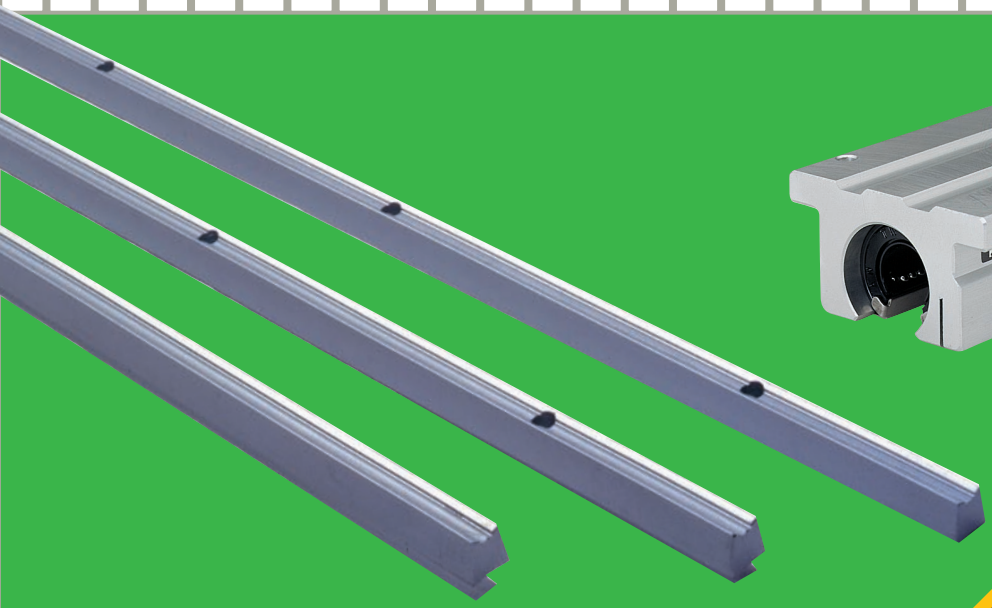
NB

Winning Solutions For Precise Movement



TOPBALL® & SLIDE SHAFT PRODUCTS

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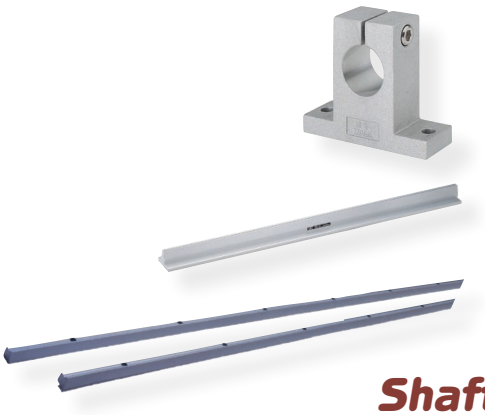
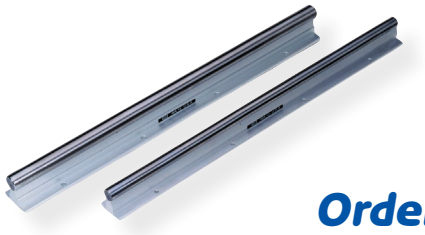
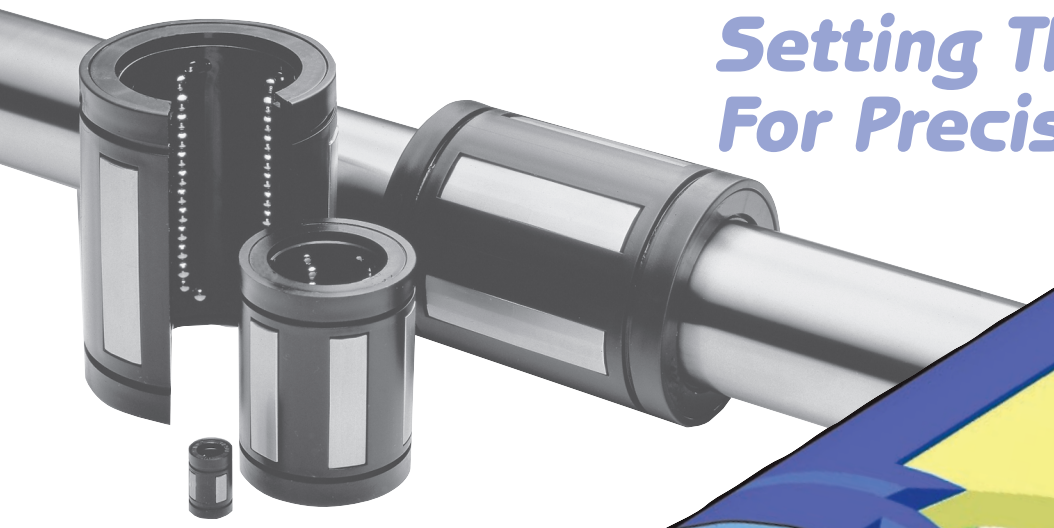


Shaft Rail Assemblies

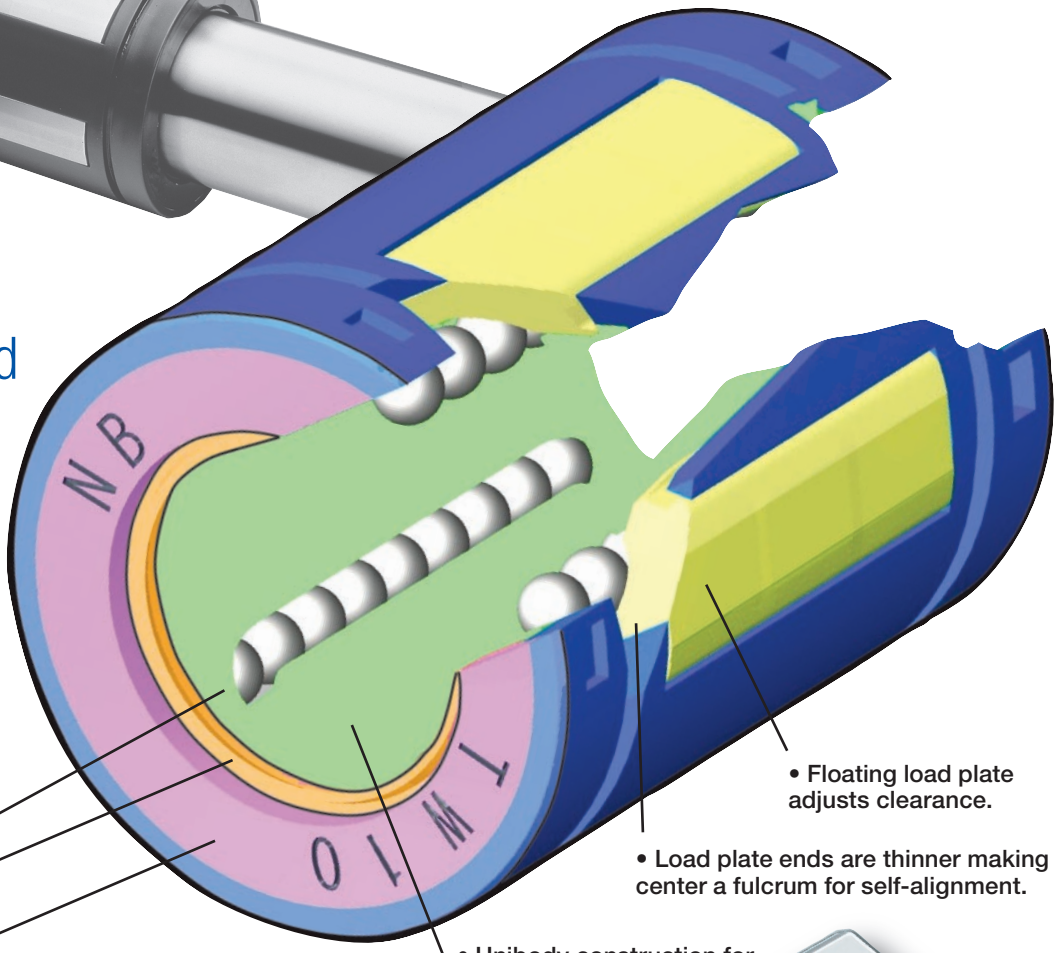


TOPBALL®

Setting The Standard For Precise Alignment

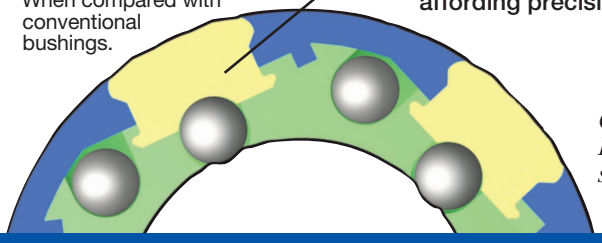


- Self-aligns to speed manufacturing and assembly.
- 3X The Load Capacity*
- 27X The Travel Life*



- Each load plate is precision-ground and checked for consistency - unlike competitions' stamped plates.
- Floating wiper seal allows unrestricted self-alignment.
- Light weight components for energy reduction.
- Floating load plate adjusts clearance.
- Load plate ends are thinner making center a fulcrum for self-alignment.
- Unibody construction for quieter operation.
- Greater ball contact in ground circular arch triples load capacity.
- Our raceways are ground - not stamped - affording precision tolerances.

*When compared with conventional bushings.



Comes in both inch and Euro metric standard series sizes..

NB

www.nbcorporation.com

Hanover Park, IL 60133
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Fax: (408) 435 1850
1-888-562-4175

Hackensack, NJ 07601
Fax: (201) 487-7107
1-800-981-8190

Products

TOPBALL® Types

TW: Clearance Adjustable Standard
Floating load plate design is self aligning. It has a light weight outer ring and retainer for low noise operation.

TW-OP: Clearance Adjustable Open
One ball circuit is removed from the outer cylinder enabling it to be used with bottom supported shaft to eliminate shaft deflection.

Anti-Corrosive Type
A special TOPBALL is also available for corrosive applications. Contact your nearest distributor for application information, price and delivery.

Fig. 1 Illustrating circular arch design and ground surface raceway

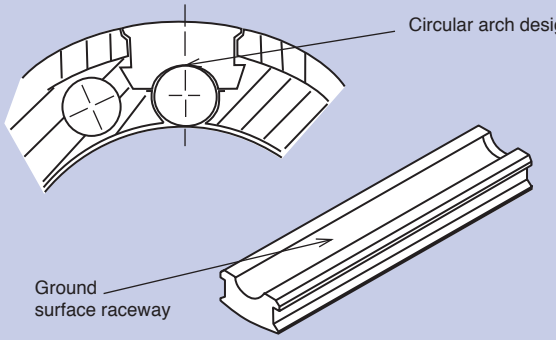
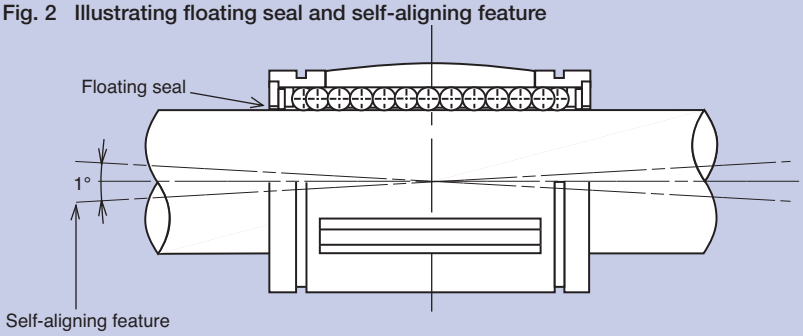


Fig. 2 Illustrating floating seal and self-aligning feature



TOPBALL® Features

• Increased Load Capacity
NB's uniquely designed ground load plate provides circular arch contact to the ball resulting in a greater dispersion of the load, enabling TOPBALL to provide three times the load capacity of conventional slide bushings. (See Fig. 1)

• Longer Travel Life
Dispersed stress on the load plate provides TOPBALL up to 27 times the travel life of conventional slide bushings. (See Fig. 1)

• Self-Aligning Capability
Load plates are thinner at the ends to provide a pivot point at the center of the plate. The center acts as a fulcrum to compensate for any slight misalignment between the shaft and the housing bore that might be caused by inaccurate machining, mounting errors or shaft deflection. (See Fig. 2)

•Floating Integral Wiper Seal
Seals are made of oil resistant industrial grade rubber for long life and durability. NB's unique floating seal design allows for self-alignment while maintaining equal and constant contact to the shaft. Seals do not add to the overall length of the bushing allowing for more compact designs. (See Fig. 2)

•Interchangeability
NB has designed TOPBALL to be fully interchangeable with conventional slide bushings.

