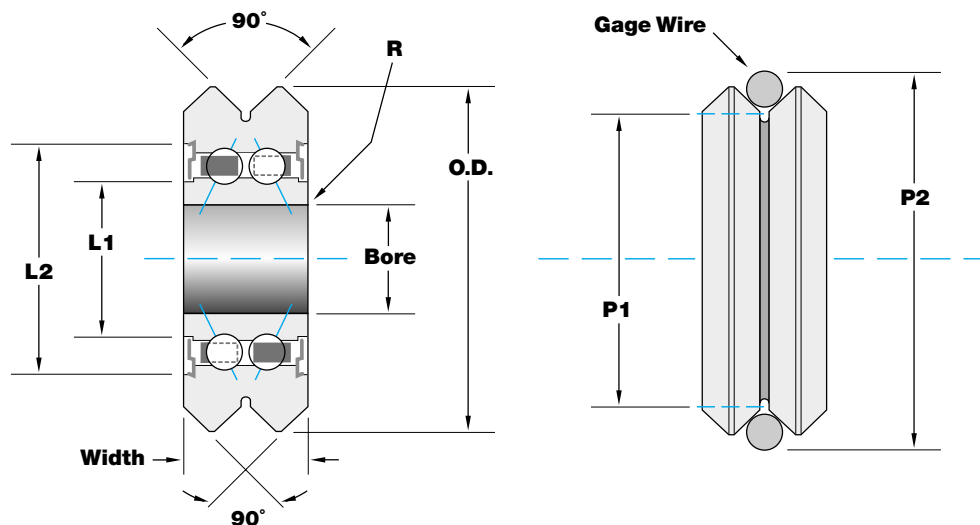
sealed

## DOUBLE V GUIDE WHEEL DIMENSIONS AND LOAD RATINGS

Bearing Part Number	Interchange Number	Basic Bearing Dimensions						Profile Dimensions			Basic Load Ratings (lbs.)		
		Bore +.0000 -.0003	O.D. ±.005	Width +.0000 -.0050	L1 Land	L2 Land	R Radius*	P1 Ref.	P2 ±.002	Gage Wire Diam.	Cr (dynamic) Radial Load	Cor (static) Radial Load	Coa (static) Axial Load
<b>W1FF</b>	<b>W1</b>	.1875	.771	.3100	.314	.564	.012	.625	.851	.0937	500	320	145
<b>W1LL</b>	<b>W1X</b>												
<b>W1LLSS</b>	<b>W1SSX</b>												
<b>W2FF</b>	<b>W2</b>	.3750	1.210	.4375	.530	.797	.012	1.000	1.302	.1250	910	750	300
<b>W2LL</b>	<b>W2X</b>												
<b>W2LLSS</b>	<b>W2SSX</b>												
<b>W3FF</b>	<b>W3</b>	.4724	1.803	.6250	.640	1.005	.024	1.500	1.953	.1875	1710	1350	600
<b>W3LL</b>	<b>W3X</b>												
<b>W3LLSS</b>	<b>W3SSX</b>												
<b>W4FF</b>	<b>W4</b>	.5906	2.360	.7500	.878	1.395	.024	2.000	2.604	.2500	3260	2750	1055
<b>W4LL</b>	<b>W4X</b>												
<b>W4LLSS</b>	<b>W4SSX</b>												

\*Radius clearance (Maximum collet radius on shaft which bearing corner will clear.)

Consult Schatz's engineering department for bearing life and load ratings at specific application loads and speeds.



