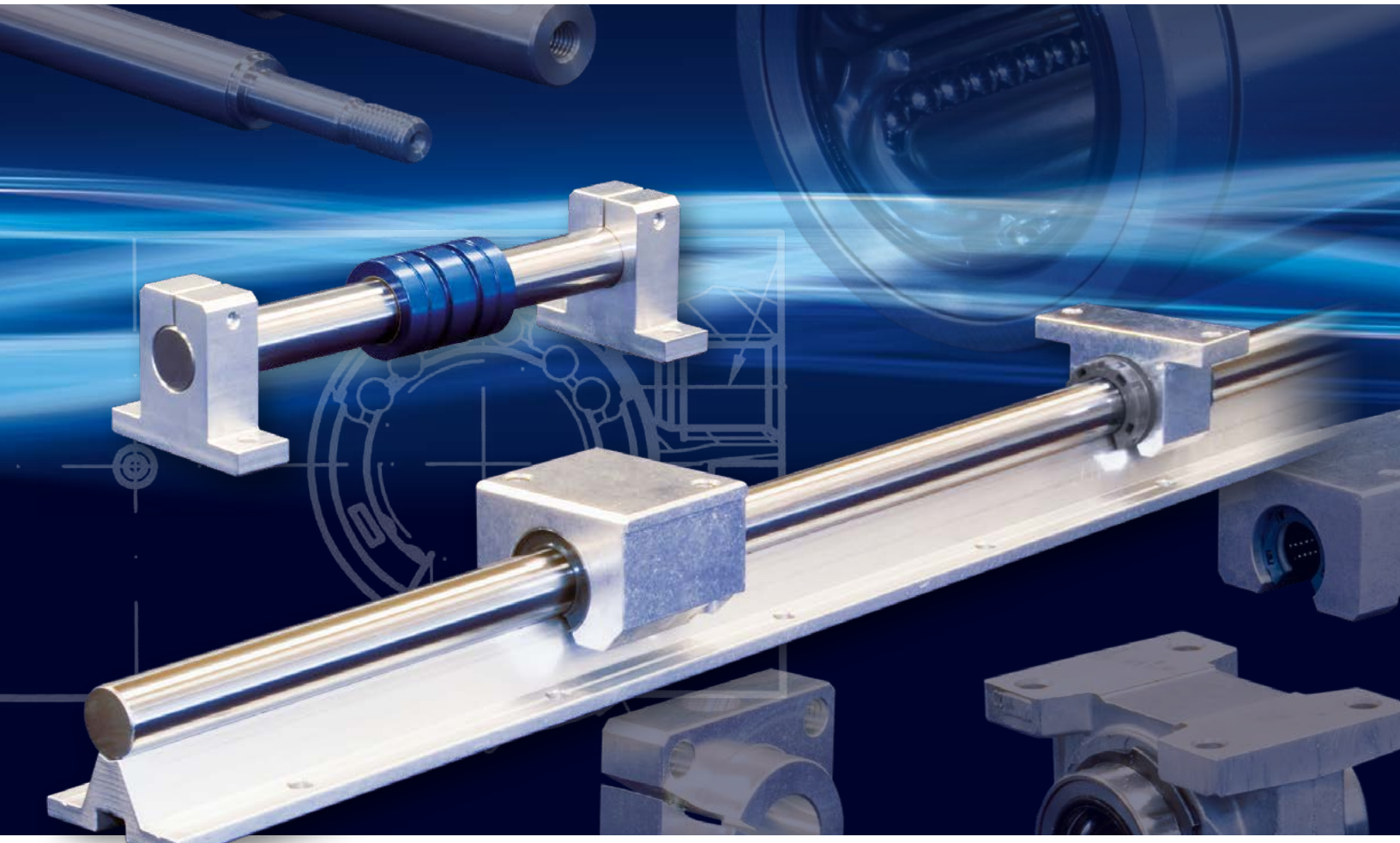


Linear-Technology - Inch

ICB International Customized Bearings

Product description

Linearguidings are used to solve linearmovement-requirements in various fields of engineering and machine building. As they contribute significantly in designing a machine technically and commercially, linearguidings gained in importance these days.

This catalogue introduces powerful linear-roundrail-components, mainly precision shafts, linear ballbushings, linear slidebushings, linear housing units and construction components.

Besides the mentioned standard-components, also special designs are available. These will be manufactured following a customer-drawing or will be designed based on given technical parameters.

We will be pleased to support you with our knowhow and experience.

Applications for Linear-Roundrail-Technology-Products:

- Food industry
- Printing machines
- Packaging machines
- Medical industry
- Optical scanner
- Robots
- Textile industry
- Semiconductor industry
- Woodworking machines
- Handling systems

Temperature and Friction

The temperature range, these linear ball bearings are suitable for, is between -20 and +80° C.
For higher temperatures we recommend all-steel bearings with special lubricants.
The coefficient of friction depends on the quality of the seals as well as on pressure and lubrication. The linear bearings have a Coefficient of Friction of 0.001 to 0.005.

Construction, Design and Materials

- Linear housings - aluminium extruded section
  Housing units can be fitted with all the linear bearings contained in this catalogue.
  Aluminium housings are made of alloy EN AW-6060 or EN AW-6082.
- Linear-housings - graphite pellet / aluminium injection mouldings.
  The housing units consist of standard linear ball bushings or self aligning linear ball bushings, slide bushings and cast iron- or aluminium injection moulding housings.
  The bores for accepting linear ball bearings are generally H7.
  Further tolerance information is given elsewhere in this catalogue.

Assembly Notes

The linear ball bearings mentioned in this catalogue are designed for bores to tolerance H7. They can be retained by retaining rings or clips. Open bearings are held in the radial-axial fixing bore by means of screws, dowels or lubricating slotted screws.
Standard linear ball bearings can also be pre-loaded with JS6 to M6 tolerances.

For safety and economic reasons however we strongly recommend the use of preassembled housing units.

Operating Life and Working Load for Linear Ball Bearings

Working Load

The load conditions listed in the tables apply to the linear ball bearings described in this catalogue in combination with precision steel shafts.

1. The load is applied at 90° to the horizontal plane

2. The surface hardness is HRC 62±2.

The following formula applies to configurations other than those given:

$$WR = \frac{P}{K_\theta \times K_S \times K_L}$$

W_R = required dynamic load (N)
P = resultant of externally applied loads (N)
K_S = hardeness factor of shaft (fig. 1)
K_θ = factor for direction of resultant load
K_L = factor for operating life

Direction of Load

For load correction factor K_θ applicable to any linear ball bearing or linear housing, please enquire.

Shaft Surface Hardness

If a shaft does not conform to the HRC 62±2 criteria, a surface hardness correction factor K_S applies.

Operating Life

The correction factor K_L for operating life expectancy can be obtained from fig. 2.

Figure 1

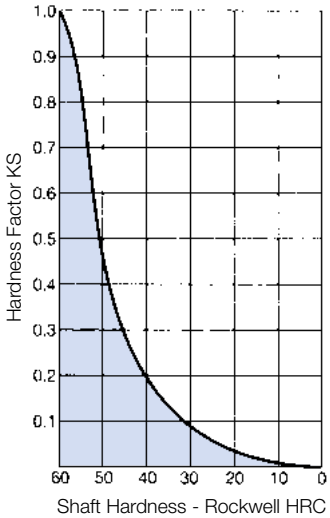
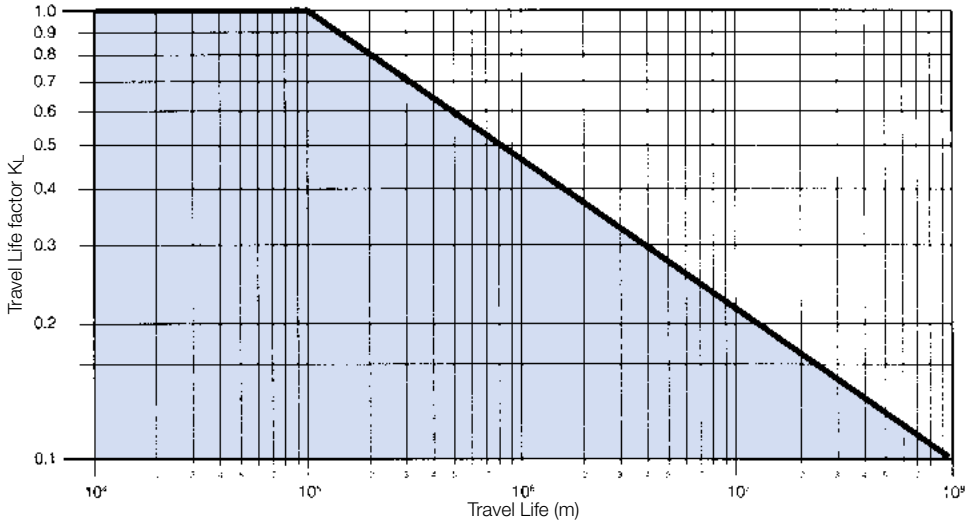


Figure 2



Load Limit

The load limit is the maximum load which may be applied to the bearing. Any application must be analysed in advance in order to ensure that maximum and / or shock laods will not exceed the load limits.