•Clearance Adjustable
TOPBALL load plates are designed to "float" in the outer sleeve which allows for clearance between the balls and shaft to best suit application requirements. TOPBALL is also available in NB's "adjustable" slide unit housing.

• Cost Effectiveness
TOPBALL's higher load capacity and longer travel life enables the use of smaller components such as bushings, housings and shafts, reducing material cost and the overall cost of the system. Longer travel life also extends replacement periods and reduces maintenance cost.

• Smooth Running Low Friction
TOPBALL is extremely smooth running due to the finely ground surface of the load plate. Self-alignment creates a smoother-running surface from shaft to load plate raceway. (See Fig. 1)

• Low Noise
Sound absorbing resin retainers and outer-sleeves enable TOPBALL to operate quietly. TOPBALL is excellent for low noise applications.

• Light Weight
TOPBALL's outer sleeve and retainer are made of high performance resin that is light weight and exceptionally rigid. TOPBALL's light weight allows users the advantages of higher operating speeds and greater acceleration compared to conventional slide bushings.

Slide Bush Life

The life of a slide bush can be easily calculated with the load rating of the bush, shaft hardness and applicable load. However, in many cases, slide bushing failure may be caused by improper design of bush peripherals, including the shaft and housing, inappropriate mounting or improper operation. Serious consideration of these peripheral factors, in addition to load rating, are highly recommended when designing a slide bush application.

Basic Dynamic Load Rating and Life Expectancy

The basic dynamic load rating is the load which allows a rating life of 2-million inches (50 km), without changing its magnitude and direction. The rating life can be obtained from the following equation.

$$L = \left(\frac{C}{P}\right)^3 \cdot 2 \times 10^6 \qquad \textbf{Equation (1)}$$

L: Rating life (inches)
C: Basic dynamic load rating (lbs.)
P: Load (lbs.)

Chart 1 shows the relationship between Life (L) and load ratio (C/P). In the practical use of a bushing, other factors that affect the life, such as shaft hardness and load condition should be considered. The equation for calculating bushing life considering these additional factors is:

$$L = \left(\frac{f_h}{f_w} \cdot \frac{C}{P}\right)^3 \cdot 2 \times 10^6 \qquad \textbf{Equation (2)}$$

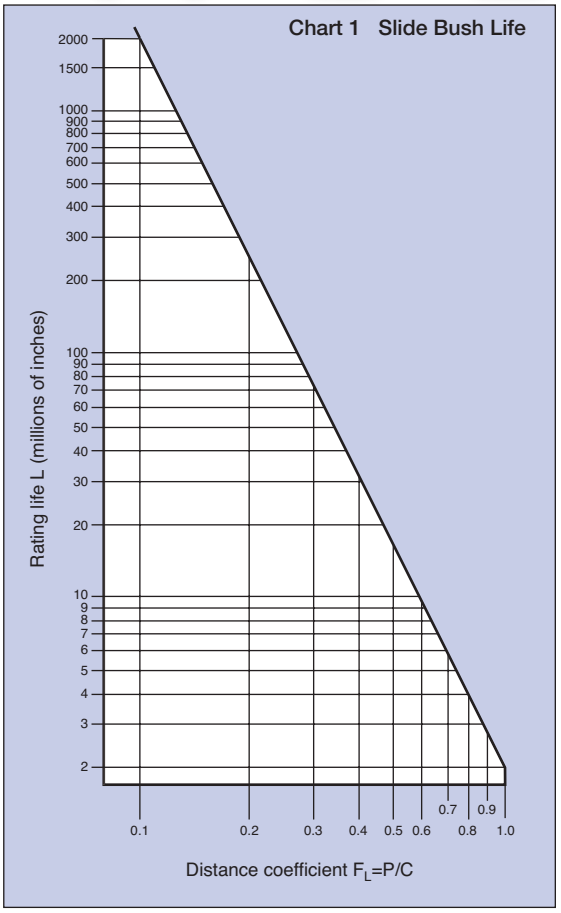
f_h: Hardness factor (See Chart 2)
f_w: Load coefficient (See Table 1)

Rating life in hours can be calculated by obtaining the travelling distance per unit of time as follows:

$$Lh = \frac{L}{2 \cdot Ls \cdot N1 \cdot 60} \qquad \textbf{Equation (3)}$$

Lh: Rating life in hours (hr.)
Ls: Stroke length (in.)
N1: Rate of cycles per minute
L: Rating life (in.)

Chart 1 Slide Bush Life



Load Coefficient (f_w)

When calculating the bush load, it is necessary to accurately obtain weight, inertial force based on speed, moment load and each transition as time passes. However, it is difficult to calculate those values accurately because reciprocating motion involves the repetition of starts and stops as well as vibration and impact. A more practical approach is to obtain the load coefficient by taking the actual operating conditions into account.

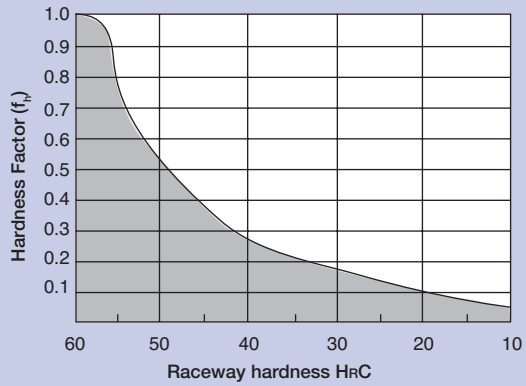
Table 1 *LOAD COEFFICIENT*

OPERATING CONDITIONS	f_w
Operation at low speed (600 in./min. or less) without impulsive shock from outside	1 - 1.5
Operation at intermediate speed (2400 in./min. or less) without impulsive shock	1.5 - 2.0
Operation at high speed (over 2400 in./min.) with impulsive shock	2.0 - 3.5

Hardness Factor (fh)

The shaft must be hardened to 60-65 HRC when a slide bush is used. If not properly hardened, permissible load is lowered and the life of the bushing will be shortened.

Chart 2 Hardness factor (f_h)



Examples of Calculations:

(1) Life expectancy when NB's TOPBALL TW 16 (1") is used under the following conditions:

Load per bush: 150 lbs.

Stroke distance: 8 inches

Rate of cycles/min: 35

Shaft hardness: 60 HRC

From Table 4 (Page 10) the basic dynamic load of TW 16 is 850 lbs. Hardness factor (f_h) is 1.0, and the operating speed can be calculated as 560"/min. Therefore, the load coefficient (f_w) is considered as 1.0.

Using equation (2)

$$L = \left(\frac{850}{1 \cdot 150}\right)^3 \cdot 2 \times 10^6 = 3.64 \times 10^8 \text{ inches}$$

Using equation (3)

$$Lh = \frac{3.63 \times 10^8}{2 \cdot 8 \cdot 35 \cdot 60} = 10{,}800 \text{ hours}$$

(2) Selection of size for the application as follows:

Expected life: 15,000 hours

Number of bushings in the carriage: 4

Gross weight on the carriage: 150 lbs.

Stroke distance: 36 inches

Traveling speed: 1200 inches/min.

Shaft hardness: 60-64 HRC

From equation (3), the life expected in traveling distance is:

$$L = 15{,}000 \cdot 2 \cdot 36 \cdot \frac{1200}{2 \cdot 36} \cdot 60 = 1.08\ 10^9 \text{ Inches}$$

$$C = \sqrt[3]{\frac{1.08 \times 10^9}{2 \times 10^6}} \cdot \left(\frac{f_w}{f_h}\right) \cdot P = 458 \text{ lbs.}$$

From the equation (2),

Note that: $f_h = 1.0$, $f_w = 1.5$, $P = 150/4 = 37.5$ lbs.

As a result, the TOPBALL that is able to handle this load is: TW 12 (3/4").

Basic Static Load Rating

If a slide bush is loaded when it is in a stationary condition or working at low speed, a permanent elastic deformation is formed on the rolling element. The deformation prevents smooth movement of the bushing. To eliminate this possibility, the basic static load rating must not be exceeded.

Clearance and Fit

An appropriate clearance between the slide bush and shaft is required in TOPBALL® operation. Inadequate clearance may cause early failure and/or poor, rough movement. Proper clearance is determined by shaft diameter and housing bore. Table 3 shows NB's recommended tolerances of the shaft diameter and housing bore in order to maintain the appropriate clearance.

Relation Between Ball Circuits and Load Rating

The load rating of a slide bush varies according to the loaded position on the circumference. The value in the dimensional table indicates the lowest load rating with the load placed on top of one ball circuit. If the slide bush is used with two ball circuits loaded uniformly, the value will be greater. The table below (Table 2) shows the load ratio for the number of ball circuits in each case.

Table 2 *OPTIONAL LOAD POSITIONS*

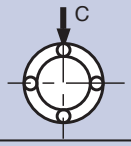
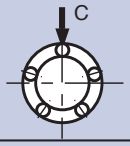
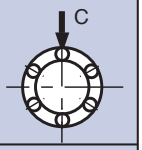
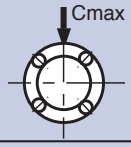
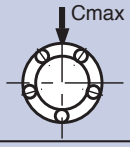
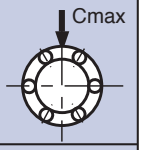
NUMBER OF ROWS	4	5	6
C (LOAD RATING SPECIFIED ON THE TABLE)			
Cmax (MAXIMUM LOAD RATING)			
LOAD RATIO Cmax/C	1.414	1.463	1.280

Table 3 *RECOMMENDED TOLERANCE FOR SHAFT O.D. AND HOUSING BORE (INCH)*

SIZE	SHAFT DIAMETER		HOUSING BORE	
	NOMINAL DIAMETER	TOLERANCE (g6)	NOMINAL BORE	TOLERANCE (H7)
TW 3	.1875	-.0002 to -.0006	.3750	0 to + .0006
TW 4	.2500	-.0002 to -.0006	.5000	0 to + .0007
TW 6	.3750	-.0002 to -.0006	.6250	0 to + .0007
TW 8	.5000	-.0002 to -.0007	.8750	0 to + .0008
TW 10	.6250	-.0002 to -.0007	1.1250	0 to + .0008
TW 12	.7500	-.0003 to -.0008	1.2500	0 to + .0010
TW 16	1.0000	-.0003 to -.0008	1.5625	0 to + .0010
TW 20	1.2500	-.0004 to -.0010	2.0000	0 to + .0012
TW 24	1.5000	-.0004 to -.0010	2.3750	0 to + .0012
TW 32	2.0000	-.0004 to -.0012	3.0000	0 to + .0012

Products

Shaft and Housing

To optimize NB TOPBALL performance, high precision shafts and housings are required.