**SCHATZ BEARING CORPORATION**

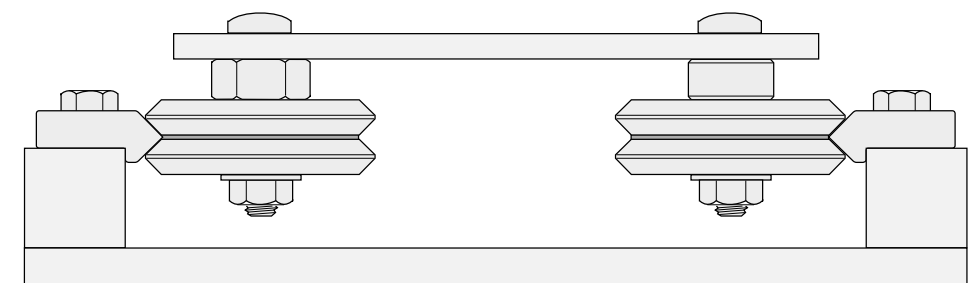
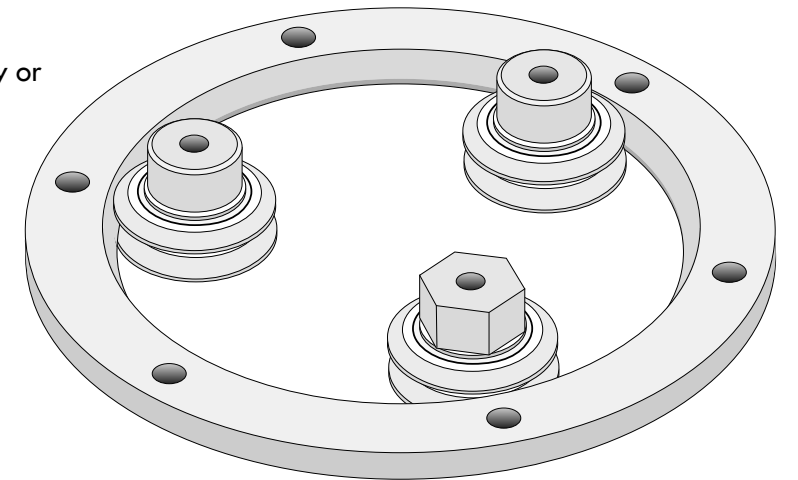
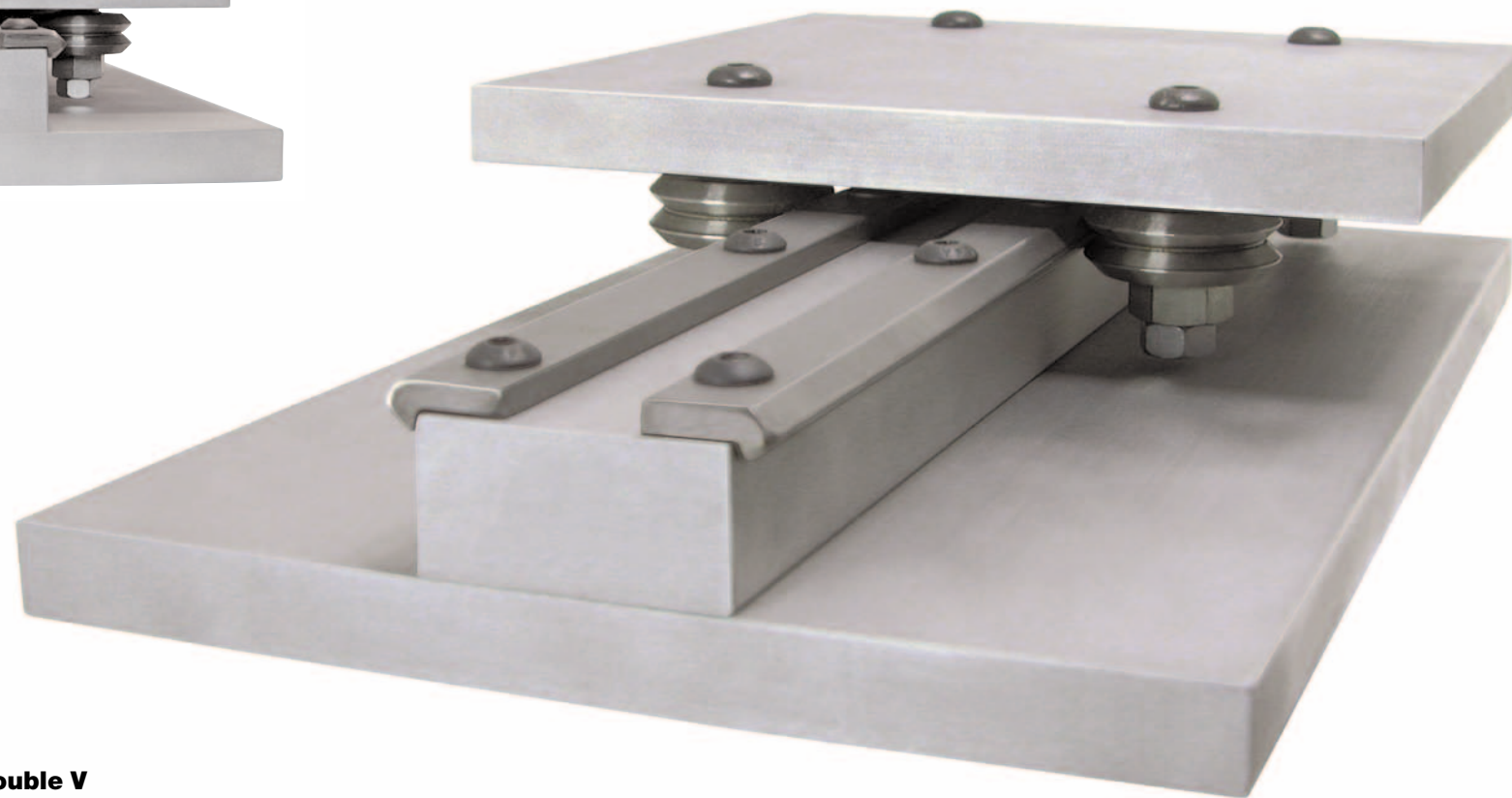
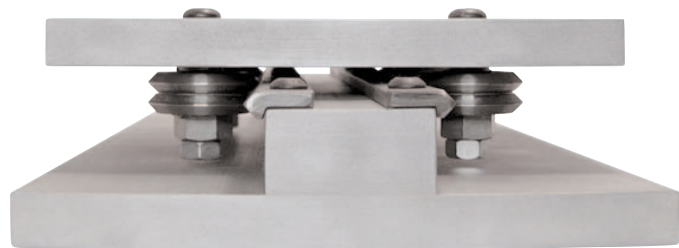
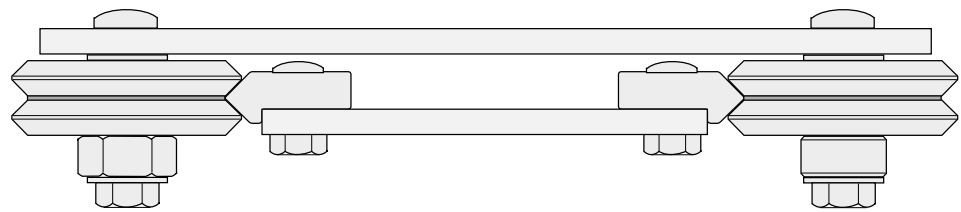
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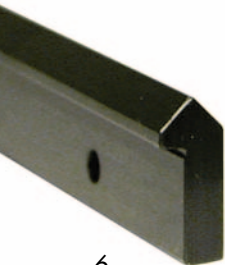