Dynamic Load Conditions

The dynamic load condition refers to the maximum continuos load which may be applied to a bearing, with a 90 % propability that a working life of 100 km can be achieved under normal operating conditions.
However, it must be considered that extremly short strokes, and the direction of load application, are also deciding factors.

Load Calculation

When designing a linear motion system, the way in which operating variables will influence performance must be considered. The following examples show how the position of the load and the load center can influence selection of the product.

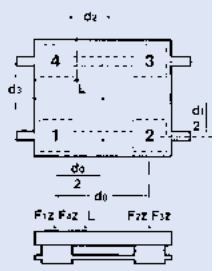
When considering an application, every force acting on the system must be evaluated in order to enable the most suitable product to be selected.

Terms:

d_0 = distance between centerlines of the bearing housings
d_1 = distance between centerlines of shafts
d_2 = distance between centerlines of carriage and center of gravity
d_3 = distance between centerline of carriage and center of gravity
L = Load (N)
F_{NX} = Force in direction of X-axis (N)
F_{NY} = Force in direction of Y-axis (N)
F_{NZ} = Force in direction of Z-axis (N)

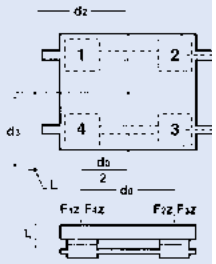
$$F_{1Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{2Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{3Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{4Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$

Horizontal Application I
At the time of movement with uniform velocity or at the time of stop.



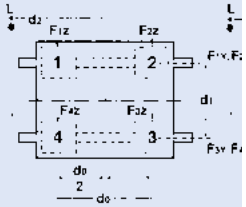
$$F_{1Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{2Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{3Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{4Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0} - \frac{L}{2}\cdot\frac{d_3}{d_1}$$

Horizontal Application II
At the time of movement with uniform velocity or at the time of stop.

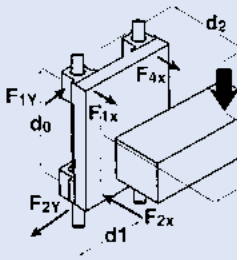


$$F_{1Y} \sim F_{4Y} = \frac{L}{2}\cdot\frac{d_3}{d_1}$$
$$F_{1Z} = F_{4Z} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0}$$
$$F_{2Y} = F_{3Y} = \frac{L}{4} + \frac{L}{2}\cdot\frac{d_2}{d_0}$$

Side Mounted Application
At the time of movement with uniform velocity or at the time of stop.



$$F_{1X} \sim F_{3X} = \frac{L}{2}\cdot\frac{d_2}{d_0}$$
$$F_{1Y} \sim F_{4Y} = \frac{L}{2}\cdot\frac{d_3}{d_0}$$
$$F_{1X} + F_{3X} \sim F_{2X} + F_{3X}$$
$$F_{1Y} + F_{4Y} \sim F_{2Y} + F_{3Y}$$

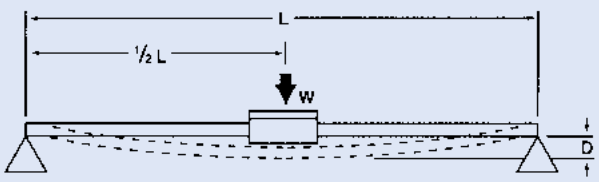


Shaft Deflection

When using hardened precision steel shafts with end supports, care must be taken to ensure that the shaft deflection within the bearing travel does not exceed the bearing performance criteria.

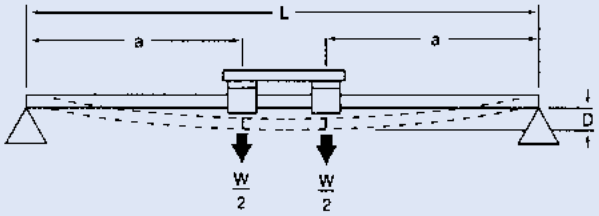
The following tables give the shaft deflection at the center of a shaft with end supports. Systems using fully supported shafts are not subjected to these deflections.

Simply Supported Shaft with Single Block



Deflection at center (D) $D = \frac{WL^3}{48\,EI}$

Simply Supported Shaft with 2 Single Blocks



Deflection at center (D) $D = \frac{Wa\,(3L^3 - 4a^2)}{48\,EI}$

Values of EI for Hardened and Ground Shafts

Shaft Ø (mm)	EI (Nm²)
5	5.838
8	38.26
10	93.41
12	193.7
16	612.2
20	1,495
25	3,649
30	7,566
40	$2{,}391 \times 10^4$
50	$5{,}838 \times 10^4$
60	$1{,}211 \times 10^5$
80	$3{,}826 \times 10^5$

Lubrication

All Linear Guiding Systems must be lubricated to ensure their function. The volume and the way of lubrication depends on the product. The definition of the re-lubrication, in terms of volume and cycles, are depending on the applications and can be calculated by our technical department. The information about grease- and oil-lubrication refer to standard industrial applications and are not obligatory. Especially in specialcases, i.e. food-industry, high temperature- or high speed-applications or short-stroke-applications, an investigation of the application is necessary as well.

Deliverycondition: All Linear ball bushings are shipped with rust preservative, that protects from corrosion and other influences during transport and storage.

Grease-lubrication: Common. Because of the trend to minimum-volumes and extended lubrication intervals, grease lubrication is useful for linear ball bushings. We recommend Klüber Isoflex NCA15.

Oil-lubrication: Possible. Useful when a central lubrication system with oil is already installed. Our recommendation is Klüberoil GEM 1-68 N.

Else: When lubricating a system initially, the lubricant has to be filled in with the shaft assembled until the lubricant is pushed out of the bushing. The lubrication cycle should be maximum 12 months or 100 km, depending on what occurs first, but it may be less due to application-specifics. Relubrication of linear ball bushings is made through a lubrication nipple. If no lubrication hole and no wipers are available the lubrication can be made through the shaft. It must be ensured that all balls obtain enough lubrication.

Precision slide bushings made of Frelon

Frelon® is a composition of Teflon® and additional materials and was developed to create superiour performance. Its intention is to ensure less friction, self lubrication, high rigidity and reduced abrasion.

Chemical resistance

Frelon® as a material is almost completely inactive. Only melted Natrium and Fluor under higher temperature effect the material.

Aluminium, anodisation and hardcoating

Precision slide bushings are made from aluminium AlMg1 SiCu. Sulfunic bath anodizing with a nickel acetate seal ensures best corrosion protection, that can be achieved with anodised coatings. Supposed the coating is correct, it is chemically inactive with a ph-value of 5-8 in most fluids. Hardcoating offers the same chemical resistance, but will be manufactured with a thickness of 50 µm, which improves the resistance of the surface.

Temperature

Precision slide bushings work in a wide temperature range: -240°C up to +260°C.

- Linear slide bushings are developed to be implemented into most industrial applications.
- We recommend the standard range (FM-series) for temperature ranges lower than -18°C, whereas FMC-series is recommended in high temperature applications.

In order to ensure the correct clearance, it is necessary to check the "real dimensions" when extreme temperatures apply.

Teflon® is a registered Trademark of Dupont Corporation

Load

Open bushings

Precision slide bushings can be installed in any situation.

- The load capacity varies depending on the system configuration.

Indication

not supported loads

- Max. lever arm ratio 2:1. The max. distance between shaft and load may not be higher than the double of the middle distance between the bearings.

Important:
Exceeding of the ratio 2:1 may cause clamping!

- The principle is not loaddependent! It is also not depending on edgeload or the applied force.

P = load
L = distance shaft - load
s = middle distance of bearings
f = load on the bearings
F = friction force for each bearing
11 = coefficient of friction force (ca. 0.25 at pause)

balance of moments:
$f \times s = L \times P$
$L/s = f/P$

calculation of friction force:
$F = f \times \mu$

Remark: The total applied friction force is 2 F.
To block the bearing, the total friction force must be equal (or higher than) P.
$P = 2\ F = 2\ f \times \mu$

PV-values

Evaluation of Slide Bushings

The capability of a Slide Bushing is given as "PV"-Value
"P" = pressure
"V" = speed or Circumferential
"PV" = P x V

max. parameters for linear slide bushings

"P" = 1034 N/cm ^{2}
"V" = 43 m/min (dry)
"PV" = 2150 N/cm ^{2} x m/min

To secure performance, all 3 parameters may not be exceeded.

formulars

A = L x d (cm ^{2})
P = WA (N/cm ^{2})
PV = P x V (N/cm ^{2} x m/min)

Assembly

The linear ball bearings are manufactured to very tight tolerances and result in smooth, almost friction-less movement. This excellent performance will be achieved only if the bearings are carefully assembled.