1. Shaft: Dimensional tolerance, surface finish and hardness greatly affect the traveling performance of the TOPBALL. The shaft must be manufactured to the following tolerances.

   A. A surface finish of 16 micro-inch rms or less.
   B. Hardness of HRC 60 to 64. Hardness less than HRC 60 decreases the life considerably and reduces the permissible load. Hardness over HRC 64 accelerates steel ball wear.
   C. Case-hardened depth should be a minimum of .04 inches.
   D. The correct tolerance of the shaft diameter is recommended on Table 3 (Page 8).

The NB Slide Shaft is an ideal component manufactured to these specifications. For details, please refer to the NB Slide Shaft catalog.

2. Housing: There are a wide range of designs and manufacturing techniques for mounted housings. NB pre-engineered slide units are also available. **For proper fit, refer to Table 3 (Page 8).**

Mounting

TOPBALL is designed to be slip fitted. Do not use extreme force when inserting bushing. Any shock load to the bushing may cause permanent damage.

Examples of Mounting
The following examples (Figs. 3 to 6) illustrate assembly of the inserted bush as they should be designed and mounted.

Explanation Of TOPBALL P/N (Part Number) Symbols

T	W	#	UU	OP
Series	Measurement Type	Inscribed Circle Diameter (inch)	Seal Symbol	Modification
T=TOPBALL®	**W**=Inch	**4**=0.250	**UU**=Seals on Both Ends	**OP**=Open Type
		6=0.375	No Entry=Not Open (Standard)	No Entry=No Seals
		8=0.500	Example:	
		10=0.625	You need a slide bush that	
		12=0.750	has a ½" interior diameter,	
		16=1.000	that's not open, with seals	
		20=1.250	on both ends. Order TW8UU	
		24=1.500		
		32=2.000		

For Ordering Assistance Call 1-800-521-2045.
See page 26-27 for ordering information.

Fig. 3 use of holding plates

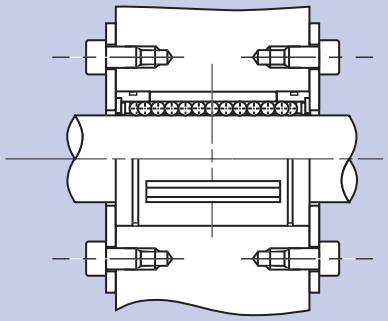


Fig. 4 Adjustable type housing

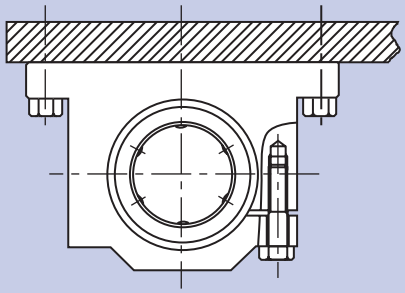


Fig. 5 Use of external retaining rings

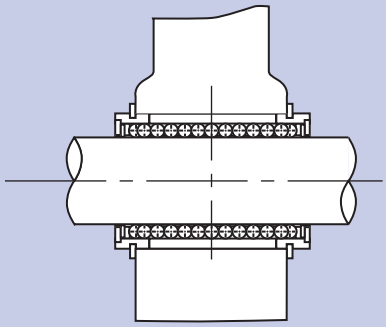
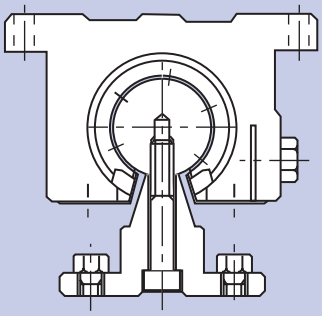


Fig. 6 Open type housing



TOPBALL

Dimensions and Load Ratings
TOPBALL® Standard Type
TW Type

Fig. 7 Standard Type TOPBALL Slide Bush

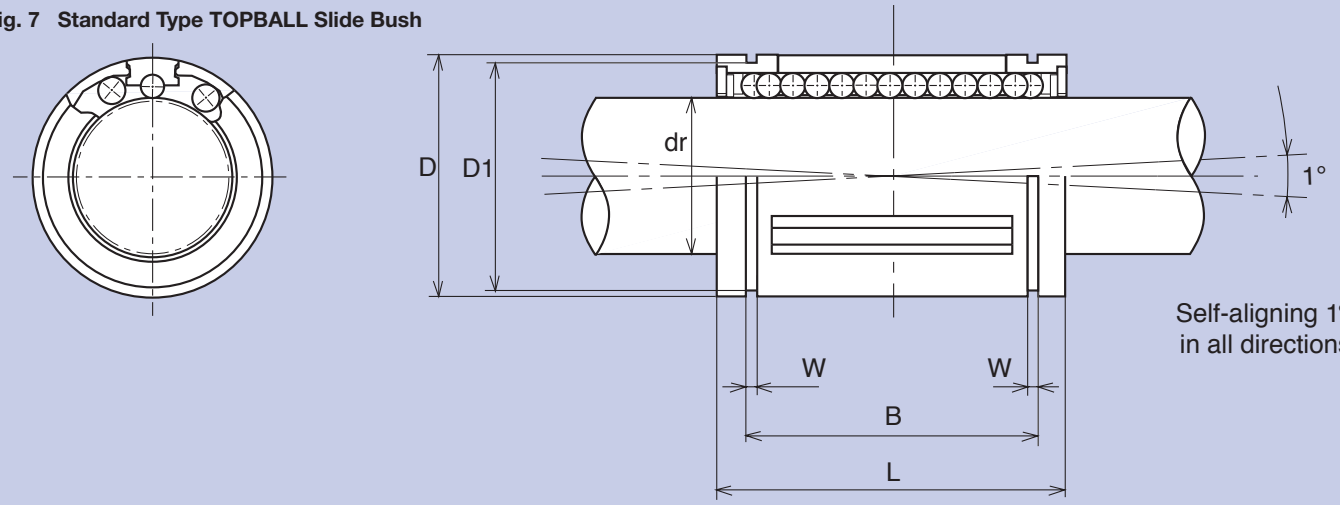


Table 4 *STANDARD TYPE DIMENSIONS AND LOAD RATINGS*

NOM. SHAFT DIA. (inch)	P/N STANDARD & W/SEALS	WORKING DIAMETER (1)		NOM. O.D. (3)	LENGTH		RETAINING RINGS				BALL DIA. (inch)	NO. OF ROWS	LOAD RATINGS (2)		Wt. (lbs.)
							DISTANCE		WIDTH	DIA.			DYNAMIC	STATIC	
		dr (inch)	TOL (inch)	D (inch)	L (inch)	TOL (inch)	B (inch)	TOL (inch)	W (inch)	D1 (inch)			C (lbs.)	C_0 (lbs.)	
3/16	TW 3	0.1875	0.0000 -0.0005	0.3750	0.562	±0.008	...	...	...	...	0.04724 (1.2mm)	4	35	47	0.0013
1/4	TW 4 TW 4UU	0.2500	0.0000 -0.0005	0.5000	0.750	0.000 -0.015	0.515	0.000 -0.015	0.0390	0.4687	1/16	4	60	80	0.008 0.009
3/8	TW 6 TW 6UU	0.3750	0.0000 -0.0005	0.6250	0.875	0.000 -0.015	0.703	0.000 -0.015	0.0390	0.5880	1/16	4	95	120	0.013 0.014
1/2	TW 8 TW 8UU	0.5000	0.0000 -0.0005	0.8750	1.250	0.000 -0.020	1.032	0.000 -0.020	0.0459	0.8209	3/32	4	230	290	0.042 0.043
5/8	TW 10 TW 10UU	0.6250	0.0000 -0.0005	1.1250	1.500	0.000 -0.020	1.112	0.000 -0.020	0.0559	1.0590	1/8	5	400	500	0.101 0.103
3/4	TW 12 TW 12UU	0.7500	0.0000 -0.0005	1.2500	1.625	0.000 -0.020	1.272	0.000 -0.020	0.0559	1.1760	1/8	6	470	590	0.123 0.123
1	TW 16 TW 16UU	1.0000	0.0000 -0.0005	1.5625	2.250	0.000 -0.020	1.886	0.000 -0.020	0.0679	1.4687	5/32	6	850	1060	0.265 0.265
1-1/4	TW 20 TW 20UU	1.2500	0.0000 -0.0006	2.0000	2.625	0.000 -0.025	2.011	0.000 -0.025	0.0679	1.8859	3/16	6	1230	1530	0.485 0.485
1-1/2	TW 24 TW 24UU	1.5000	0.0000 -0.0006	2.3750	3.000	0.000 -0.030	2.422	0.000 -0.030	0.0859	2.2389	7/32	6	1480	1850	0.750 0.750
2	TW 32 TW 32UU	2.0000	0.0000 -0.0008	3.0000	4.000	0.000 -0.040	3.206	0.000 -0.040	0.1029	2.8379	1/4	6	2430	3040	1.389 1.411

(1) Based on nominal housing bore.
(2) See Table 2 for maximum load rating.
(3) See Table 3 for recommended tolerances.

Products

Dimensions and Load Ratings
TOPBALL® Open Type
TW Open Type

Fig. 8 TW 8 OP

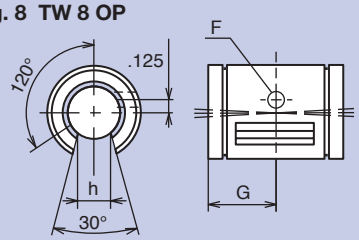


Fig. 9 TW 10 OP

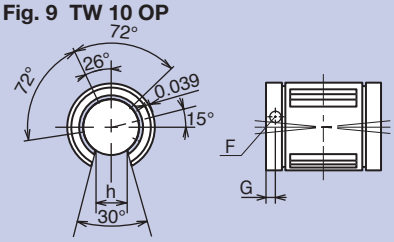


Fig. 10 TW 12 OP through TW 32 OP

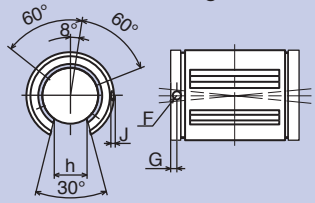


Table 5 *OPEN TYPE DIMENSIONS AND LOAD RATINGS*

NOM. SHAFT DIA. (inch)	P/N OPEN & W/SEALS	WORKING DIAMETER (1)		NOM. O.D. (3)	LENGTH		RETAINING RINGS			
							DISTANCE		WIDTH	DIA.
		dr (inch)	TOL (inch)	D (inch)	L (inch)	TOL (inch)	B (inch)	TOL (inch)	W (inch)	D1 (inch)
1/2	TW 8-OP TW 8 UU-OP	0.5000	0.0000 -0.0005	0.8750	1.250	0.000 -0.020	1.032	0.000 -0.020	0.0459	0.8209
5/8	TW 10-OP TW 10 UU-OP	0.6250	0.0000 -0.0005	1.1250	1.500	0.000 -0.020	1.112	0.000 -0.020	0.0559	1.0590
3/4	TW 12-OP TW 12 UU-OP	0.7500	0.0000 -0.0005	1.2500	1.625	0.000 -0.020	1.272	0.000 -0.020	0.0559	1.1760
1	TW 16-OP TW 16 UU-OP	1.0000	0.0000 -0.0005	1.5625	2.250	0.000 -0.020	1.886	0.000 -0.020	0.0679	1.4687
1-1/4	TW 20-OP TW 20 UU-OP	1.2500	0.0000 0.0006	2.0000	2.625	0.000 -0.025	2.011	0.000 -0.025	0.0679	1.8859
1-1/2	TW 24-OP TW 24 UU-OP	1.5000	0.0000 -0.0006	2.3750	3.000	0.000 -0.030	2.422	0.000 -0.030	0.0859	2.2389
2	TW 32-OP TW 32 UU-OP	2.0000	0.0000 -0.0008	3.0000	4.000	0.000 -0.040	3.206	0.000 -0.040	0.1029	2.8379