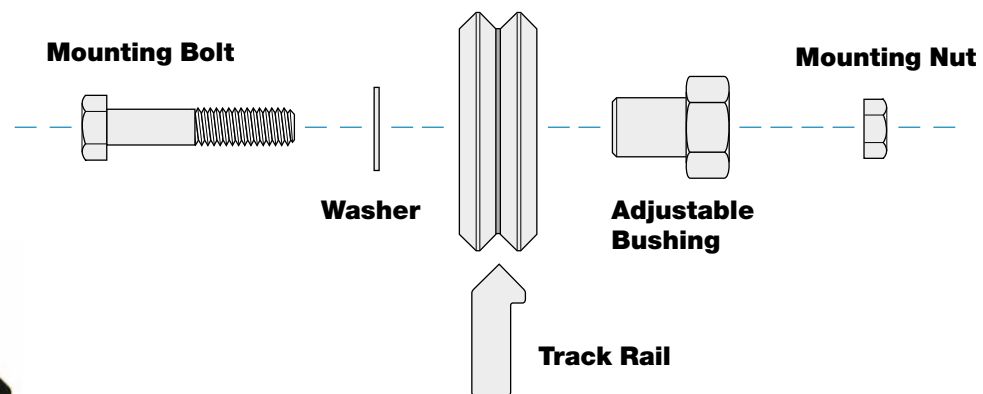
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Guide wheels can be mounted vertically or horizontally to suite differing space and application requirements. Additionally, guide wheels can be used to support rotary motion.