The alignment of the bearing and the parallelism of the shaft are the most important factors. To achieve smooth movement, two linear bearings per shaft are normally used. The housings should be carefully aligned as described below. When using tandem bearing housings, such alignment becomes superfluous.

In addition, make sure that the height of the mounting plate surface to the shaft is constant within limits of 0.0009 inch. Depending on the accuracy of the mounting surface, it may be necessary to use shims.

The housings can be fitted to the mounting plate as follows:

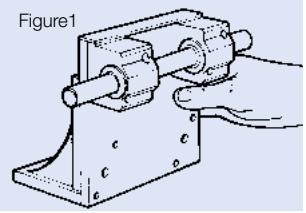


Figure1

a. Mount two housings, align them, and tighten the fixing screws. (Fig. 1)

b. Mount the second pair of housings on the opposite side of the carriage and screw the fixing screws finger tight.

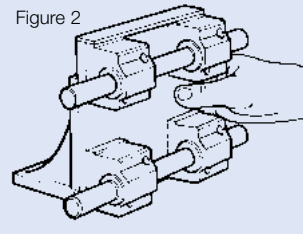


Figure 2

c. Push a sample shaft of the correct diameter and tolerance (Class L) through this pair of housings in order to align them. (Fig. 2)

d. After correct alignment of the second pair of housings tighten the fixing screws.

After properly preparing the carriage, the shafts need to be fixed on the mounting plate. To provide smooth running, the shafts must be parallel, with a tolerance of not more than 0.0009 inch over the entire length of travel. To achieve this, proceed as follows:

a. Mount one shaft, either supported at the ends or over the whole length, finger tight on the mounting plate.

b. Using an optical align and fix screws.

c. When the first shaft is fixed correctly, mount the second shaft, align, and screw finger tight.

d. Now assemble the carriage. Moving it along will pull the second shaft into alignment with the first one. (Fig. 3 & 4)

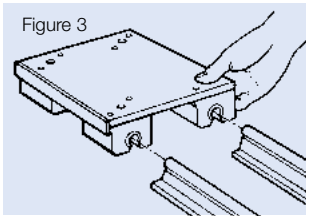


Figure 3

e. When the second shaft is fixed the process is complete. Note however that, when using continuous shaft supports, the fixing screws should be tightened when the carriage is in the vicinity. Shafts with end supports should be tightened when the carriage is at the end being fixed. (Fig. 5)

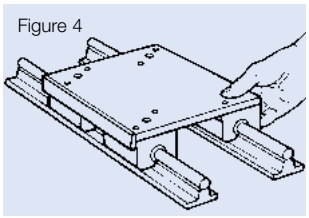


Figure 4

f. At this point another check can be carried out to ensure that the carriage is tracking as it should, i.e. that the edge of the carriage is moving parallel with the shaft. This can be done by means of a dial indicator, mounted on the edge of the carriage. When moving the carriage the indicated value should be within the stated tolerance. (Fig. 6)

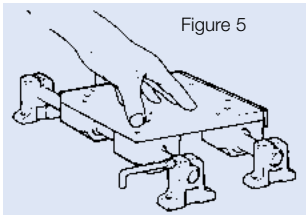


Figure 5

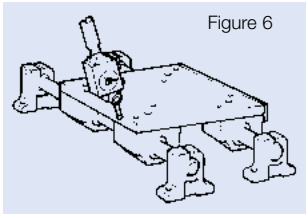
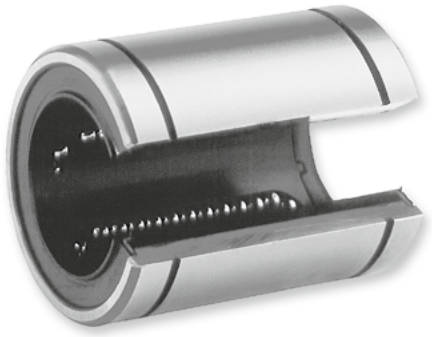


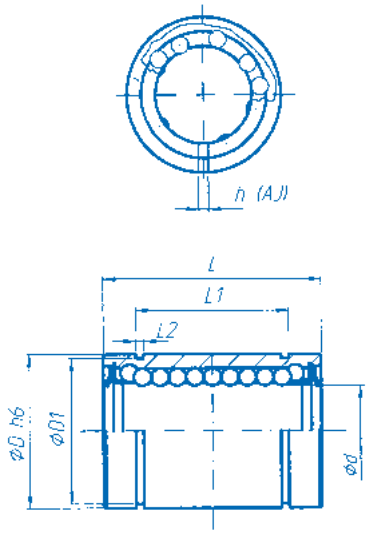
Figure 6

The outer sheel is made of steel, the cage is plastic. Balls are Grade 10. The wipers are vulcanised onto the endring. Standard linear ball bushings are available in the following versions:

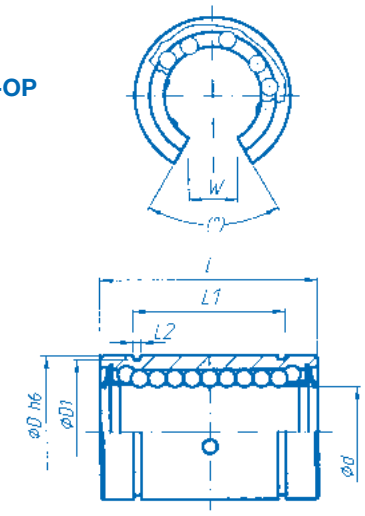
- closed
- open



LMB



LMB-OP



	Dimensions in inch									Load ratings [lbf]		Weight
Part No.	Ød	ØD	L	L1 ± 0.003	L2 ± 0.003	D1 ± 0.003	h ± 0.003	W	(°)	dyn	stat	(lbs.)
LMB-6	0.375	0.625	0.875	0.636	0.039	0.588	0.04			50	70	0.03
LMB-8	0.500	0.875	1.250	0.963	0.046	0.821	0.06	0.340	80	114	176	0.08
LMB-10	0.625	1.125	1.500	1.104	0.056	1.059	0.06	0.375	80	174	265	0.17
LMB-12	0.750	1.250	1.625	1.166	0.056	1.176	0.06	0.438	60	193	308	0.21
LMB-16	1.000	1.560	2.250	1.755	0.068	1.469	0.06	0.563	60	220	353	0.44
LMB-20	1.250	2.000	2.625	2.005	0.068	1.886	0.10	0.625	50	353	616	0.97
LMB-24	1.500	2.375	3.000	2.412	0.086	2.239	0.12	0.750	50	490	903	1.48

Ordering example

LMB-	size-	OP-		UU-		FX	
standard ball bushing		OP	open	U	seal one end	FX	radial-axial fixing hole
				UU	seal both ends		

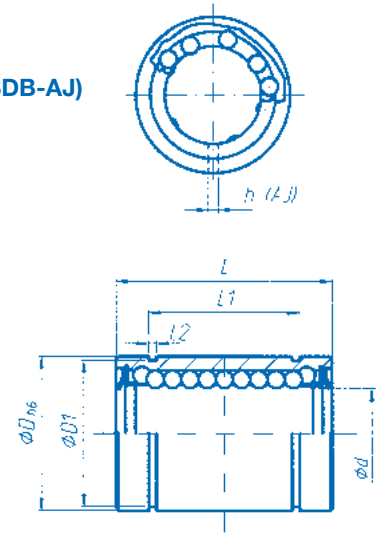
Load ratings only apply in connection with hardened and ground shafts.