Table 5 *CONTINUED*

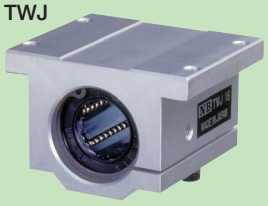
NOM. SHAFT DIA. (inch)	P/N OPEN & W/SEALS	SLOT WIDTH h (inch)	RETENTION HOLE			BALL DIA. (inch)	NO. OF ROWS	LOAD RATINGS (2)		Wt. (lbs.)
			DIA.	LOC.	DEPTH			DYNAMIC	STATIC	
			F (inch)	G (inch)	J (inch)			C (lbs.)	C_0 (lbs.)	
1/2	TW 8-OP TW 8 UU-OP	0.313	0.136	0.6250	Thru hole	3/32	3	230	290	0.033 0.033
5/8	TW 10-OP TW 10 UU-OP	0.375	0.105	0.1250	0.0390	1/8	4	400	500	0.082 0.083
3/4	TW 12-OP TW 12 UU-OP	0.438	0.136	0.1250	0.0590	1/8	5	470	590	0.101 0.102
1	TW 16-OP TW 16 UU-OP	0.563	0.136	0.1250	0.0470	5/32	5	850	1060	0.220 0.220
1-1/4	TW 20-OP TW 20 UU-OP	0.625	0.201	0.1875	0.0900	3/16	5	1230	1530	0.397 0.419
1-1/2	TW 24-OP TW 24 UU-OP	0.750	0.201	0.1875	0.0900	7/32	5	1480	1850	0.617 0.639
2	TW 32-OP TW 32 UU-OP	1.000	0.265	0.3125	Thru hole	1/4	5	2430	3040	1.146 1.168

(1) Based on nominal housing bore.
(2) See Table 2 for maximum load rating.
(3) See Table 3 for recommended tolerances.

TOPBALL

Slide Unit Introduction/Design Features

NB TOPBALL Slide Units include a clear anodized corrosion resistant aluminum block and either one or two TOPBALL self-aligning slide bushings. Closed and adjustable clearance styles incorporate machined snap ring grooves in combination with standard retaining rings for slide bush retention. The open style incorporates bottom plates and mounting screws to retain bushing in proper position. All styles are provided with standard machined reference edges for proper alignment and installation.

WIDE / SPECIFICATION		HOUSING TYPE		
		BLOCK	ADJUSTABLE	OPEN
SINGLE	SINGLE; • Conventional Type • Self-Aligning Capability • High Load Capacity compared with SW type units	TWA 	TWJ 	TWD 
DOUBLE	DOUBLE; • Compact Tandem Design • Oiling feature available • Double Capacity compared with single type units	TWA-W 	TWJ-W 	TWD-W 

Explanation Of TOPBALL SLIDE UNIT P/N (Part Number) Symbols

TW	#	W	UU
Series	Inscribed Circle Diameter (inch)	Width Symbol	Seal Symbol
TWA=Block	**4**=0.250	**W**=Double Width	**UU**=Seals on Both Ends
TWJ= Adjustable	**6**=0.375	No Entry= Single Width	No Entry=No Seals
TWD= Open	**8**=0.500	Example:	
	10=0.625	You need a slide bush in a block that is adjustable,	
	12=0.750	has a 3/4" interior diameter, with seals, and is	
	16=1.000	double wide. Order TWJ12UU.	
	20=1.250	**For Ordering Assistance**	
	24=1.500	**Call 1-800-521-2045.**	
	32=2.000	See page 26-27 for ordering information.	

Slide Units

TWA Block Type

Fig. 11 Block type slide unit

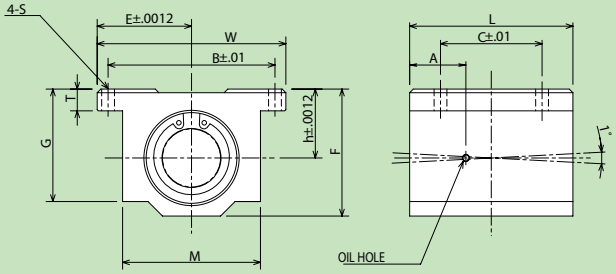


Table 6 *BLOCK TYPE DIMENSIONS AND LOAD RATINGS*

NB PART NUMBER	NOM. SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)								MOUNTING DIMENSIONS (inch)			LOAD RATING		Wt. (lbs.)
		h ± .0012	E ± .0012	W	L	F	T	G	M	B ± .01	C ± .01	S	DYNAMIC C (lbs.)	STATIC C0 (lbs.)	
TWA 4UU	1/4	.4370	.8125	1.625	1.188	.813	.188	.750	1.000	1.312	.750	.156	60	80	.090
TWA 6UU	3/8	.5000	.8750	1.750	1.313	.938	.188	.875	1.125	1.437	.875	.156	95	120	.120
TWA 8UU	1/2	.6870	1.0000	2.000	1.688	1.250	.250	1.125	1.375	1.688	1.000	.156	230	290	.248
TWA 10UU	5/8	.8750	1.2500	2.500	1.938	1.625	.281	1.437	1.750	2.125	1.125	.188	400	500	.465
TWA 12UU	3/4	.9370	1.3750	2.750	2.063	1.750	.313	1.563	1.875	2.375	1.250	.188	470	590	.553
TWA 16UU	1	1.1870	1.6250	3.250	2.813	2.188	.375	1.938	2.375	2.875	1.750	.219	850	1060	1.200
TWA 20UU	1-1/4	1.5000	2.0000	4.000	3.625	2.813	.438	2.500	3.000	3.500	2.000	.219	1230	1530	2.380
TWA 24UU	1-1/2	1.7500	2.3750	4.750	4.000	3.250	.500	2.875	3.500	4.125	2.500	.281	1480	1850	3.460
TWA 32UU	2	2.1250	3.0000	6.000	5.000	4.063	.625	3.625	4.500	5.250	3.250	.406	2430	3040	6.830

TWA-W Block Type Double Wide

Fig. 12 Double-wide block type slide unit

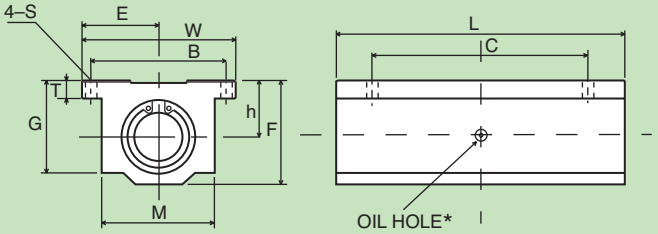


Table 7 *DOUBLE-WIDE BLOCK TYPE DIMENSIONS AND LOAD RATINGS*

NB PART NUMBER	NOM. SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)								MOUNTING DIMENSIONS (inch)			LOAD RATING		Wt. (lbs.)
		h ± .0012	E ± .0012	W	L	F	T	G	M	B ± .01	C ± .01	S	DYNAMIC C (lbs.)	STATIC C0 (lbs.)	
TWA 4WUU	1/4	.4370	.8125	1.625	2.500	.813	.188	.750	1.000	1.312	2.000	.156	96	160	.190
TWA 6WUU	3/8	.5000	.8750	1.750	2.750	.938	.188	.875	1.125	1.437	2.250	.156	150	240	.250
TWA 8WUU	1/2	.6870	1.0000	2.000	3.500	1.250	.250	1.125	1.375	1.688	2.500	.156	370	580	.510
TWA 10WUU	5/8	.8750	1.2500	2.500	4.000	1.625	.281	1.437	1.750	2.125	3.000	.188	640	1000	1.000
TWA 12WUU	3/4	.9370	1.3750	2.750	4.500	1.750	.313	1.563	1.875	2.375	3.500	.188	750	1180	1.200
TWA 16WUU	1	1.1870	1.6250	3.250	6.000	2.188	.375	1.938	2.375	2.875	4.500	.219	1360	2120	2.400
TWA 20WUU	1-1/4	1.5000	2.0000	4.000	7.500	2.813	.438	2.500	3.000	3.500	5.500	.219	1970	3060	5.000
TWA 24WUU	1-1/2	1.7500	2.3750	4.750	9.000	3.250	.500	2.875	3.500	4.125	6.500	.281	2370	3700	7.800

*Provided with push-in oil fitting for 1/4" to 1/2" sizes. Sizes from 5/8" to 2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.

TWJ Adjustable Type

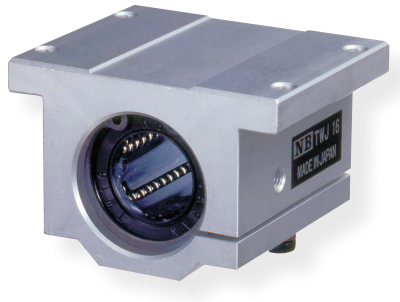


Fig. 13 Adjustable Type Slide Unit

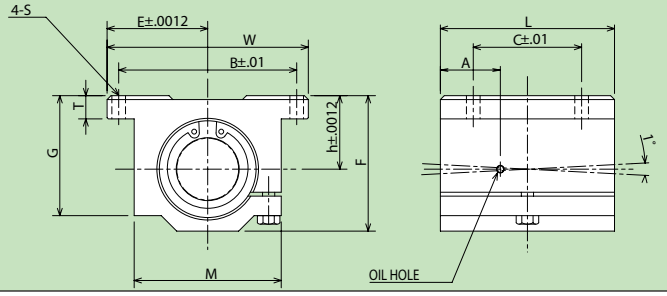


Table 8 *ADJUSTABLE TYPE DIMENSIONS AND LOAD RATINGS*

NB PART NUMBER	NOM. SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)								MOUNTING DIMENSIONS (inch)			LOAD RATING		Wt. (lbs.)
		h ± .0012	E ± .0012	W	L	F	T	G	M	B ± .01	C ± .01	S	DYNAMIC C (lbs.)	STATIC C0 (lbs.)	
TWJ 4 UU	1/4	.4370	.8125	1.625	1.188	.813	.188	.750	1.000	1.312	.750	.156	60	80	.090
TWJ 6 UU	3/8	.5000	.8750	1.750	1.313	.938	.188	.875	1.125	1.437	.875	.156	95	120	.120
TWJ 8 UU	1/2	.6870	1.0000	2.000	1.688	1.250	.250	1.125	1.375	1.688	1.000	.156	230	290	.248
TWJ 10 UU	5/8	.8750	1.2500	2.500	1.938	1.625	.281	1.437	1.750	2.125	1.125	.188	400	500	.465
TWJ 12 UU	3/4	.9370	1.3750	2.750	2.063	1.750	.313	1.563	1.875	2.375	1.250	.188	470	590	.553
TWJ 16 UU	1	1.1870	1.6250	3.250	2.813	2.188	.375	1.938	2.375	2.875	1.750	.219	850	1060	1.200
TWJ 20 UU	1-1/4	1.5000	2.0000	4.000	3.625	2.813	.438	2.500	3.000	3.500	2.000	.219	1230	1530	2.380
TWJ 24 UU	1-1/2	1.7500	2.3750	4.750	4.000	3.250	.500	2.875	3.500	4.125	2.500	.281	1480	1850	3.460
TWJ 32 UU	2	2.1250	3.0000	6.000	5.000	4.063	.625	3.625	4.500	5.250	3.250	.406	2430	3040	6.830