**Schatz Double V Precision Bearing**

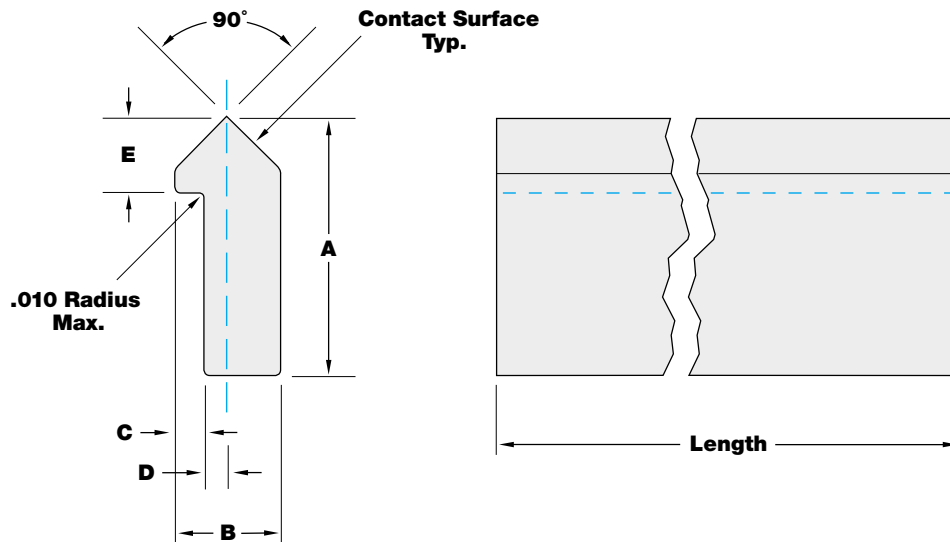




## GUIDE WHEEL TRACK RAILS

Carbon Steel Rails		Stainless Steel Rails		Basic Track Rail Dimensions				
Track Rail Number	Interchange Number	Track Rail Number	Interchange Number	A	B	C	D	E
<b>TR1</b>	<b>T1</b>	<b>TR1SS</b>	<b>T1SS</b>	.437	.187	.062	.031	.125
<b>TR2</b>	<b>T2</b>	<b>TR2SS</b>	<b>T2SS</b>	.625	.250	.093	.031	.187
<b>TR3</b>	<b>T3</b>	<b>TR3SS</b>	<b>T3SS</b>	.875	.343	.109	.062	.250
<b>TR4</b>	<b>T4</b>	<b>TR4SS</b>	<b>T4SS</b>	1.062	.437	.125	.093	.312

Length (in feet): 1, 2, 3, 4, 5, and 6. Custom lengths available upon request.



### Carbon Track Rail Details:

Material: Medium Carbon Steel.  
Contact surface hardened Rc 58 min. and polished.

### Stainless Steel Track Rail Details:

Material: 420 Stainless Steel.  
Contact surface hardened Rc 48 min. and polished.

Area below contact surface left unhardened to permit drilling holes for mounting.  
All track rails are available unhardened. Use **TRS**- prefix when ordering.

When ordering, specify number of pieces, rail number, and length.

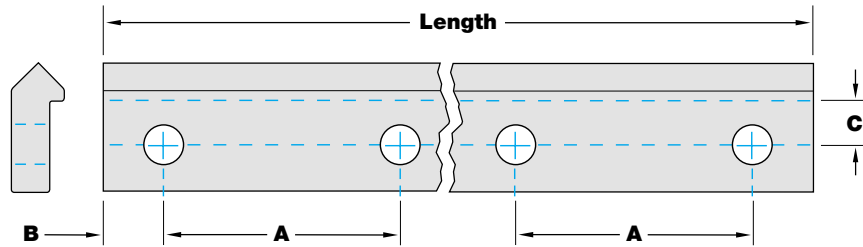
Example: 4 **TR2**, 5 (Four pieces, Hardened **TR2** rail, Five feet long)