SDB Linear Ball Bushing, all steel

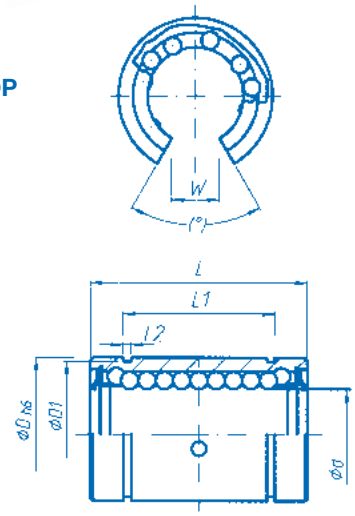
The outer sheel and the cage are made of steel. Balls are Grade 10. The wipers are vulcanised onto the endring. All steel linear ball bushings are available in the following versions:

- closed
- closed, radial adjustable
- open

SDB (SDB-AJ)



SDB-OP



Part No.	Dimensions in inch Ød	ØD	L	L1 ± 0.003	L2 ± 0.003	D1 ± 0.003	h ± 0.003	W	(°)	Load ratings [lbf] dyn	stat	Weight (lbs.)
SDB-4	0.250	0.500	0.750	0.511	0.044	0.469				24	42	0.02
SDB-6	0.375	0.625	0.875	0.636	0.044	0.588				27	51	0.03
SDB-8	0.500	0.875	1.250	0.963	0.051	0.821	0.059	0.343	80	65	114	0.08
SDB-10	0.625	1.125	1.500	1.104	0.063	1.059	0.059	0.374	80	108	172	0.17
SDB-12	0.750	1.250	1.625	1.166	0.063	1.176	0.059	0.437	60	132	227	0.21
SDB-16	1.000	1.560	2.250	1.755	0.073	1.469	0.059	0.563	60	234	405	0.4
SDB-20	1.250	2.000	2.625	2.005	0.073	1.886	0.098	0.626	50	454	800	0.98
SDB-24	1.500	2.375	3.000	2.412	0.083	2.239	0.118	0.752	50	580	971	1.49
SDB-32	2.000	3.000	4.000	3.192	0.102	2.838	0.118	1.000	50	904	1601	2.53

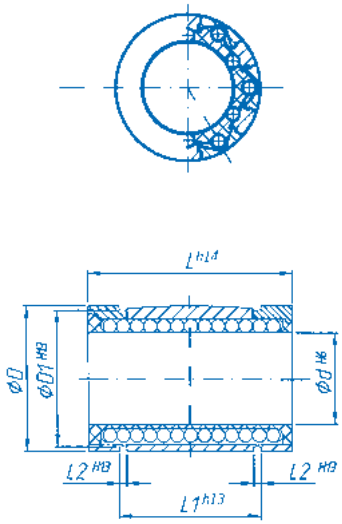
Ordering example

SDB-	size-	OP-		UU-		FX	
standard ball bushing		OP	open	U	seal one end	FX	radial-axial fixing hole
		AJ	radial adjustable from size 8	UU	seal both ends		

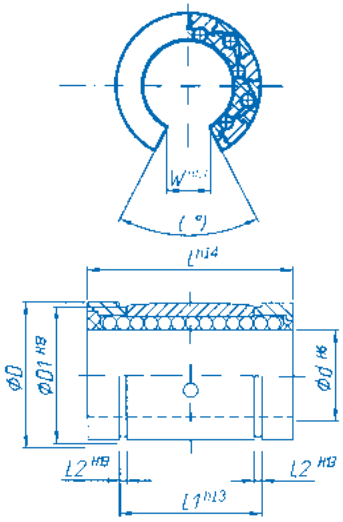
Load ratings only apply in connection with hardened and ground shafts.

These bushings consist of a very precise injection-moulded plastic carrier with clipped-in runner plates. The plastic carrier also acts as a return track and for seal fixing. The seal is made of a special polyamide material with a low coefficient of friction. The twin-lip seal is clipped into the bushing.

SBA



SBAO



	Dimensions in inch								Load ratings [lbf]		Weight
Part No.	Ød	ØD	L	L1 ± 0.003	L2 ± 0.003	D1 ± 0.003	W	(°)	dyn	stat	(lbs.)
SBA-6	0.375	0.625	0.875	0.703	0.039	0.588			94	119	0.02
SBA-8	0.500	0.875	1.250	1.032	0.046	0.821	0.313	30	229	290	0.04
SBA-10	0.625	1.125	1.500	1.112	0.056	1.059	0.375	30	400	499	0.1
SBA-12	0.750	1.250	1.625	1.272	0.056	1.176	0.438	30	470	589	0.14
SBA-16	1.000	1.560	2.250	1.886	0.068	1.469	0.563	30	850	1059	0.25
SBA-20	1.250	2.000	2.625	2.011	0.068	1.886	0.625	30	1230	1529	0.45
SBA-24	1.500	2.375	3.000	2.422	0.086	2.239	0.750	30	1479	1848	0.85

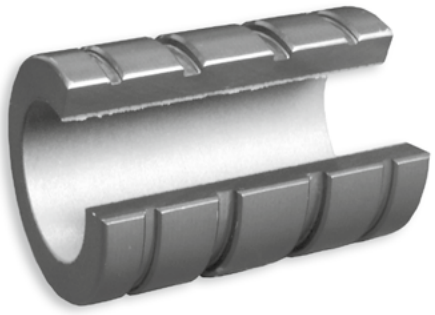
Ordering example

SBA-	0-		size-	UU-	
linear ball bushing	0	open		U	seal one end
				UU	seal both ends

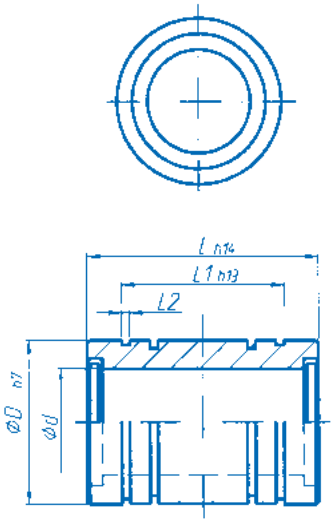
Load ratings only apply in connection with hardened and ground shafts.

FL(N) Linear Slide Bushing, Frelon®, selflubricating

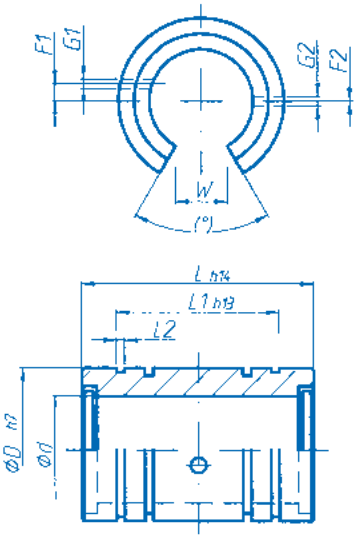
You will find detailed technical information on page 7.



FL



FLN



Part No.	Dimensions in inch Ød, min.	Ød, max.	ØD	L	L1 ± 0,003	L2 ± 0,003	W	(°)	Load ratings stat [lbf]	Weight lbs.
FL-4	0.2502	0.2511	0.500	0.750	0.519	0.041	0.188	60	300	0.009
FL-6	0.3752	0.3761	0.625	0.875	0.644	0.041	0.250	60	510	0.016
FL-8	0.5002	0.5013	0.875	1.250	0.971	0.048	0.313	60	975	0.041
FL-10	0.6252	0.6263	1.125	1.500	1.116	0.058	0.375	60	1470	0.091
FL-12	0.7503	0.7516	1.250	1.625	1.178	0.058	4.380	60	1905	0.109
FL-16	1.0003	1.0016	1.560	2.250	1.765	0.070	0.563	60	3525	0.228
FL-20	1.2504	1.2519	2.000	2.625	2.015	0.070	0.625	60	5414	0.459
FL-24	1.5004	1.5019	2.375	3.000	2.428	0.089	0.750	60	7050	0.725
FL-32	2.0004	2.0022	3.000	4.000	3.210	0.105	1.000	60	12525	1.442

Ordering example

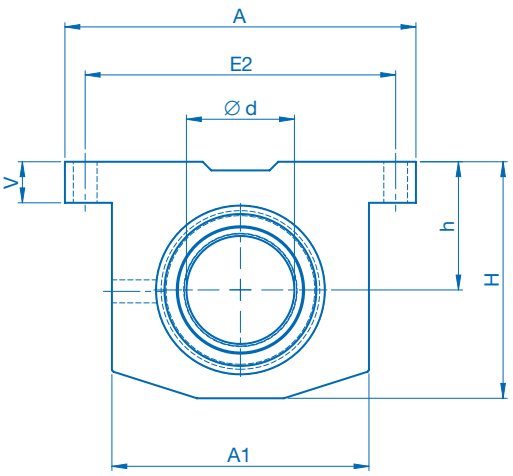
FL-	size-	C/A-		N-	
linear slide bushing		C	precision class	N	open**
		A	self-aligning		