TWJ-W Adjustable Type Double Wide

Fig. 14 Double-wide Adjustable Type Slide Unit

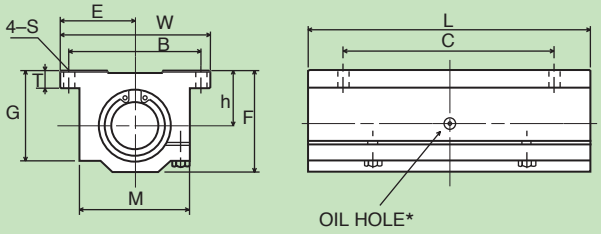


Table 9 *DOUBLE-WIDE ADJUSTABLE TYPE DIMENSIONS AND LOAD RATINGS*

NB PART NUMBER	NOM. SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)								MOUNTING DIMENSIONS (inch)			LOAD RATING		Wt. (lbs.)
		h ± .0012	E ± .0012	W	L	F	T	G	M	B ± .01	C ± .01	S	DYNAMIC C (lbs.)	STATIC C0 (lbs.)	
TWJ 4WUU	1/4	.4370	.8125	1.625	2.500	.813	.188	.750	1.000	1.312	2.000	.156	96	160	.190
TWJ 6WUU	3/8	.5000	.8750	1.750	2.750	.938	.188	.875	1.125	1.437	2.250	.156	150	240	.250
TWJ 8WUU	1/2	.6870	1.0000	2.000	3.500	1.250	.250	1.125	1.375	1.688	2.500	.156	370	580	.510
TWJ 10WUU	5/8	.8750	1.2500	2.500	4.000	1.625	.281	1.437	1.750	2.125	3.000	.188	640	1000	1.000
TWJ 12WUU	3/4	.9370	1.3750	2.750	4.500	1.750	.313	1.563	1.875	2.375	3.500	.188	750	1180	1.200
TWJ 16WUU	1	1.1870	1.6250	3.250	6.000	2.188	.375	1.938	2.375	2.875	4.500	.219	1360	2120	2.400
TWJ 20WUU	1-1/4	1.5000	2.0000	4.000	7.500	2.813	.438	2.500	3.000	3.500	5.500	.219	1970	3060	5.000
TWJ 24WUU	1-1/2	1.7500	2.3750	4.750	9.000	3.250	.500	2.875	3.500	4.125	6.500	.281	2370	3700	7.800

*Provided with push-in oil fitting for 1/4" to 1/2" sizes. Sizes from 5/8" to 2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.

Slide Units

TWD Open Type

Fig. 15 Open Type Slide Unit

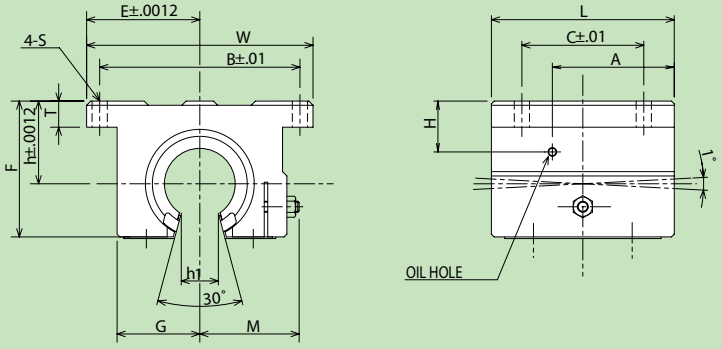


Table 10 *OPEN TYPE DIMENSIONS AND LOAD RATINGS*

NB PART NUMBER	NOM. SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)									MOUNTING DIMENSIONS (inch)			LOAD RATING		Wt. (lbs.)
		h ± .0012	E ± .0012	W	L	F	T	G	M	h_1	B ± .01	C ± .01	S	DYNAMIC C (lbs).	STATIC C0 (lbs).	
TWD 8UU	1/2	.6870	1.000	2.000	1.500	1.100	.250	.688	.86	.260	1.688	1.000	.156	230	290	.188
TWD 10UU	5/8	.8750	1.2500	2.500	1.750	1.405	.281	.875	1.06	.319	2.125	1.125	.188	400	500	.365
TWD 12UU	3/4	.9370	1.3750	2.750	1.875	1.535	.315	.937	1.12	.386	2.375	1.250	.188	470	590	.452
TWD 16UU	1	1.1870	1.6250	3.250	2.625	1.975	.375	1.188	1.40	.512	2.875	1.750	.218	850	1060	1.010
TWD 20UU	1-1/4	1.5000	2.0000	4.000	3.375	2.485	.437	1.500	1.88	.569	3.500	2.000	.218	1230	1530	1.980
TWD 24UU	1-1/2	1.7500	2.3750	4.750	3.750	2.910	.500	1.750	2.12	.681	4.125	2.500	.281	1480	1850	2.950
TWD 32UU	2	2.1250	3.0000	6.000	4.750	3.660	.625	2.250	2.70	.933	5.250	3.250	.406	2430	3040	5.840

TWD Open Type Double Wide

Fig. 16 Double-wide Open Type Slide Unit

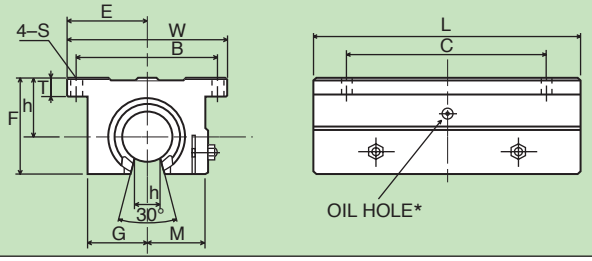


Table 11 *DOUBLE-WIDE OPEN TYPE DIMENSIONS AND LOAD RATINGS*

NB PART NUMBER	NOM. SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)									MOUNTING DIMENSIONS (inch)			LOAD RATING		Wt. (lbs.)
		h ± .0012	E ± .0012	W	L	F	T	G	M	h_1	B ± .01	C ± .01	S	DYNAMIC C (lbs.)	STATIC C0 (lbs.)	
TWD 8WUU	1/2	.6870	1.000	2.000	3.500	1.100	.250	.688	.86	.260	1.688	2.500	.156	370	580	.400
TWD 10WUU	5/8	.8750	1.2500	2.500	4.000	1.405	.281	.875	1.06	.319	2.125	3.000	.188	640	1000	.800
TWD 12WUU	3/4	.9370	1.3750	2.750	4.500	1.535	.315	.937	1.12	.386	2.375	3.500	.188	750	1180	1.000
TWD 16WUU	1	1.1870	1.6250	3.250	6.000	1.975	.375	1.188	1.40	.512	2.875	4.500	.218	1360	2120	2.000
TWD 20WUU	1-1/4	1.5000	2.0000	4.000	7.500	2.485	.437	1.500	1.88	.569	3.500	5.500	.218	1970	3060	4.200
TWD 24WUU	1-1/2	1.7500	2.3750	4.750	9.000	2.910	.500	1.750	2.12	.681	4.125	6.500	.281	2370	3700	6.700

*Provided with push-in oil fitting for 1/2" size only. Sizes from 5/8" to 2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.

Slide Shaft

Specification of NB Slide Shafts

Materials

Materials of NB slide shafts are selected AISI 52100, 1060, and 440C (or equivalent) on the basis of hardenability, fatigue strength, wear resistance, and toughness.

AISI 52100	High carbon chromium bearing steel Most-used steel for bearings
AISI 1060	High carbon alloy steel The most popular steel in linear motion shafts
AISI 440C	Martensite stainless steel A hardenable stainless steel

Other materials may also be available, please contact NB

Heat Treatment

NB slide shafts are case hardened with controlled surface hardness and consistent adequate hardness depth. If the hardness depth is not great enough it will cause early failure to both the shaft and bushing.

NB controls the surface hardness by using high frequency induction hardening techniques. The surface hardness for SFW type (AISI 52100 or 1060 shafts) is 60-64 Rc, SFWS Stainless type (AISI 440C or equivalent shafts) is 52-56 Rc.

Surface Roughness & Straightness

NB slide shafts are finished to a surface roughness of 10-16 micro inches RMS. Straightness of shafts is maintained at 0.001″- 0.002″ per foot.

Surface finish of shafting must be kept consistent to maintain proper operation of bushing and to maintain the proper life of the bearing system.

Diameter Tolerance and Length Tolerance

NB recommends (g6) ISO tolerance shafting for standard high grade linear motion bearings and (h5) ISO tolerance for precision grade linear motion bearings. Both (g6) & (h5) tolerance shafting are available from stock in particular standard lengths or can be cut to special lengths with a tolerance of ±1/32″ for less than 2″ diameter shafts, and ±1/16″ for over 2″ diameter. The maximum standard length of (g6) tolerance shafting is available in continuous usable length but with rough ends. The maximum standard length of (h5) tolerance are available in continuous usable length with finished ends. NB's maximum standard stock lengths are shown in the table provided. Special diameter tolerance and special length tolerance are also available. Please contact your NB sales representative for details.

Explanation Slide Shaft (Part Number) Symbols

SFW	#	h5	x	72	-	PD
Series	Nominal Shaft Diameter (Inch)	Tolerance		Overall Length In Inches		Shaft Modifications
SFW =Carbon Steel	2=0.125	h5=ISO h5				PD=Pre-Drilled
SFWS =Anti-Corrosive	3=0.1875	No Entry= ISO g6				M=Custom Shaft
Example: You need an anti-corrosive slide shaft that has a 2" diameter, is ISO g6, is 72" long with no holes. Order SFWS32x72.	4=0.250					No Entry= Straight Shaft
	6=0.375					
	8=0.500					
	10=0.625					
	12=0.750					
	16=1.000					
	20=1.250					
	24=1.500					
	32=2.000					

For Ordering Assistance Call 1-800-521-2045.

See page 26-27 for ordering information.

Features

- Case hardened
- Ground steel shafting
- Improves bearing life:
  Better surface hardness
  Better depth of hardness
  Better surface roughness
  Better cylindricity
  Better straightness
- Stock for high grade bearings (g6) ISO tolerance
- Stock for precision grade bearings h5 tolerance
- Corrosion resistant Shafts 1/8″ – 2″ Stainless Steel (g6)
- Standard pre-drilled shafts for open bushings 1/2″ - 2″

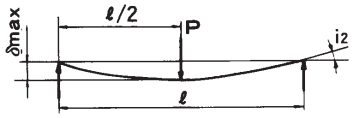
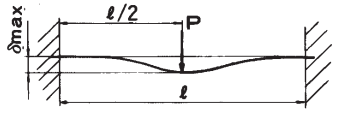
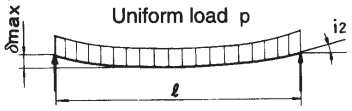
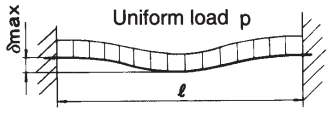
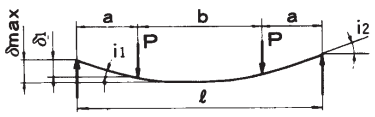
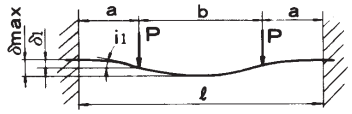
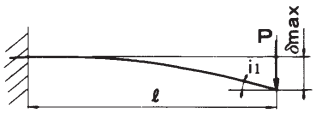
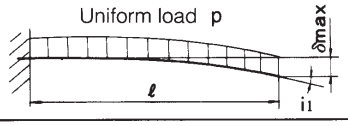
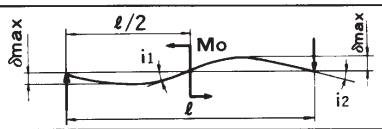
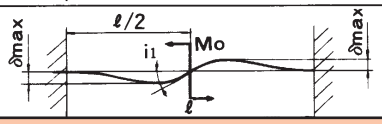
Products

Shaft Deflection and Angle

As Shafts are used for guideways it becomes important that shaft deflection constraints be maintained within certain limits under load. Deflection under load must be maintained otherwise the functioning and service life of the linear bearing assembly could be reduced and cause premature failures.