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## STANDARD HOLE SPACING

Carbon Steel Rails		Stainless Steel Rails		Track Rail Hole Layout Dimensions					
Track Rail Number	Interchange Number	Track Rail Number	Interchange Number	Length ±.015	Number of Holes	Hole Diam.	A ±.005	B ±.005	C ±.005
<b>TR 1-100</b>	<b>T1-1250-7</b>	<b>TR 1SS-100</b>	<b>T1SS-1250-7</b>	12.50	7	5/32	2.000	.25	.156
<b>TR 1-196</b>	<b>T1-2450-13</b>	<b>TR 1SS-196</b>	<b>T1SS-2450-13</b>	24.50	13				
<b>TR 1-292</b>	<b>T1-3650-19</b>	<b>TR 1SS-292</b>	<b>T1SS-3650-19</b>	36.50	19				
<b>TR 1-388</b>	<b>T1-4850-25</b>	<b>TR 1SS-388</b>	<b>T1SS-4850-25</b>	48.50	25				
<b>TR 1-484</b>	<b>T1-6050-31</b>	<b>TR 1SS-484</b>	<b>T1SS-6050-31</b>	60.50	31				
<b>TR 1-580</b>	<b>T1-7250-37</b>	<b>TR 1SS-580</b>	<b>T1SS-7250-37</b>	72.50	37				
<b>TR 2-101</b>	<b>T2-1263-5</b>	<b>TR 2SS-101</b>	<b>T2SS-1263-5</b>	12.63	5	13/64	3.000	.31	.219
<b>TR 2-197</b>	<b>T2-2463-9</b>	<b>TR 2SS-197</b>	<b>T2SS-2463-9</b>	24.63	9				
<b>TR 2-293</b>	<b>T2-3663-13</b>	<b>TR 2SS-293</b>	<b>T2SS-3663-13</b>	36.63	13				
<b>TR 2-389</b>	<b>T2-4863-17</b>	<b>TR 2SS-389</b>	<b>T2SS-4863-17</b>	48.63	17				
<b>TR 2-485</b>	<b>T2-6063-21</b>	<b>TR 2SS-485</b>	<b>T2SS-6063-21</b>	60.63	21				
<b>TR 2-581</b>	<b>T2-7263-25</b>	<b>TR 2SS-581</b>	<b>T2SS-7263-25</b>	72.63	25				
<b>TR 3-102</b>	<b>T3-1275-5</b>	<b>TR 3SS-102</b>	<b>T3SS-1275-5</b>	12.75	5	9/32	3.000	.38	.313
<b>TR 3-198</b>	<b>T3-2475-9</b>	<b>TR 3SS-198</b>	<b>T3SS-2475-9</b>	24.75	9				
<b>TR 3-294</b>	<b>T3-3675-13</b>	<b>TR 3SS-294</b>	<b>T3SS-3675-13</b>	36.75	13				
<b>TR 3-390</b>	<b>T3-4875-17</b>	<b>TR 3SS-390</b>	<b>T3SS-4875-17</b>	48.75	17				
<b>TR 3-486</b>	<b>T3-6075-21</b>	<b>TR 3SS-486</b>	<b>T3SS-6075-21</b>	60.75	21				
<b>TR 3-582</b>	<b>T3-7275-25</b>	<b>TR 3SS-582</b>	<b>T3SS-7275-25</b>	72.75	25				
<b>TR 4-104</b>	<b>T4-1300-4</b>	<b>TR 4SS-104</b>	<b>T4SS-1300-4</b>	13.00	4	11/32	4.000	.50	.375
<b>TR 4-200</b>	<b>T4-2500-7</b>	<b>TR 4SS-200</b>	<b>T4SS-2500-7</b>	25.00	7				
<b>TR 4-296</b>	<b>T4-3700-10</b>	<b>TR 4SS-296</b>	<b>T4SS-3700-10</b>	37.00	10				
<b>TR 4-392</b>	<b>T4-4900-13</b>	<b>TR 4SS-392</b>	<b>T4SS-4900-13</b>	49.00	13				
<b>TR 4-488</b>	<b>T4-6100-16</b>	<b>TR 4SS-488</b>	<b>T4SS-6100-16</b>	61.00	16				
<b>TR 4-584</b>	<b>T4-7300-19</b>	<b>TR 4SS-584</b>	<b>T4SS-7300-19</b>	73.00	19				



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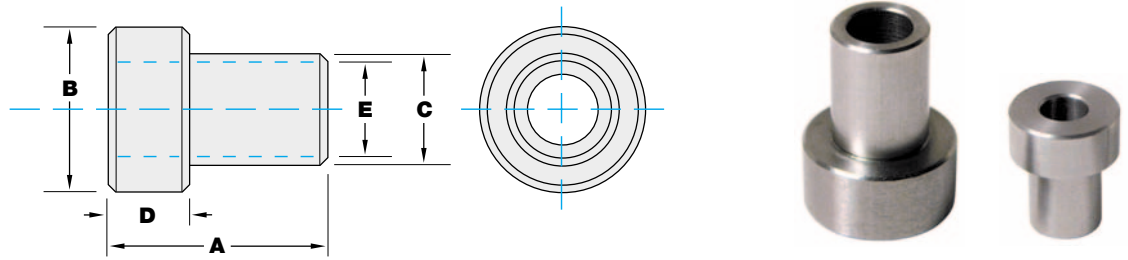
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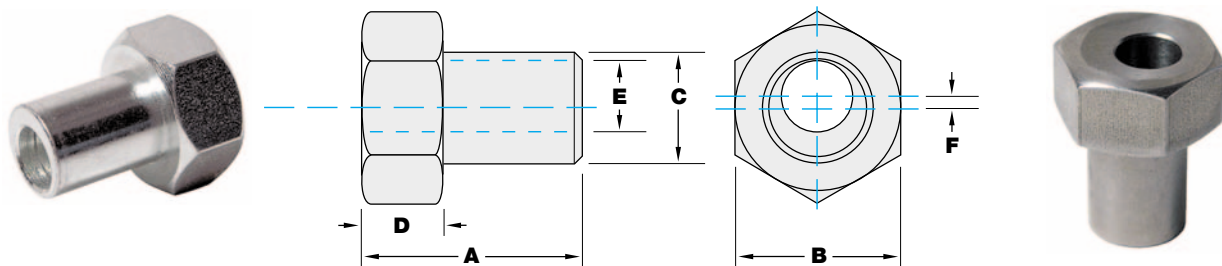
## STATIONARY BUSHINGS