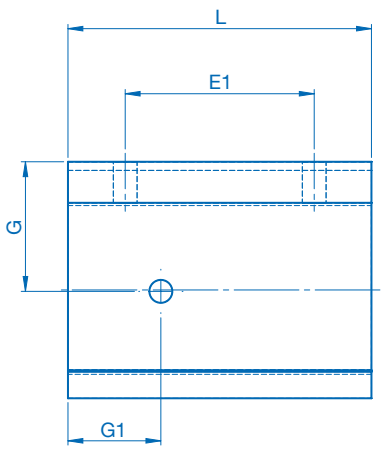
Load ratings only apply in connection with hardened and ground shafts.
** not available in self-aligning

calculation of load capacity

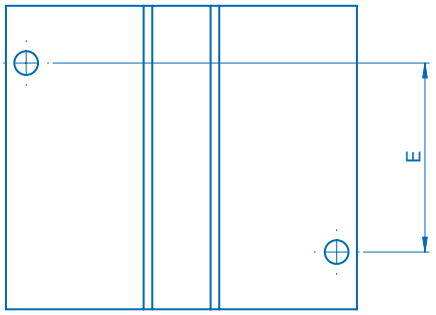
stat: max. surface pressure: 1050 N/cm²

dyn: max. surface pressure: 2150 N/cm² × m/min





- single
- integrated wipers on both ends



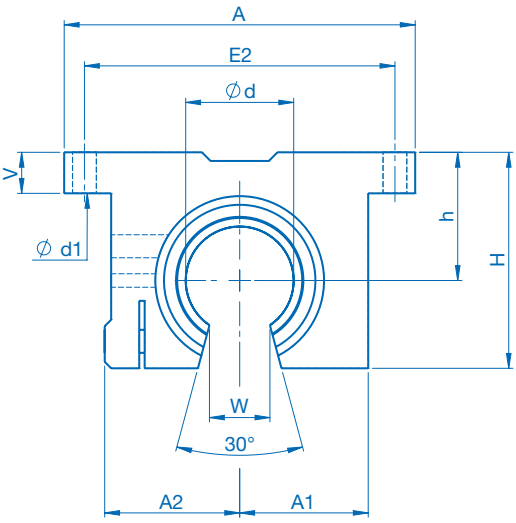
Part No.	Dimensions in inch Ød	A	A1	H	h ± 0.001	L	E1 ± 0.005	E2 ± 0.005	V	G	G1	Ød1		Weight lbs.
RSPB-8	0.500	2.00	1.38	1.25	0.687	1.69	1.00	1.688	0.25	0.69	0.84	0.16	#6	0.25
RSPB-10	0.625	2.50	1.75	1.63	0.875	1.94	1.125	2.125	0.28	0.70	0.68	0.19	#8	0.47
RSPB-12	0.750	2.75	1.88	1.75	0.937	2.06	1.25	2.375	0.31	0.94	0.72	0.19	#8	0.55
RSPB-16	1.000	3.25	2.38	2.19	1.187	2.81	1.75	2.875	0.38	1.20	0.86	0.22	#10	1.20
RSPB-20	1.250	4.00	3.00	2.81	1.500	3.63	2.00	3.500	0.44	1.50	1.20	0.22	#10	2.38
RSPB-24	1.500	4.75	3.50	3.25	1.750	4.00	2.50	4.125	0.50	1.75	1.25	0.28	0.25	3.46

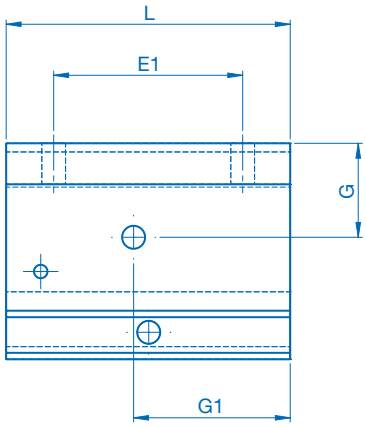
Ordering example

RSPB-	size-	K-		V
single integrated wipers		K	linear ball bushing, standard (refer to p. 9)	external front seal
		V	llinear ball bushing, all-steel (refer to page 10)	
		KS	linear ball bushing, standard, self-aligning (refer to page 11)	
		FL	linear slide bushing, self-lubricating (refer to page 12)	

- Load ratings according to the specification of the bearing
- weight value considering the standard ball bushing

- single open
- adjustable
- integrated wipers on both ends





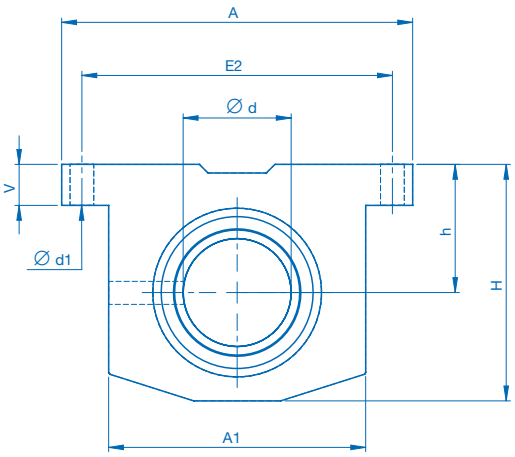
	Dimensions in inch															Weight
Part No.	Ød	A	A1	A2	H	h ±0,001	L	E1 ± 0,005	E2 ±0,005	W min.	V	G	G1	Ød1		lbs.
RSPBOA-8	0.500	2.00	0.69	0.75	1.13	0.687	1.50	1.000	1.688	0.31	0.25	0.69	0.75	0.16	#6	0.19
RSPBOA-10	0.625	2.50	0.88	0.94	1.44	0.875	1.75	1.125	2.125	0.37	0.28	0.42	0.53	0.19	#8	0.37
RSPBOA-12	0.750	2.75	0.94	1.00	1.56	0.937	1.88	1.250	2.375	0.43	0.31	1.08	0.55	0.19	#8	0.45
RSPBOA-16	1.000	3.25	1.19	1.25	2.00	1.187	2.63	1.750	2.875	0.56	0.38	1.37	0.76	0.22	#10	1.01
RSPBOA-20	1.250	4.00	1.50	1.63	2.56	1.500	3.38	2.000	3.500	0.62	0.44	1.73	1.05	0.22	#10	1.98
RSPBOA-24	1.500	4.75	1.75	1.88	2.94	1.750	3.75	2.500	4.125	0.75	0.50	2.03	1.12	0.28	0.25	2.95

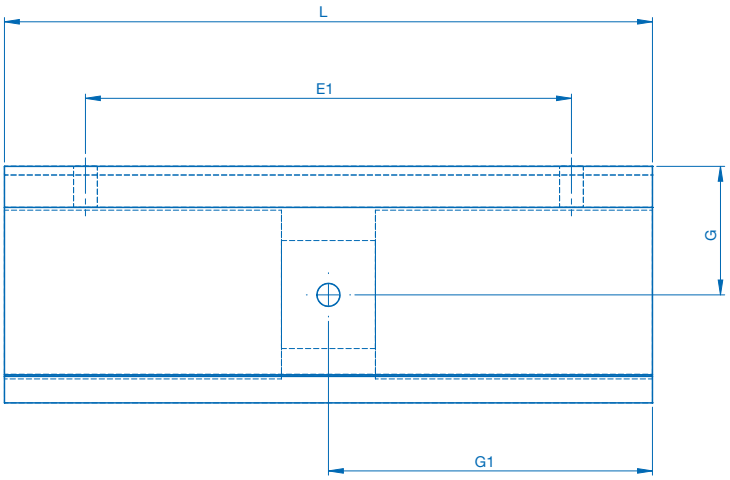
Ordering example

RSPBOA-	size-	K-		V
single integrated wipers		K	linear ball bushing, standard (refer to p. 9)	external front seal
		V	llinear ball bushing, all-steel (refer to page 10)	
		KS	linear ball bushing, standard, self-aligning (refer to page 11)	
		FL	linear slide bushing, self-lubricating (refer to page 12)	

- load ratings according to the specification of the bearing
- weight value considering the linear ball bushing, standard

- tandem closed
- integrated wipers on both ends





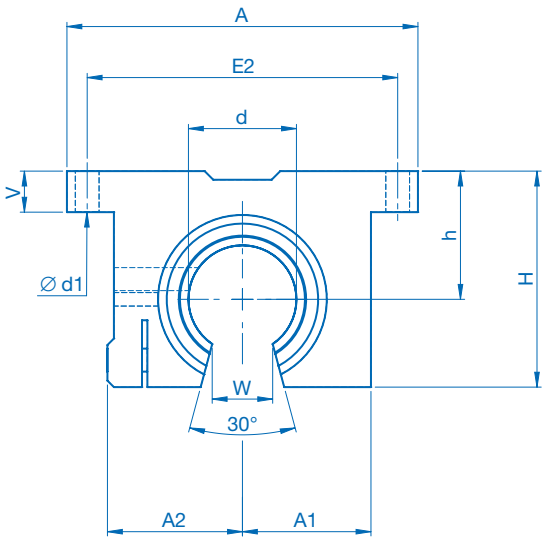
	Dimensions in inch													Weight
Part No.	Ød	A	A1	H	h ±0,001	L	E1 ± 0,005	E2 ± 0,005	V	G	G1	Ød1		lbs.
RTPB-8	0.500	2.00	1.38	1.25	0.687	3.50	2.50	1.688	0.25	0.59	1.75	0.16	#6	0.51
RTPB-10	0.625	2.50	1.75	1.63	0.875	4.00	3.00	2.125	0.28	0.85	2.00	0.19	#8	1.00
RTPB-12	0.750	2.75	1.88	1.75	0.937	4.50	3.50	2.375	0.31	0.94	2.25	0.19	#8	1.20
RTPB-16	1.000	3.25	2.38	2.19	1.187	6.00	4.50	2.875	0.38	1.19	3.00	0.22	#10	2.40
RTPB-20	1.250	4.00	3.00	2.81	1.500	7.50	5.50	3.500	0.44	1.50	3.75	0.22	#10	5.00
RTPB-24	1.500	4.75	3.50	3.25	1.750	9.00	6.50	4.125	0.50	1.75	4.50	0.28	0.25	7.80