To aid in the determination of the shaft deflection and its angle, we have established a list of the most common loading conditions and the appropriate calculations for the selected condition. The table below shows the conditions and calculations for the deflection and its angle.

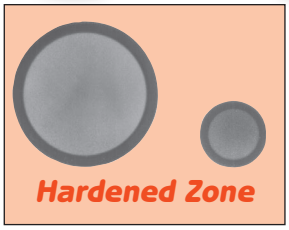
Chart 3

	Supporting method	Specified conditions	Deflection equation	Deflection angle equation
1	Free at both ends		$\delta_{max} = \frac{P\ell^3}{48EI} = P\ell^3C$	$i_1 = 0$ $i_2 = \frac{P\ell^2}{16EI} = P\ell^2C$
2	Fixed at both ends		$\delta_{max} = \frac{P\ell^3}{192EI} = \frac{1}{4}P\ell^3C$	$i_1 = 0$ $i_2 = 0$
3	Free at both ends		$\delta_{max} = \frac{5p\ell^4}{384EI} = \frac{5}{8}p\ell^4C$	$i_2 = \frac{p\ell^3}{24EI} = 2p\ell^3C$
4	Fixed at both ends		$\delta_{max} = \frac{p\ell^4}{384EI} = \frac{1}{8}p\ell^4C$	$i_2 = 0$
5	Free at both ends		$\delta_1 = \frac{Pa^3}{6EI}\left(2+\frac{3b}{a}\right) = 8Pa^3\left(2+\frac{3b}{a}\right)C$ $\delta_{max} = \frac{Pa^3}{24EI}\left(\frac{3\ell^2}{a^2}-4\right) = 2Pa^3\left(\frac{3\ell^2}{a^2}-4\right)C$	$i_1 = \frac{Pab}{2EI} = 24PabC$ $i_2 = \frac{Pa(a+b)}{2EI} = 24Pa(a+b)C$
6	Fixed at both ends		$\delta_1 = \frac{Pa^3}{6EI}\left(2-\frac{3a}{\ell}\right) = 8Pa^3\left(2-\frac{3a}{\ell}\right)C$ $\delta_{max} = \frac{5}{8}p\ell^4C = 0.27(mm)$	$i_1 = \frac{Pa^2b}{2EI\cdot\ell} = \frac{24Pa^2bC}{\ell}$ $i_2 = 0$
7	Fixed at one end		$\delta_{max} = \frac{P\ell^3}{3EI} = 16P\ell^3C$	$i_1 = \frac{P\ell^2}{2EI} = 24P\ell^2C$ $i_2 = 0$
8	Fixed at one end		$\delta_{max} = \frac{p\ell^4}{8EI} = 6p\ell^4C$	$i_1 = \frac{p\ell^3}{6EI} = 8p\ell^3C$ $i_2 = 0$
9	Free at both ends		$\delta_{max} = \frac{\sqrt{3}M_o\ell^2}{216EI} = \frac{2\sqrt{3}}{9}M_o\ell^2C$	$i_1 = \frac{M_o\ell}{12EI} = 4M_o\ell C$ $i_2 = \frac{M_o\ell}{24EI} = 2M_o\ell C$
10	Fixed at both ends		$\delta_{max} = \frac{M_o\ell^2}{216EI} = \frac{2}{9}M_o\ell^2C$	$i_1 = \frac{M_o\ell}{16EI} = 3M_o\ell C$ $i_2 = 0$

Σfi_1: Deflection at loaded point (mm)
Σfi_max: Maximum deflection (mm)
*i*1: Deflection angle at loading point
*i*2: Deflection angle at supporting point
Mo: Moment (N•mm)
P: Concentrated load (N)
p: Uniform load (N/mm)
a,b: Loading point distance (mm)
l: Span (mm)
I: Geometrical moment of inertia (mm^4)
E: Modulus of direct elasticity 2.1 x 105 (N/mm^2)
C: 1/48EI ($1/N•mm^2$)

Slide Shaft

Standard Material & Stainless Steel Slide Shafts



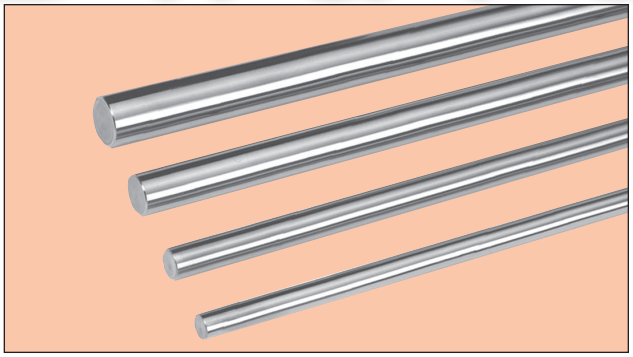


Table 12: *STANDARD MATERIAL SLIDE SHAFTS*

NOM. SHAFT DIA. (inch)	STANDARD GRADE			PRECISION GRADE			MINIMUM HARDNESS DEPTH (inch)	WEIGHT PER INCH (lb)
	NB PART NUMBER	TOL. ISO g6 (inch)	STOCKED MAX* LGTH (inch)	NB PART NUMBER	TOL. ISO h5 (inch)	STOCKED MAX* LGTH (inch)		
1/4	SFW 4xL	-0.0002 -0.0006	158	SFW 4(h5)xL	0 -0.00025	39	0.03	0.014
3/8	SFW 6xL	-0.0002 -0.0006	168	SFW 6(h5)xL	0 -0.00025	78	0.03	0.031
1/2	SFW 8xL	-0.0002 -0.0007	186	SFW 8(h5)xL	0 -0.00030	78	0.03	0.056
5/8	SFW 10xL	-0.0002 -0.0007	185	SFW 10(h5)xL	0 -0.00030	78	0.05	0.087
3/4	SFW 12xL	-0.0003 -0.0008	185	SFW 12(h5)xL	0 -0.00035	78	0.06	0.125
1	SFW 16xL	-0.0003 -0.0008	204	SFW 16(h5)xL	0 -0.00035	78	0.06	0.222
1-1/4	SFW 20xL	-0.0004 -0.0010	204	SFW 20(h5)xL	0 -0.00045	78	0.08	0.347
1-1/2	SFW 24xL	-0.0004 -0.0010	208	SFW 24(h5)xL	0 -0.00045	78	0.08	0.500
2	SFW 32xL	-0.0004 -0.0011	204	SFW 32(h5)xL	0 -0.00050	78	0.08	0.889

*CONTACT NB FOR CURRENT MAXIMUM LENGTH.

Surface Hardness: RC 60-64
Material: AISI 5100 1060

Table 13: *STAINLESS STEEL SLIDE SHAFTS*

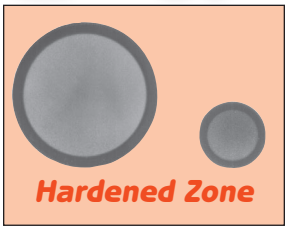
NOM. SHAFT DIA. (inch)	NB PART NUMBER	TOL. ISO g6 (inch)	STOCKED MAX* LGTH (inch)	MINIMUM HARDNESS DEPTH (inch)	WEIGHT PER INCH (lb)
1/8	SFWS 2xL	-0.0002 -0.0005	16	0.03	0.004
3/16	SFWS 3xL	-0.0002 -0.0005	16	0.03	0.008
1/4	SFWS 4xL	-0.0002 -0.0006	158	0.03	0.014
3/8	SFWS 6xL	-0.0002 -0.0006	158	0.03	0.031
1/2	SFWS 8xL	-0.0002 -0.0007	158	0.03	0.056
5/8	SFWS 10xL	-0.0002 -0.0007	158	0.05	0.087
3/4	SFWS 12xL	-0.0003 -0.0008	158	0.06	0.125
1	SFWS 16xL	-0.0003 -0.0008	222	0.06	0.222
1-1/4	SFWS 20xL	-0.0004 -0.0010	204	0.08	0.0347
1-1/2	SFWS 24xL	-0.0004 -0.0010	158	0.08	0.0500
2	SFWS 32xL	-0.0004 -0.0010	158	0.08	0.889

Surface Hardness: RC 52-56
Material: AISI 440C (or equivalent)

*CONTACT NB FOR CURRENT MAXIMUM LENGTH.

Products

Pre-Drilled Shafts



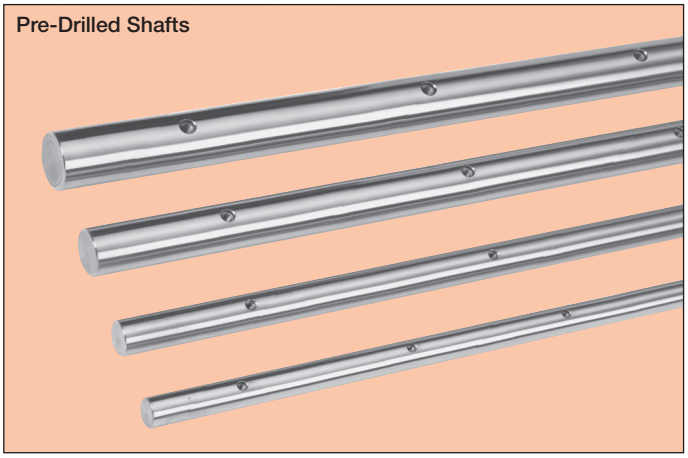


Table 17

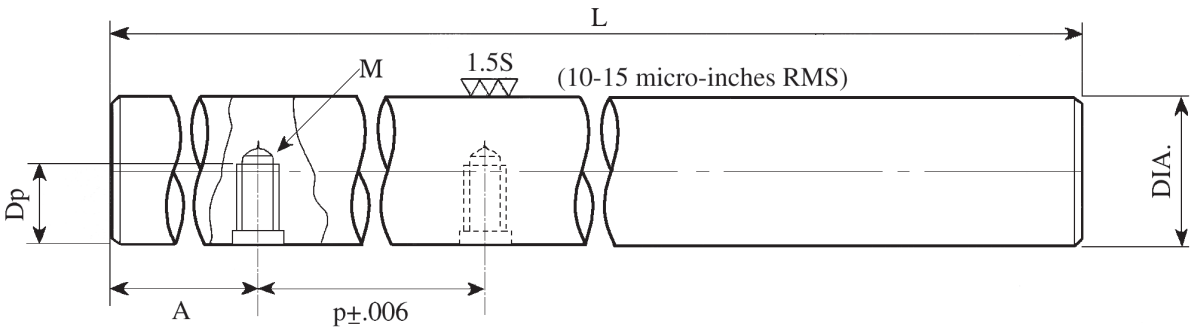


Table 14: *PRE-DRILLED SHAFTS*

NOM. SHAFT DIA. (inch)	NB PART NUMBER	TOL. ISO g6 (inch)	STOCKED MAX* LGTH (inch)	HOLE SPACING		STANDARD THREAD		MINIMUM HARDNESS DEPTH (inch)	WEIGHT PER INCH (lb)
				A (inch)	P (inch)	M	Dp (inch)		
1/2	SFW 8xL-PD	-0.0002 -0.0007	168	2	4	6-32 UNC	0.28	0.03	0.056
5/8	SFW 10xL-PD	-0.0002 -0.0007	180	2	4	8-32 UNC	0.35	0.05	0.087
3/4	SFW 12xL-PD	-0.0003 -0.0008	204	3	6	10-32 UNC	0.40	0.06	0.125
1	SFW 16xL-PD	-0.0003 -0.0008	204	3	6	1/4-20 UNC	0.50	0.06	0.222
1-1/4	SFW 20xL-PD	-0.0004 -0.0010	204	3	6	5/16-18 UNC	0.65	0.08	0.347
1-1/2	SFW 24xL-PD	-0.0004 -0.0010	204	4	8	3/8-16 UNC	0.70	0.08	0.500
2	SFW 32xL-PD	-0.0004 -0.0011	158	4	8	1/2-13 UNC	0.85	0.09	0.889

*CONTACT NB FOR CURRENT MAXIMUM LENGTH.