Part Number	Interchange Number	Stainless Steel		Stationary Bushing Dimensions				
		Part Number	Interchange Number	A	B	C	D	E
<b>BS1</b>	<b>B1</b>	<b>BS1SS</b>	<b>B1SS</b>	.550	7/16	.1873	.250	.140
<b>BS2</b>	<b>B2</b>	<b>BS2SS</b>	<b>B2SS</b>	.706	9/16	.3748	.281	.250
<b>BS3</b>	<b>B3</b>	<b>BS3SS</b>	<b>B3SS</b>	.990	3/4	.4722	.375	.312
<b>BS4</b>	<b>B4</b>	<b>BS4SS</b>	<b>B4SS</b>	1.177	7/8	.5904	.437	.375



## ADJUSTABLE BUSHINGS

Part Number	Interchange Number	Stainless Steel		Adjustable Bushing Dimensions					
		Part Number	Interchange Number	A	B	C	D	E	F
<b>BA1</b>	<b>BX1</b>	<b>BA1SS</b>	<b>BX1SS</b>	.550	7/16	.1873	.250	.140	.012
<b>BA2</b>	<b>BX2</b>	<b>BA2SS</b>	<b>BX2SS</b>	.706	9/16	.3748	.281	.250	.024
<b>BA3</b>	<b>BX3</b>	<b>BA3SS</b>	<b>BX3SS</b>	.990	3/4	.4722	.375	.312	.042
<b>BA4</b>	<b>BX4</b>	<b>BA4SS</b>	<b>BX4SS</b>	1.177	7/8	.5904	.437	.375	.060



Material: Leaded screw stock, zinc plated to resist corrosion.

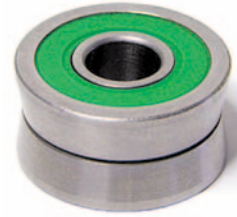
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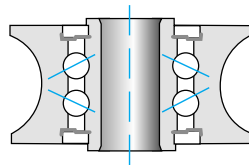
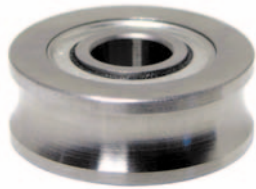
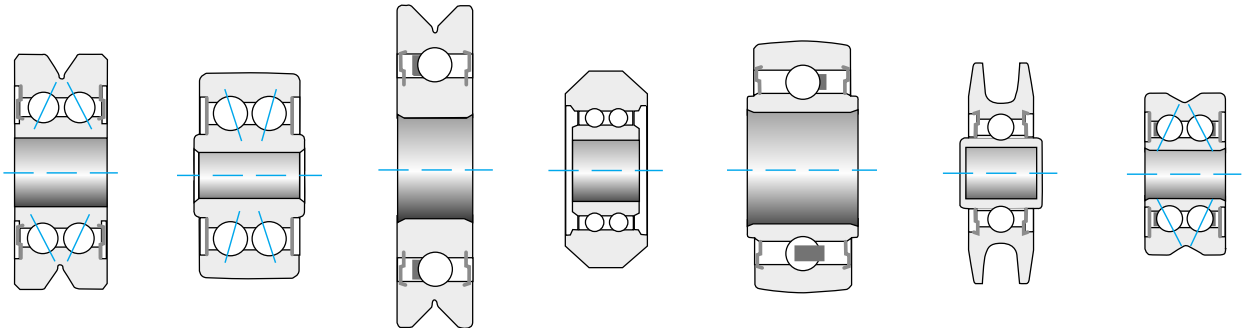
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Schatz has designed and manufactured many different bearing configurations that are used in linear motion, cam follower, and guide applications. While these configurations are far too numerous to list here, the following diagrams represent a handful of examples of some of the design options that we offer.

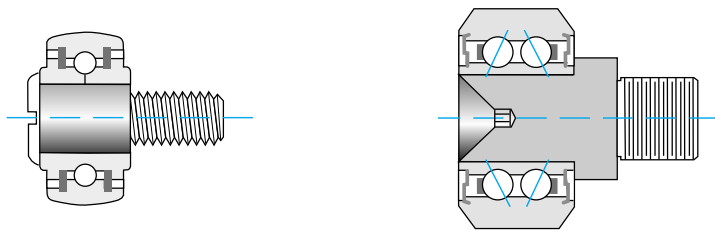


## Outer Ring Shapes



Schatz can custom design and manufacture parts and assemblies to meet the specific requirements of your particular application.