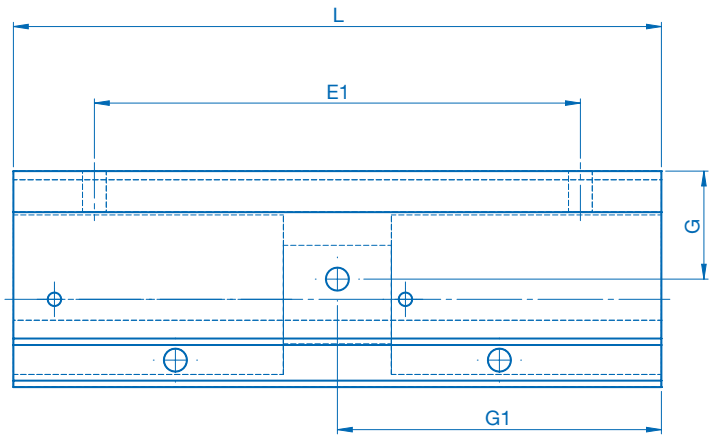
Ordering example

RTPB-	size-	K-		V
linear housing, tandem, closed		K	linear ball bushing, standard (refer to p. 9)	external front seal
		V	llinear ball bushing, all-steel (refer to page 10)	
		KS	linear ball bushing, standard, self-aligning (refer to page 11)	
		FL	linear slide bushing, self-lubricating (refer to page 12)	

- load ratings according to the specification of the bearing (x 2)
- weight value considering the linear ball bushing, standard

- tandem open
- adjustable
- integrated wipers on both ends





	Dimensions in inch															Weight
Part No.	Ød	A	A1	A2	H	h ±0,001	L	E1 ± 0,005	E2 +- 0,005	W	V	G	G1	Ød1		lbs.
RTPBOA-8	0.500	2.00	0.69	0.75	1.13	0.687	3.50	2.50	1.688	0.31	0.25	0.56	1.75	0.16	#6	0.40
RTPBOA-10	0.625	2.50	0.88	0.94	1.44	0.875	4.00	3.00	2.125	0.37	0.28	0.67	2.00	0.19	#8	0.80
RTPBOA-12	0.750	2.75	0.94	1.00	1.56	0.937	4.50	3.50	2.375	0.43	0.31	0.94	2.25	0.19	#8	1.00
RTPBOA-16	1.000	3.25	1.19	1.25	2.00	1.187	6.00	4.50	2.875	0.56	0.38	1.20	3.00	0.22	#10	2.00
RTPBOA-20	1.250	4.00	1.50	1.63	2.56	1.500	7.50	5.50	3.500	0.62	0.44	1.50	3.75	0.22	#10	4.20
RTPBOA-24	1.500	4.75	1.75	1.88	2.94	1.750	9.00	6.50	4.125	0.75	0.50	1.75	4.50	0.28	0.25	6.70

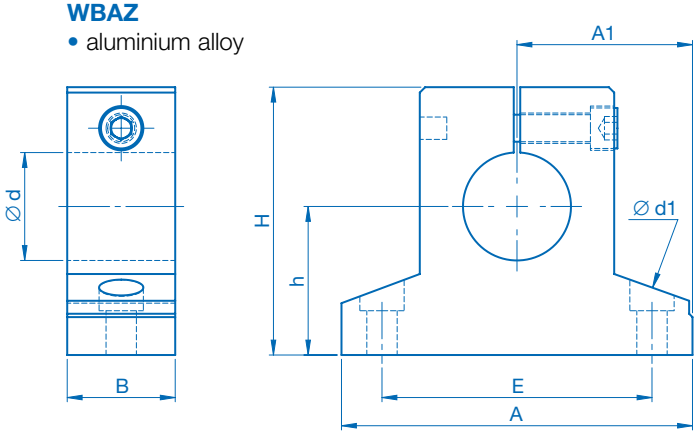
Ordering example

RTPBOA-	size-	K-		V
linear housing, tandem, open		**K**	linear ball bushing, standard (refer to p. 9)	**external front seal**
		V	llinear ball bushing, all-steel (refer to page 10)	
		KS	linear ball bushing, standard, self-aligning (refer to page 11)	
		FL	linear slide bushing, self-lubricating (refer to page 12)	

- load ratings according to the specification of the bearing (x 2)
- weight value considering the linear ball bushing, standard

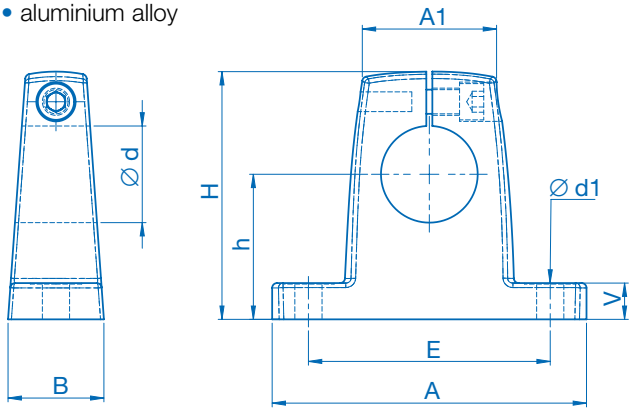
WBAZ

- aluminium alloy



WBASZ

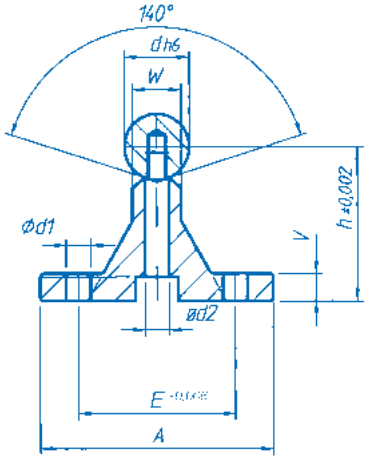
- standard
- aluminium alloy

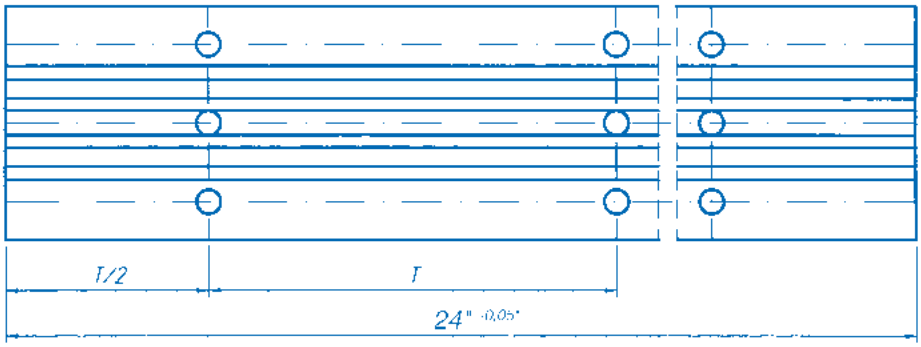


Part No.	Dimensions in inch Ød	A	A1 ± 0,001	B	H	h ± 0,001	E ± 0,005	Ød1		Weight lbs.
WBAZ-08	0.500	2.00	1.000	0.63	1.48	0.875	1.500	0.19	#8	0.11
WBAZ-12	0.750	2.50	1.250	0.75	1.95	1.125	2.000	0.22	#10	0.22
WBAZ-16	1.000	3.25	1.625	1.00	2.48	1.375	2.500	0.28	1/4	0.44
WBAZ-24	1.500	4.75	2.375	1.25	3.50	2.000	3.500	0.34	5/16	1.16

Part No.	Dimensions in inch Ød	A	A1	B	H	h ± 0,001	E ± 0,005	Ød1		V	Weight lbs.
WBASZ-08	0.500	2.00	0.75	0.63	1.63	1.00	1.500	0.190	#8	0.25	0.30
WBASZ-10	0.625	2.50	0.88	0.69	1.75	1.00	1.875	0.220	#10	0.31	0.40
WBASZ-12	0.750	2.75	1.00	0.75	2.13	1.25	2.000	0.220	#10	0.31	0.50
WBASZ-16	1.000	3.25	1.38	1.00	2.56	1.50	2.500	0.280	1/4	0.38	1.00
WBASZ-20	1.250	4.00	1.75	1.13	3.00	1.75	3.000	0.340	5/16	0.44	2.00
WBASZ-24	1.500	4.75	2.00	1.25	3.50	2.00	3.500	0.340	5/16	0.50	2.60

- high
- aluminium alloy
- 24" long





Support Part No.	Assembly	Dimensions in inch Ød	A	h	V	Ød1	W	E	T	Weight lbs.
WUHZ-8	TSHZ-8	0.500	1.500	1.125	0.19	0.17 #6	0.25	1.000	4.000	1.2
WUHZ-10	TSHZ-10	0.625	1.630	1.125	0.25	0.19 #8	0.31	1.125	4.000	1.6
WUHZ-12	TSHZ-12	0.750	1.750	1.500	0.25	0.22 #10	0.38	1.250	6.000	2.0
WUHZ-16	TSHZ-16	1.000	2.130	1.750	0.25	0.28 1/4	0.50	1.500	6.000	2.8
WUHZ-20	TSHZ-20	1.250	2.500	2.125	0.31	0.34 5/16	0.56	1.875	6.000	4.2
WUHZ-24	TSHZ-24	1.500	3.000	2.500	0.38	0.34 5/16	0.69	2.250	8.000	2.6

- suitable for precision steel shafts shown in the catalogue
- WUHZ standard without holes, for predrilled pelase add T1

An economic and proven solution to many linear bearing applications is the use of hardened and ground shafts (solid or tubular) offered in various materials and finishes, together with recirculating linear ball bushes, linear housings, shaft mounting blocks, continuous shaft supports. Our precision shafts are induction hardened. This ensures a constant degree of hardness along the ball-ways, as well as the rest of the shaft surface, in both the radial and axial direction.