Surface Hardness: RC 60-64

Material: AISI 5100 1060

Slide Shaft

For Ordering Assistance Call 1-800-521-2045

see page 25-26 for ordering information

Pre-Cut Slide Shafts

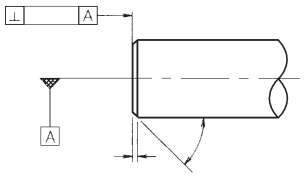
Table 15: *PRE-CUT SLIDE SHAFTS*

NB Part Number Prefix	Length (inch) (L)	Nominal Diameter (inch)	Diameter Tolerances (inch) From ~ To	Standard Lengths (inch) (L) 6	12	18	24	30	36	42	48
PC	4 - ##	.250	.2498 ~ .2494	◆	◆	◆	◆				
PC	6 - ##	.375	.3748 ~ .3744	◆	◆	◆	◆				
PC	8 - ##	.500	.4998 ~ .4993		◆	◆	◆	◆	◆		
PC	10 - ##	.625	.6248 ~ .6243		◆	◆	◆	◆	◆		
PC	12 - ##	.750	.7497 ~ .7492			◆	◆	◆	◆	◆	◆
PC	16 - ##	1.000	.9997 ~ .9992			◆	◆	◆	◆	◆	◆
PC	20 - ##	1.250	1.2496 ~ 1.2490			◆	◆	◆	◆	◆	◆
PC	24 - ##	1.500	1.4996 ~ 1.4990			◆	◆		◆		◆

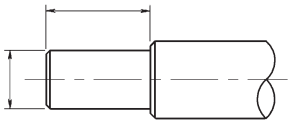
Products

Custom Shafts

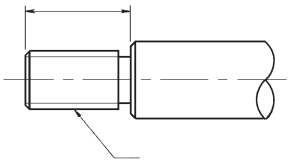
Example 1



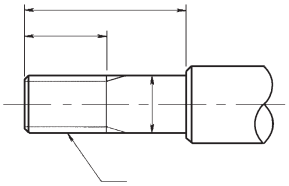
Example 2



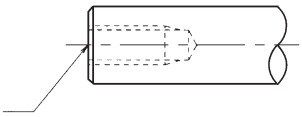
Example 3



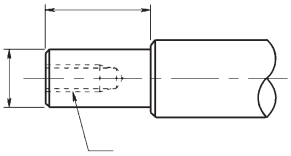
Example 4



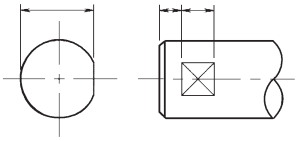
Example 5



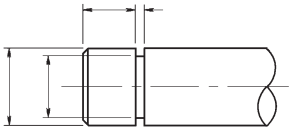
Example 6



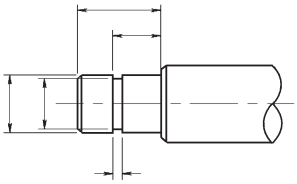
Example 7



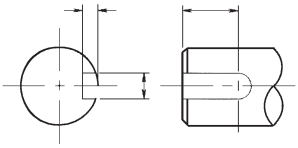
Example 8



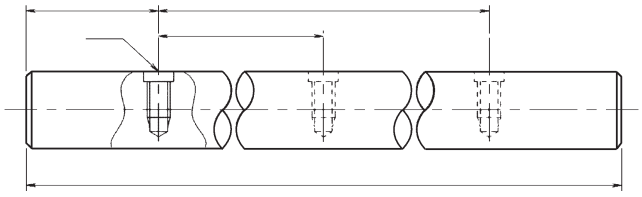
Example 9



Example 10



Example 11



Example 1.
Special Chamfer & Length

Example 2.
Reduced Diameter

Example 3-4.
External Thread

Example 5.
Tapped Hole

Example 6.
Reduced Diameter & Tapped Hole

Example 7.
Flats

Example 8.
External Ring Groove

Example 9.
Reduced Diameter & External Ring Groove

Example 10.
Key Way

Example 11.
Tapped Holes (radial)

NB can offer many custom machined shafts, such as spindles, guide rods, control rods, mandrels, quills, rollers, etc. Please contact our sales representative for details.

Note 1: Recommended maximum tap diameter in example 5 is half of the nominal shaft diameter or slightly larger.

Note 2: In the case of small diameter stainless shafts, the hardness depth may be too deep for additional machining.

All machined shaft requests for quotation must be accompanied by a drawing.

Shaft Support

End Shaft Support: WH-A Type

Precision machined aluminum die cast support blocks provide end support for shafts in applications where slight deflection is not critical.

Fig. 17 End Shaft Support

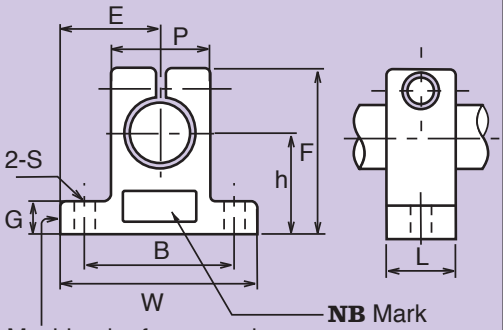


Table 16 *END SHAFT SUPPORT DIMENSIONS AND MOUNTING DIMENSIONS*

NB PART NUMBER	NOMINAL SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)								MOUNTING HOLE(S)		Wt. (LBS.)
		h ± .0010	E ± .005	W	L	F	G	P	B + 0.01	S	BOLT #	
WH 4A	1/4	.6875	.7500	1.500	.500	1.063	.250	.500	1.125	.156	#6	.033
WH 6A	3/8	.7500	.8125	1.625	.563	1.187	.250	.688	1.250	.156	#6	.044
WH 8A	1/2	1.0000	1.0000	2.000	.625	1.625	.250	.875	1.500	.188	#8	.075
WH 10A	5/8	1.0000	1.2500	2.500	.688	1.750	.313	1.000	1.875	.218	#10	.106
WH 12A	3/4	1.2500	1.2500	2.500	.750	2.063	.313	1.250	2.000	.218	#10	.156
WH 16A	1	1.5000	1.5315	3.063	1.000	2.500	.375	1.500	2.500	.281	1/4	.294
WH 20A	1-1/4	1.7500	1.8750	3.750	1.125	3.000	.438	2.000	3.000	.346	5/16	.531
WH 24A	1-1/2	2.0000	2.1875	4.375	1.250	3.437	.500	2.250	3.500	.346	5/16	.725
WH 32A	2	2.5000	2.7500	5.500	1.500	4.375	.625	3.000	4.500	.406	3/8	1.400

Explanation Of END SHAFT SUPPORT P/N (Part Number) Symbols

WH	#
Series	Nominal Shaft Diameter (inch)
WH=Machined Aluminum, Die Cast, Block	**4A**=0.250
	6A=0.375
	8A=0.500
Example: You need an end support to support a 3/8" shaft. Order WH6A.	**10A**=0.625
	12A=0.750
	16A=1.000
	20A=1.250
	24A=1.500
	32A=2.000

Explanation Of SHAFT SUPPORT RAIL P/N (Part Number) Symbols

WA	#	x	24	-	PD
Series	Nominal Shaft Diameter (inch)		Overall Length In Inches		Shaft Modifications
WA=Inch Aluminum Extrusion	**8**=0.500		Example: You need a shaft support that is 1½" by 24" with pre-drilled mounting holes. Order WA24x24-PD.		**PD**=Pre-Drilled
	10=0.625				
	12=0.750				
	16=1.000				
	20=1.250				
	24=1.500				
	32=2.000				

For Ordering Assistance Call 1-800-521-2045.

See page 26-27 for ordering information.

Products

Shaft Support Rail: WA and WA-PD Types

Precision machined aluminum extrusion available with or without pre-drilled mounting holes. Offers continuous shaft support and consistent shaft centerline.

Fig. 18 Top View of Shaft Support Rail

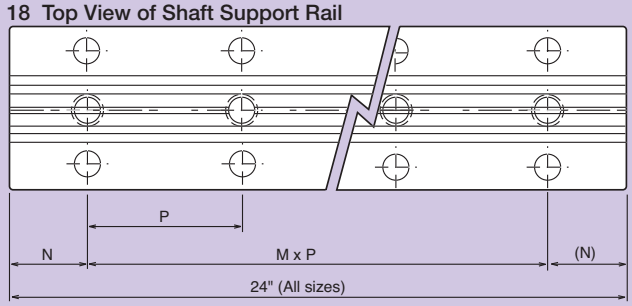


Fig. 19 Side View

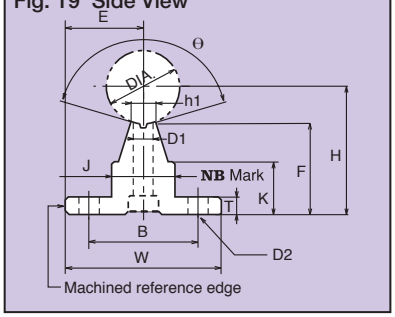


Table 17 *SHAFT SUPPORT RAIL DIMENSIONS AND MOUNTING DIMENSIONS*

NB PART NUMBER	NOMINAL SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)									MOUNTING DIMENSIONS (inch)							Wt. (lbs.)
														D1		D2		
		H ± .0010	E ± .0050	W	F	T	K	J	h1	U (Deg.)	B ± .01	N	M x P	HOLE	BOLT #	HOLE	BOLT #	
WA 08-24 PD	1/2	1.1250	.7500	1-1/2	.903	3/16	.466	.500	.255	145°	1	2	(5) x 4	.169	#6	.169	#6	1.326
WA 10-24 PD	5/8	1.1250	.8125	1-5/8	.841	1/4	.423	.500	.276	145°	1-1/8	2	(5) x 4	.193	#8	.193	#8	1.488
WA 12-24 PD	3/4	1.5000	.8750	1-3/4	1.158	1/4	.592	.625	.322	145°	1-1/4	3	(3) x 6	.221	#10	.221	#10	2.100
WA 16-24 PD	1	1.7500	1.0625	2-1/8	1.280	1/4	.727	.875	.359	150°	1-1/2	3	(3) x 6	.281	1/4	.281	1/4	2.776
WA 20-24 PD	1-1/4	2.1250	1.2500	2-1/2	1.537	5/16	.799	1.100	.437	150°	1-7/8	3	(3) x 6	.343	5/16	.343	5/16	4.060
WA 24-24 PD	1-1/2	2.5000	1.5000	3	1.798	3/8	.922	1.375	.558	150°	2-1/4	4	(2) x 8	.406	3/8	.343	5/16	5.840
WA 32-24 PD	2	3.2500	1.8750	3-3/4	2.322	1/2	1.450	1.500	.800	150°	2-3/4	4	(2) x 8	.531	1/2	.406	3/8	9.500

All sizes are also available without pre-drilled mounting holes. Specify Part Number as WA##-## when ordering. Complete shaft-rail assemblies are also available as well as custom drilling and lengths. Please send drawing for quotation on custom configurations.