## Integral Studs or Integral Mounting Hardware



## High Temperature Applications

- Rings heat stabilized for operation in elevated temperatures
- Steel cages
- High temperature grease
- High temperature seal material

**High Capacity Bearings** - full complement for high load capacity

**Special Enclosures** - numerous seal and shield options to suit application needs

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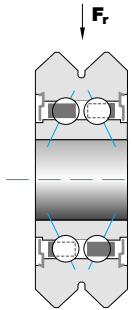
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## BASIC LOAD RATINGS

### Basic Dynamic Radial Load Rating $C_r$

Schatz Guide Wheel basic dynamic radial load ratings are the radial bearing loads that will give a basic rating life of 1,000,000 revolutions. The basic dynamic load ratings have been determined in accordance with the methods prescribed by ISO, AFBMA, and ANSI.



### Basic Static Radial Load Rating $C_{or}$

Basic static radial load rating is the static radial load that creates a maximum Hertzian contact stress at the center of the most heavily loaded ball/raceway contact of 609ksi. Under this stress, a permanent deformation of rolling element and raceway will occur. The depth of the deformation is approximately .0001 times the diameter of the ball.

Figure 1:  
Guide Wheel Bearing Under Radial Load

### Basic Static Axial Load Rating $C_{oa}$

Basic static axial load rating is the static axial load that creates a maximum Hertzian contact stress at the center of the most heavily loaded ball/raceway contact of 609ksi. Under this stress, a permanent deformation of rolling element and raceway will occur. The depth of the deformation is approximately .0001 times the diameter of the ball.

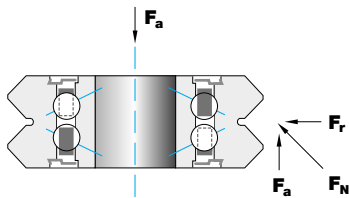


Figure 2:  
Guide Wheel Bearing Under Axial Load

For a guide wheel bearing, the axial load is applied through the V-shaped outer ring and mating guide rail. As shown in figure 2, this axial load will induce a reactive radial load and moment load.

Schatz Bearing Basic P/N	$C_{or}$ (lbs.)	$C_{oa}$ (lbs.)
W1	320	145
W2	750	300
W3	1,350	600
W4	2,750	1,055

## BEARING FATIGUE LIFE

The fatigue life of a guide wheel bearing is defined by the number of revolutions the bearing will operate before the first signs of fatigue occur. The  $L_{10}$  life is the basic rating life in hours that 90% of a sufficiently large group of apparently identical bearings will operate before the first signs of fatigue appear.

Use the formula below to calculate  $L_{10}$  life for bearings operating under radial and axial load as shown:

$$L_{10} = \frac{16,667}{S} * \left( \frac{C_r}{F_r + ZF_a} \right)^3$$

Where:

$F_r$  = Applied Radial Load       $Z$  = Factor  
 $F_a$  = Applied Axial Load       $C_r$  = Schatz Bearing  
 $S$  = Bearing Speed (RPM)      Dynamic Load Rating  
 $L_{10}$  = Life (hrs.)      (see table to above)

Schatz Bearing Basic P/N	$C_r$ (lbs.)	$Z$
W1	500	2.20
W2	910	2.50
W3	1,740	2.25
W4	3,260	2.45

## LIFE ADJUSTMENT FACTORS

Many life adjustment factors can be applied to the calculated bearing life as stated above. These factors are simply multiplied by the bearing life to determine the final expected operating life of the bearing.

$$L_{10} \text{ (calculated)} * A1 * A2 * A3 = \text{Adjusted Bearing Life}$$

The three life adjustment factors that Schatz recommends using are:

- A1** – life adjustment factor for reliability
- A2** – life adjustment factor for material
- A3** – life adjustment factor for lubrication



## SCHATZ BEARING CORPORATION

A leading producer of high-quality ball bearings and motion control products.