This induction process provides an effective hardened zone all over the shaft surface whilst leaving the core unhardened. This facilitates subsequent machining. The shafts are centerless ground and are then tested rigorously for straightness and roundness of the cylindrical form, as well as for surface finish. Please select the shaft-type best suited to your application.

Selection criteria for solid or tubular linear bearing shafts

your special requirements	our type	material + finish	surface Hardness	tolerance of o/d	sizes avail. Ø	see page
- very high surface hardness - machining examples on page 22 can be carried out - no special corrosion	WV	solid shafts material induction-hardened + precision-ground Cf 53 (1.1213)	62 +/- 2 HRC	h6/L	0,25" - 2,5" 3–120 mm	20
- o/d hardened + 5-10 µm hard-chrome plating - machining examples on page 22 can be carried out - considerable corrosion resistance	WV 1	solid shafts material induction-hardened ground, and hard chrome plated Cf 53 Cr (1.1213)	900-1100 HV	h7/L	0,5" - 2" 3–100 mm	20
- high surface hardness - machining examples on page 22 can be carried out - considerable corrosion- and acid resistance	WRS 2	acid-resistant "stainless" steel" solid shafting, induction-hardened + precision-ground 440B	54 +/- 2 HRC	h6/L	0,25" - 2" 5–50 mm	21
- high surface hardness - machining examples on page 22 can be carried out - considerable corrosion- and acid resistance	WRS3	acid-resistant "stainless" steel" solid shafting, induction-hardened + precision-ground 440C	54 +/- 2 HRC	h6/L	0,5" - 1"	21
very high surface hardness - machining examples on page 22 can be carried out - low wt/m - good wt/stiffness ratio - cables and fluids can be fed through hollow center no corrosion resistance	WH	hollow/tubular shafts, induction-hardened + precision ground 100Cr6/C60 (1.3505/1.9601)	62 +/- 2 HRC	h6/L	12–100 mm	21

	WV	WV1	WRS2 / WRS3	WH
Roundness	1/2 tolerance of diameter			
Straightness	0,1/1000 mm			
Surface	Ra ≤ 0.3 µm			

WV solid* steel shafts, induction hardened to HRC 62±2, material spec. CF-53 (1.1213)
WV 1 solid* shafts, hard-chrome plated 5-10µm thickness, hardness HV 900/1100, material spec. CF-53 (1.1213)

shaft o/d Ø mm	shaft o/d Ø inch	weight per inch lbs.	shafts material code WV	production length max. inch	hardness depth inch	standard tolerance
5		0.009	WV-5	153.5	0.03	h6
6		0.012	WV-6	236.2	0.03	h6
6.35	0.25	0.014	WV-6.35	244.1	0.04	L
8		0.022	WV-8	244.1	0.04	h6
9.525	0.375	0.031	WV-9.525	244.1	0.04	L
10		0.035	WV-10	244.1	0.05	h6
12		0.050	WV-12	244.1	0.05	h6
12.7	0.5	0.055	WV-12.7	244.1	0.05	L
14		0.068	WV-14	244.1	0.05	h6
15.875	0.625	0.087	WV-15.875	244.1	0.06	L
16		0.088	WV-16	283.5	0.06	h6
19.05	0.75	0.125	WV-19.05	244.1	0.06	L
20		0.138	WV-20	283.5	0.06	h6
22.225	0.875	0.170	WV-22.225	244.1	0.07	L
25		0.216	WV-25	307.1	0.07	h6
25.4	1	0.223	WV-25.4	244.1	0.08	L
28.575	1.125	0.282	WV-28.575	244.1	0.08	L
30		0.311	WV-30	307.1	0.08	h6
31.75	1.25	0.348	WV-31.75	244.1	0.10	L
38.1	1.5	0.501	WV-38.1	244.1	0.10	L
40		0.552	WV-40	307.1	0.10	h6
50		0.863	WV-50	307.1	0.12	h6
50.8	2	0.890	WV-50.8	244.1	0.12	L
60		1.243	WV-60	307.1	0.12	h6
63.5	2.5	1.392	WV-63.5	244.1	0.12	L
76.2	3	2.004	WV-76.2	244.1	0.12	L
80		2.210	WV-80	307.1	0.12	h6
			WV1			
5		0.009	WV1-5	153.5	0.03	h7
6		0.012	WV1-6	236.2	0.03	h7
6.35	0.25	0.014	WV1-6.35	153.5	0.04	L
8		0.022	WV1-8	236.2	0.04	h7
9.525	0.375	0.031	WV1-9.525	177.2	0.04	L
10		0.035	WV1-10	236.2	0.05	h7
12		0.050	WV1-12	236.2	0.05	h7
12.7	0.5	0.055	WV1-12.7	177.2	0.05	L
14		0.068	WV1-14	236.2	0.05	h7
15.875	0.625	0.087	WV1-15.875	177.2	0.06	L
16		0.088	WV1-16	236.2	0.06	h7
19.05	0.75	0.125	WV1-19.05	177.2	0.06	L
20		0.138	WV1-20	236.2	0.06	h7
22.225	0.875	0.170	WV1-22.225	177.2	0.07	L
25		0.216	WV1-25	236.2	0.07	h7
25.4	1	0.223	WV1-25.4	177.2	0.08	L
28.575	1.125	0.282	WV1-28.575	236.2	0.08	L
30		0.311	WV1-30	236.2	0.08	h7
31.75	1.25	0.348	WV1-31.75	177.2	0.10	L
38.1	1.5	0.501	WV1-38.1	177.2	0.10	L
40		0.552	WV1-40	236.2	0.10	h7
50		0.863	WV1-50	236.2	0.12	h7
50.8	2	0.890	WV1-50.8	236.2	0.12	L
60		1.243	WV1-60	236.2	0.12	h7

other diameters and materials to be inquired
** depending on lots. the precision shafts up to Ø 10mm can be throughhardened.
The Rht is defined by DIN 50190. We will be pleased to provide details if required.
The borderhardnessdepth is the depth, where the hardness is at least 80 % of the surfacehardness.

WRS 2 "stainless" steel, acid resistant, HRC 52-56, material spec. 440B (1.4112)
WRS 3 "stainless" steel, acid resistant, HRC 52-56, material spec. 440C (1.4125)
WH hollow/tubular shafts, induction hardened HRC 62±2, material spec. C60 or 100Cr 6 (1.0601/1.3505)

shaft o/d Ø mm	shaft o/d Ø inch	weight per inch lbs.	shafts material code WRS2	production length max. inch	hardness depth. inch	standard tolerance
5		0.009	WRS2-5	153.5	0.03	h6
6		0.012	WRS2-6	236.2	0.03	h6
6.35	0.25	0.014	WRS2-6.35	177.2	0.04	L
8		0.022	WRS2-8	236.2	0.04	h6
9.525	0.375	0.031	WRS2-9.525	177.2	0.04	L
10		0.035	WRS2-10	236.2	0.04	h6
12		0.050	WRS2-12	236.2	0.05	h6
12.7	0.5	0.055	WRS2-12.7	177.2	0.05	L
14		0.068	WRS2-14	236.2	0.06	h6
16		0.088	WRS2-16	236.2	0.06	h6
19.05	0.75	0.125	WRS2-19.05	177.2	0.06	L
20		0.138	WRS2-20	236.2	0.07	h6
25		0.216	WRS2-25	236.2	0.08	h6
25.4	1	0.223	WRS2-25.4	177.2	0.08	L
30		0.311	WRS2-30	236.2	0.09	h6
38.1	1.5	0.501	WRS2-38.1	177.2	0.10	L
40		0.552	WRS2-40	236.2	0.10	h6
50		0.863	WRS2-50	236.2	0.11	h6
50.8	2	0.890	WRS2-50.8	177.2	0.12	L
60		1.243	WRS2-60	236.2	0.12	h6
			WRS3			
12.7	0.5	0.055	WRS3-12.7	177.2	0.05	L
19.05	0.75	0.125	WRS3-19.05	177.2	0.06	L
25.4	1	0.233	WRS3-25.4	177,2	0.08	L
			WH			
12	4	0.044	WH - 12	236.2	0.02	h6
16	7	0.072	WH - 16	236.2	0.02	h6
20	14	0.070	WH - 20	236.2	0.04	h6
25	15.6	0.132	WH - 25	236.2	0.04	h6
30	18	0.196	WH - 30	236.2	0.04	h6
40	28	0.279	WH - 40	236.2	0.06	h6
50	28	0.555	WH - 50	236.2	0.06	h6
60	36	0.795	WH - 60	236.2	0.09	h6
80	57	1.088	WH - 80	236.2	0.09	h6

other diameters and materials to be inquired
*standard value: we reserve the right to deliver other inner diameters
** depending on lots. the precision shafts up to Ø 10mm can be throughhardened.
The Rht is defined by DIN 50190. We will be pleased to provide details if required.
The borderhardnessdepth is the depth, where the hardness is at least 80 % of the surfacehardness.