Low Shaft Support Rail: LWA (Solid) and LWA-PD (Pre-Drilled) Types

Fig. 20 Low Shaft Support Rail

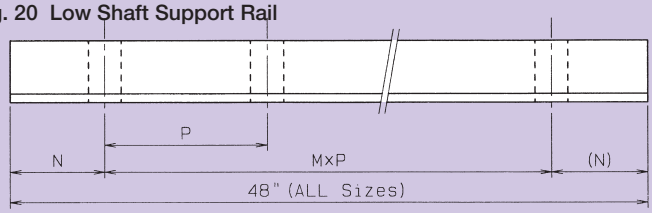
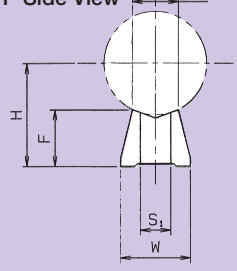


Table 18 *LOW SHAFT SUPPORT RAIL DIMENSIONS AND MOUNTING DIMENSIONS*

NB PART NUMBER	NOMINAL SHAFT DIA. (inch)	MAIN DIMENSIONS (inch)			MOUNTING DIMENSIONS (inch)				WEIGHT lbs / foot
		F	W	H ± .002	h 1	S 1	P	N (3)	
LWA 08-48 PD	1/2	0.341	0.37	0.5625	0.216	0.169	4	2	0.11
LWA 10-48 PD	5/8	0.405	0.45	0.6875	0.269	0.193	4	2	0.17
LWA 12-48 PD	3/4	0.409	0.51	0.7500	0.317	0.224	6	3	0.20
LWA 16-48 PD	1	0.545	0.69	1.0000	0.422	0.281	6	3	0.35
LWA 20-48 PD	1-1/4	0.617	0.78	1.1875	0.523	0.343	6	3	0.44
LWA 24-48 PD	1-1/2	0.691	0.93	1.3750	0.623	0.406	8	4	0.58
LWA 32-48 PD	2	0.836	1.18	1.7500	0.824	0.531	8	4	0.89

Fig. 21 Side View



Shaft Rail

Slide Units and Shaft Rail Accessories

NB's Slide Units and Shaft Rail accessories are produced to tightly controlled tolerances to provide reliably high performance.

The WSS Shaft Rail Assembly comes to you pre-assembled and ready for use.

For corrosive environments, Stainless Steel Slide Shaft is mated with Aluminum Rail Supports which are clear anodized. Slide Units are also made available with corrosion resistance components.

Longer than Maximum Length Rail supports are available making use of Butt Joint or Dowel Pin Joint - quoted by factory.

NB's Slide Units and Shaft Rail accessories contain referenced edges to provide quick and accurate installation.

Explanation Of SHAFT RAIL ASSEMBLIES P/N (Part Number) Symbols

WSS	#	x	144
Series	Nominal Shaft Diameter (inch)		Overall Length In Inches
WSS=Inch Measurement Shaft Rail Assembly	**8**=0.500 **10**=0.625 **12**=0.750 **16**=1.000 **20**=1.250 **24**=1.500 **32**=2.000		Example: You need a slide shaft that has a 1½" diameter and is affixed onto a support that is 48" long. Order WSS24x48".

For Ordering Assistance Call 1-800-521-2045.

See page 26-27 for ordering information.

Assemblies

Shaft Rail Assemblies: WSS Type

Fig. 22 Side View

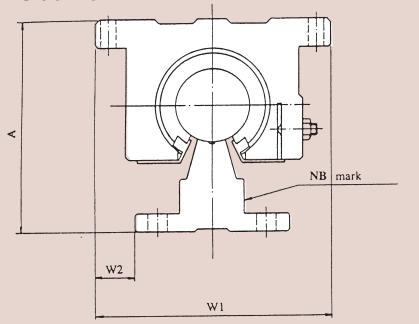


Fig. 23 Shaft Rail Assemblies

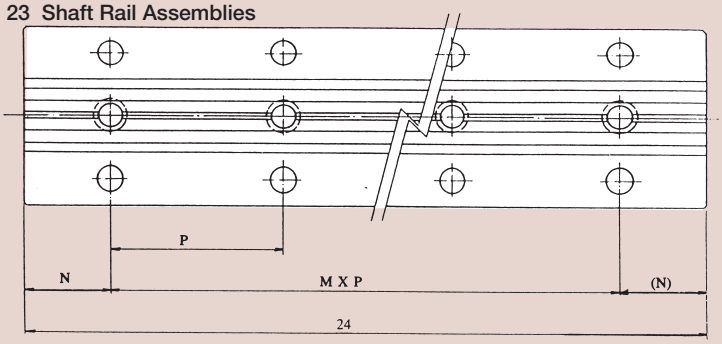


Table 15 Shaft Rail Assembly Dimensions and Mounting Dimensions

NB Part Number	Nominal Shaft Dia. (inch)	Outer Assembly Dimensions (Inch)			Maximum Length 1 - Piece	Base Mounting Holes		WT / FT Lbs.
		A	W 1	W 2		N (Inch)	P (Inch)	
WSS 8 x L	1/2	1.812	2.000	.2500	144”	2	4	1.26
WSS 10 x L	5/8	2.000	2.500	.4375	144”	2	4	1.83
WSS 12 x L	3/4	2.437	2.750	.5000	144”	3	6	2.50
WSS 16 x L	1	2.937	3.250	.5625	144”	3	6	4.06
WSS 20 x L	1-1/4	3.625	4.000	.7500	168”	3	6	6.28
WSS 24 x L	1-1/2	4.250	4.750	.8750	168”	4	8	8.60
WSS 32 x L	2	5.375	6.000	1.1250	168”	4	8	14.88

Notes:

(1) Specify Length (L) when ordering.

(2) Reference to nominal shaft diameter, measured while clamped.

(3) Dimension “N” will be provided equal (both ends) unless otherwise requested.

(4) Ordering Example:
Need 1-1/2” x 48” order Part Number as WSS 24 x 48.0”

(5) Longer than “Maximum Std Length” contact NB for quotation.

(6) For Custom Hole Location or Non-Standard Lengths, contact NB for quotation.

Ordering

Ordering By Part Number

Ordering by part number code makes it unnecessary to specify all the dimensions listed in the tables of specifications associated with each product. All associated dimensions will be indicated by the code.

All you have to do to order is specify:

A. PART CODE

The first letters in the table that symbolize the product series. They also specify whether it is an inch or metric series.

B. DIAMETER CODE

A single code number corresponds to either the inscribed diameter for TOPBALL bushings, or the nominal shaft diameter for all shaft associated products. For example, Code 4 is ¼ inch; diameter Code 16 is 1 inch.

C. WIDTH SYMBOL

Indicate whether block housing is double wide or not.

D. SEAL CODE

Indicate whether TOPBALL bushings and combined TOPBALL block housing units are sealed or not.

E. X LENGTH

Indicate the length of support rails or shafts.

F. SHAFT MODIFICATION

There are only two symbols, PD for Pre-Drilled or M for custom shaft. Indicate which. For non-standard lengths or non-standard hole locations, or any other questions…

Do not hesitate to call NB Corp.
Customer Service for assistance:
1-800 521-2045

Explanation Of TOPBALL P/N (Part Number) Symbols

T	W	#	UU	OP
Series	Measurement Type	Inscribed Circle Diameter (inch)	Seal Symbol	Modification
T=TOPBALL®	W=Inch	4=0.250	UU=Seals on Both Ends	OP=Open Type
Example: You need a slide bush that has a ½" interior diameter, that's not open, with seals on both ends. Order TW8UU.		6=0.375		
		8=0.500	No Entry= Not Open (Standard)	No Entry= No Seals
		10=0.625		
		12=0.750		
		16=1.000		
		20=1.250		
		24=1.500		
		32=2.000		

Explanation Of TOPBALL SLIDE UNIT P/N (Part Number) Symbols

TW	#	W	UU
Series	Inscribed Circle Diameter (Inch)	Width Symbol	Seal Symbol
TWA= Block	4=0.250	W=Double Width	UU=Seals on Both Ends
TWJ= Adjustable	6=0.375		
TWD= Open	8=0.500	No Entry= Single Width	No Entry= No Seals
	10=0.625		
	12=0.750	Example: You need a slide bush in a block that is adjustable, has a ¾" interior diameter, with seals and is double wide. Order TWJ12UU.	
	16=1.000		
	20=1.250		
	24=1.500		
	32=2.000		

Information

Explanation Slide Shaft (Part Number) Symbols

SFW	#	h5	x	72	-	PD
Series	Nominal Shaft Diameter (inch)	Tolerance		Overall Length In Inches		Shaft Modifications
SFW =Carbon Steel	2=0.125	h5=ISO h5				PD=Pre-Drilled
SFWS =Anti-Corrosive	3=0.1875	No Entry= ISO g6				M=Custom Shaft
Example: You need an anti-corrosive slide shaft that has a 2" diameter, is ISO g6, is 72" long with no holes. Order SFWS32x72.	4=0.250					No Entry= Straight Shaft
	6=0.375					
	8=0.500					
	10=0.625					
	12=0.750					
	16=1.000					
	20=1.250					
	24=1.500					
	32=2.000					

Explanation Of SHAFT RAIL ASSEMBLIES P/N (Part Number) Symbols

WSS	#	x	144
Series	Nominal Shaft Diameter (inch)		Overall Length In Inches
WSS=Inch Measurement Shaft Rail Assembly	8=0.500		Example: You need a slide shaft that has a 1½" diameter and is affixed onto a support that is 48" long. Order WSS24x48".
	10=0.625		
	12=0.750		
	16=1.000		
	20=1.250		
	24=1.500		
	32=2.000		

Explanation Of END SHAFT SUPPORT P/N (Part Number) Symbols

WH	#
Series	Nominal Shaft Diameter (inch)
WH=Machined Aluminum, Die Cast, Block	4A=0.250
	6A=0.375
	8A=0.500
Example: You need an end support to support a 3/8" shaft. Order WH6A.	10A=0.625
	12A=0.750
	16A=1.000
	20A=1.250
	24A=1.500
	32A=2.000

Explanation Of SHAFT SUPPORT RAIL P/N (Part Number) Symbols

WA	#	x	24	-	PD
Series	Nominal Shaft Diameter (inch)		Overall Length In Inches		Shaft Modifications
WA=Inch Aluminum Extrusion	8=0.500		Example: You need a shaft support that is 1½" by 24" with pre-drilled mounting holes. Order WA24x24-PD.		PD=Pre-Drilled
	10=0.625				
	12=0.750				
	16=1.000				
	20=1.250				
	24=1.500				
	32=2.000				

For assistance on any questions, please call 1-800-521-2045

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