10 Fairview Avenue, Poughkeepsie, New York 12602

Tel: 845.452.6000 • schatzbearing.com • Fax: 845.452.1660

### Reliability (A1):

All formulas are based on an **L<sub>10</sub>** life. If a different life needs to be calculated, use the following table for the adjustment factor:

Reliability (%)	90 ( <b>L<sub>10</sub></b> )	95 ( <b>L<sub>5</sub></b> )	96 ( <b>L<sub>4</sub></b> )	97 ( <b>L<sub>3</sub></b> )	98 ( <b>L<sub>2</sub></b> )	99 ( <b>L<sub>1</sub></b> )
Factor ( <b>A1</b> )	1.00	.62	.53	.44	.33	.21

### Material (A2):

There are several material options for use in linear guide wheel bearings. The following chart shows the life adjustment factors for the materials offered:

Material Type	52100	440C	Schatz EMS 138
Factor ( <b>A2</b> )	2.2	.6	4.2

### Lubrication (A3):

Lubrication and the presence of an elastic-hydrodynamic lubrication film is critical to achieving proper bearing life. Please consult the Schatz engineering department for information on determining the lubrication factor for a specific application. While the calculation for the specific lubrication film thickness is complex, in general, choosing a grease with a base oil that has a high viscosity is more suitable for low to moderate speed and high load applications. Alternatively, grease with a low viscosity base oil is more suitable for high speed applications with light to moderate loads.

Schatz's standard grease for the guide wheel bearings is Chevron SRI, which is a good general purpose grease with good water resistance. The following is a table of other greases that can be used in guide wheel applications.

Name	Manufacturer	Mil-SPEC	Lube Type	Temperature Range (°F)	Oil Type	Thickener Type	Color	Viscosity @ 100°F	Viscosity @ 210°F	Characteristics/ Application
<b>Aeroshell 22</b>	Shell Oil Co.	MIL-PRF-81322	Grease	-80 to 350	SH	Microgel	Dark Grey	30.5 cSt	5.7 cSt	General purpose
<b>Aeroshell 33</b>	Shell Oil Co.	MIL-PRF-23827	Grease	-99 to 250	SH/Ester	Lithium	Green	14.2 cSt	3.4 cSt	Aircraft, Gen. purpose, Corrosion-inhibiting
<b>Aeroshell 7</b>	Shell Oil Co.	MIL-PRF-23827	Grease	-100 to 300	Synthetic	Clay	Amber	10.3 cSt	3.1 cSt	Wide temperature range
<b>Aeroshell 22</b>	Shell Oil Co.	—	Grease	-65 to 275	Mineral	Lithium	Amber	189 cSt	15.6 cSt	General purpose
<b>Asonic HQ72-102</b>	Kluber	—	Grease	-40 to 356	Ester	Polyurea	Beige	100 cSt	12 cSt	High temperature
<b>Beacon 325</b>	Exxon Corp.	MIL-PRF-23827	Grease	-65 to 250	Diester	Lithium	Light Tan	12 cSt	—	General purpose
<b>Braycote 815</b>	Castrol	—	Oil	-100 to 400	PFPE	—	—	148 cSt	45 cSt	Wide temperature range, Chemically inert
<b>Braycote 601 EF</b>	Castrol	—	Grease	-112 to 400	PFPE	—	Off-White	148 cSt	45 cSt	High-vacuum grease
<b>Braycote Micronic 1613</b>	Castrol	—	Grease	-99 to 400	PFPE	—	Off-White	148 cSt	45 cSt	High-vacuum grease, Long shelf life
<b>Isoflex NBU 15</b>	Kluber	—	Grease	-40 to 265	SH/Est./Min.	Alkaline Earth	Beige	21 cSt	4.7 cSt	High speed
<b>Krytox 240 AC</b>	Dupont	—	Grease	-30 to 550	Fluorinated	Fluorotelomer	White	270 cSt	—	Stable at high temperatures
<b>Mobil 28</b>	Mobil Oil	MIL-PRF-81322	Grease	-65 to 350	SH	Clay	Dark Red	29.3 cSt	—	Wide temperature range
<b>Mobil SHC 220</b>	Mobil Oil	—	Grease	-40 to 350	SH	Lithium	Red	220 cSt	23.8 cSt	High wear resistance, Corrosion resistance
<b>RheoTemp 500</b>	NYE	—	Grease	-65 to 350	Diester	Sodium	Dark Blue	51 cSt	8.9 cSt	High speed, Moderate temperature
<b>RheoLube 2000</b>	NYE	—	Grease	-49 to 257	SH	Organic Gel	Light Tan	110 cSt	15 cSt	Low temp. operation, Vacuum Applications
<b>RheoLube 374-C *</b>	NYE	—	Grease	-40 to 248	SH	Lithium	Tan	60.7 cSt	9.5 cSt	Superior washout characteristics
<b>RheoTemp 700B</b>	NYE	—	Grease	-40 to 347	Polyester	Lithium	Blue Black	51 cSt	8.9 cSt	High speed, High temperature
<b>SRI-2</b>	Chevron Oil Co.	—	Grease	-20 to 350	Mineral	Polyurea	Blue/Green	100 cSt	11 cSt	General purpose

\* Replacement for Andok C

SH- Synthetic Hydrocarbon



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