ISO h6, metric shafting

Diameter, mm	h6
5	0/ -8
6	0/ -9
8	0/ -9
10	0/ -11
12	0/ -11
14	0/ -11
15	0/ -11
16	0/ -11
18	0/ -13
20	0/ -13
22	0/ -13
25	0/ -13
30	0/ -16
35	0/ -16
40	0/ -16
50	0/ -18
60	0/ -19
80	0/ -19
100	0/ -22

Classes L, N + S, inch shafting

Diameter, inch	Class L	Class N	Class S
0.250	0.2495/ 02490	0.2500/ 0.2498	0.2490/ 0.2485
0.375	0.3745/ 0.3740	0.3750/ 0.3748	0.374/ 0.3735
0.500	0.4995/ 0.4990	0.5000/ 0.4998	0.4990/ 0.4985
0.625	0.6245/ 0.6240	0.6250/ 0.6248	0.6240/ 0.6235
0.750	0.7495/ 0.7490	0.7500/ 0.7498	0.7490/ 0.7485
0.875	0.8745/ 0.8740	0.8750/ 0.8748	
1.000	0.9995/ 0.9990	1.0000/ 0.9998	0.9990/ 0.9985
1.125	1.1245/ 1.1240	1.1250/ 1.2480	
1.250	1.2495/ 1.2490	1.2500/ 1.2498	1.2490/ 1.2485
1.500	1.4994/ 1.4989	1.5000/ 1.4997	1.4989/ 1.4984
2.000	1.9994/ 1.9980	2.0000/ 1.9997	1.9987/ 1.9980
2.500	2.4993/ 2.4985	2.5000/ 2.4996	2.4985/ 2.4977
3.000	2.9920/ 2.9983	3.0000/ 2.9996	

Precision Steel Shafts, machined hardened and ground

Please take advantage of our machining facilities, your overall costs will be lower if you use our “ready-to-install” precision shafts

We specialise in machining induction hardened shafts. Using modern CNC machines we can supply finish-machined shaft units: eg: cyl. dias, chamfers, radial or axial drilled and tapped bores.

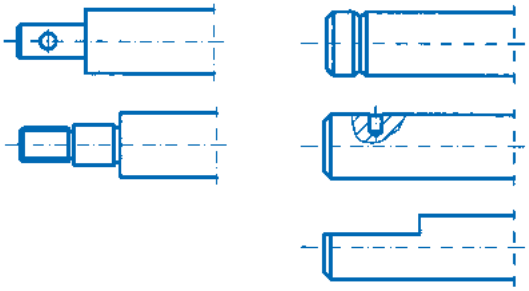
Machining examples

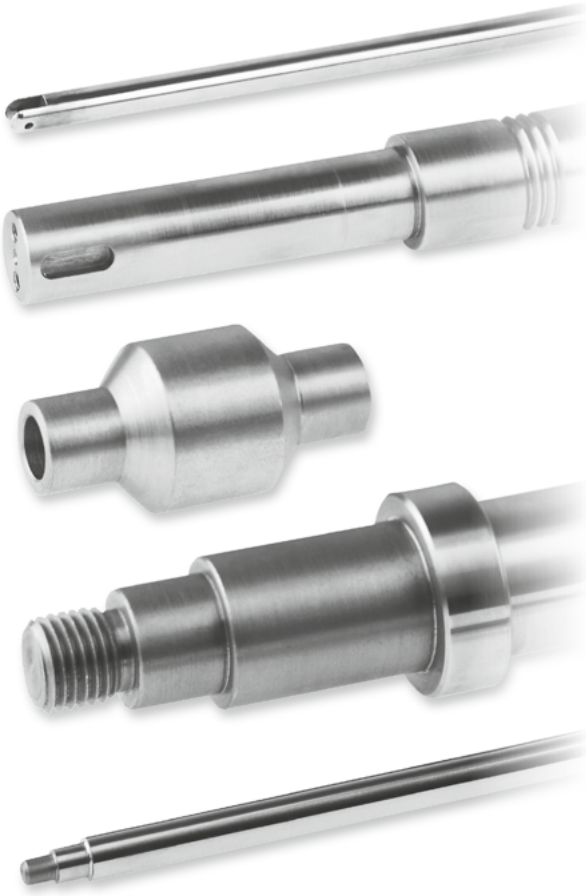
version 1AX – axial thread on one end

version 2AX – axial thread on both ends

version T1 or T2 – radial hole pattern T1 or T2

version Z – end machining per drawing



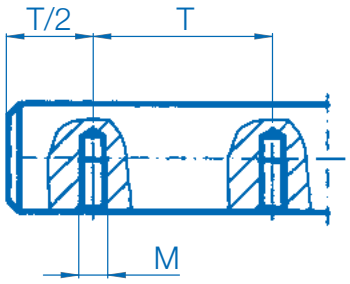


Shafts may be annealed depending on the hardnesszone and the required machining.

We will machine your shafts to your specification or drawing!

Radial Hole Pattern

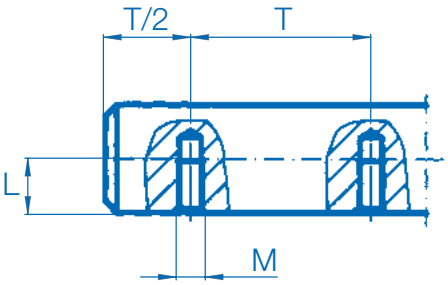
shafts-Ø, inch	M to center of shaft	T
0.5	6-32	4
0.625	8-32	4
0.75	10-32	6
1	1/4-20	6
1.25	5/16-18	6
1.5	3/8-16	8
2	1/2-13	8
3	3/4-10	8



Radial Hole Pattern, metric

T1, T2, T3, Z (special, according to customer drawing)

shaft-Ø, mm	M	L	T1	T2	T3
12	M4	8	75 mm	120 mm	75 mm
16	M5	9.5	100 mm	150 mm	75 mm
20	M6	13	100 mm	150 mm	75 mm
25	M8	14	120 mm	200 mm	75 mm
30	M10	18	150 mm	200 mm	100 mm
40	M10	20	200 mm	300 mm	100 mm
50	M12	23	300 mm	–	–



For special threads or hole patterns etc. please add the suffix “Z” instead of T1/ T2/ T3 and indicate the specification. Sinking of the thread depending on the hardnessdepth of the shaft.

Ordering example

WV –	Ø 20 –	h6 –	2500 –	T2 –
material **WV, WV1, WRS2, WRS3, WH**	**diameter in mm**	OD-tolerance, please refer to page 22	shaft length in mm	endmachining **T1** T1-hole pattern **T2** T2-hole pattern **Z** per drawing/other specification

Germany

Main Office and Production
RODRIGUEZ GmbH
Ernst-Abbe-Str. 20
52249 Eschweiler
Tel.: +49 (0)2403 780-0
Fax: +49 (0)2403 780-60
info@rodriguez.de
www.rodriguez.de

Office South Germany
RODRIGUEZ GmbH
Max-Eyth-Str. 8
71672 Marbach a. Neckar
Tel.: +49 (0)7144 8558-0
Fax: +49 (0)7144 8558-20
info-sued@rodriguez.de

France

Rodriguez GmbH
29/31 Boulevard de la Paix
Parc d'activités du Bel Air
78 100 Saint Germain En Laye
Tel.: +33 (0)130 610616
Fax: +33 (0)130 615282
info_france@rodriguez.de
www.rodriguez.de

ICB International Customized Bearings

a Member of RODRIGUEZ® Group

Distribution

For latest releases – newest features – and downloads of catalogs, software, or CAD drawings visit our website www.icb-usa.com