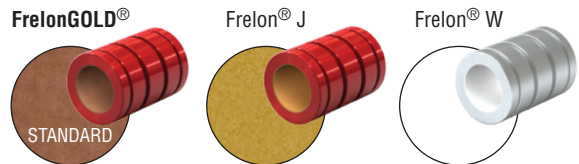
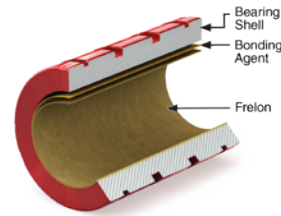


Performance Benefits Simplicity® Plain Bearings

Frelon® + Precision Bearing Technology = Simplicity®

- The Frelon liner is bonded to the bearing shell at the molecular level, which transfers the load and dissipates heat buildup throughout the bearing
- Will not rust or corrode due to anodized aluminum or 316 stainless steel shell
- Patented self-aligning capabilities are standard
- Provides both linear, oscillating, rotary, or any combination of motions
- Maintenance free operation
- Smooth and quiet operation – plus long life
- Highly accurate – all critical surfaces are ground on precision bearing grinders
- Will not catastrophically fail or damage shaft

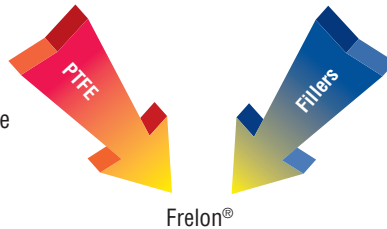


Frelon Bearing Liner Materials

The Frelon liners are compounds of PTFE and fillers developed for improved performance over other bearings. They provide low wear, low friction, self-lubrication, and high strength.

PTFE FEATURES:

- Self-lubricating (runs without added lubricant)
- Embeddability of hard particulate
- Wide temperature range (-400°F to +400°F) (-240°C to +204°C)
- Chemically inert
- Vibration damping (no metal-to-metal contact)



FILLER BENEFITS:

- High load capacity
- High strength
- Low wear rate vs. other materials

- FrelonGOLD® – dark gold high performance material compatible with RC60 hardened steel shafting, RC70 ceramic coated, and 440 stainless steel shafting.
- Frelon J – yellow material formulated to provide the optimum performance with 300 series stainless steel and softer shafting such as bare aluminum.
- Frelon W – white color, food-grade liner, FDA compliant, compatible with stainless steel and softer metal shafting.
- PBC Linear's unique bonding process facilitates the ability to provide solutions for applications with a range of additional bearing liner materials. Contact PBC Linear to discuss your specific application.



Email an Application Engineer

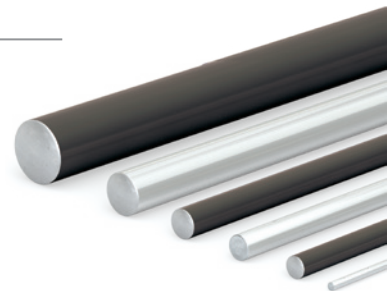
Simplicity® 60 Plus® Shafting

PBC Linear's development team, working in close conjunction with engineers from Lee Linear®, have together formulated a linear shaft designed specifically for optimal bearing performance – *Simplicity 60 Plus Shafting*. Advanced process capabilities maintain the ideal surface finish resulting in the longest life and highest performing shaft-to-bearing combination.

Don't be misled—all shafting is not alike! Don't settle for below average performance. The smoothest shafting is NOT always the best for all situations. **In most applications, smoother does not equal better; in fact, it means decreased performance and shortened life.** A shaft surface finish of 8-12 Ra is the optimal smoothness for linear plain and ball bearings.

Simplicity 60 Plus Shafting provides maximum linear bearing performance and the following features:

- Optimized shaft surface finish for plain bearings
- Customizable length and machined features via the configurator with no minimum quantities
- Faster Made in the USA



Only certified Simplicity 60 Plus Shafting provides maximum linear bearing performance.

[Inch Series—page 44](#) [Metric Series—page 81](#)

Plain Bearings Simplicity®

Running Clearance

Simplicity bearings are available with two classes of running clearance:

PRECISION—"FL":

- Performs like a preloaded ball bearing
- Tightest running clearance approximately .001" (.025 mm)
- Used in applications that require high precision

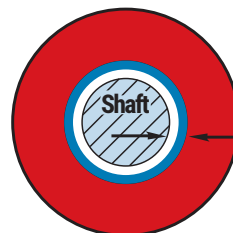
CAUTION *Not recommended for all parallel shaft applications. Any misalignment can cause binding on the shaft. Recommend: Compensated—"FLC" (see below).*

COMPENSATED—"FLC":

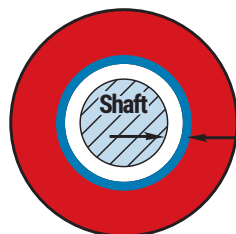
- Performs like a standard ball bearing
- Additional clearance built into the I.D.—all other dimensions are the same as the precision bearings
- Ideally suited for parallel shaft applications

Note: Many parallel shaft applications will run "FL" precision on one rail and "FLC" compensation on the opposite rail to accommodate slight misalignments.

RUNNING CLEARANCE



Standard "FL"
Performs like a preloaded linear ball bearing
.0005" per side clearance average
(.0127 mm)



Compensated "FLC"
Performs like a standard linear ball bearing
.0015" + per side clearance average
(.0381 + mm)

Bearing Shell

Simplicity bearings are available in a variety of configurations to help meet specific application needs:

- Standard is aluminum alloy with anodized finish
- 316 stainless steel (no plating)

MATERIALS:

Aluminum Alloy – Is a heat treated and artificially aged aluminum with good strength and corrosion resistance.

316 Stainless Steel – Has an excellent corrosion resistance and is widely used by the paper, food, and other industries.

FINISHES:

Standard Anodized – A sulfuric bath anodizing with a nickel acetate seal that will stand up to 14 days exposure in a 5% salt spray solution at 96°F. It is applied at a .0002" thickness.



[Link to the Simplicity Video](#)



[More Information about Simplicity's Chemical Resistance](#)

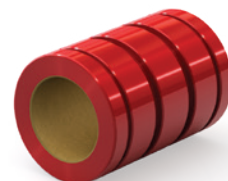


Only certified Simplicity 60 Plus Shafting provides maximum linear bearing performance.

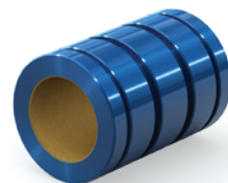
[Inch Series—page 44](#) [Metric Series—page 81](#)



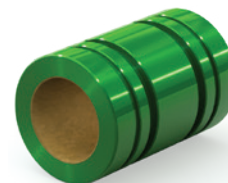
Standard



Inch Series

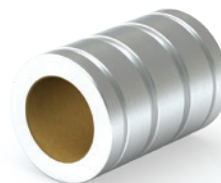


ISO Metric Series



JIS Metric Series

Optional



316 Stainless Steel

Plain Bearings Simplicity®

Self-Alignment Feature

Simplicity bearings are available with a standard straight O.D. or a crowned self-aligning O.D.

FL – (Standard):

- Straight O.D.
- Standard pillow blocks have the self-aligning capability designed into the block using standard “FL” bearings for the final assembly

FLA – (Self-aligning O.D.):

- Has a crown on the O.D. allowing the bearing to re-align itself in binding situations
- Specifically designed to easily retrofit straight bore housings
- The bearing will allow $1/2^\circ$ of misalignment capability from centerline (1° overall)
- O-rings are used on either side of the crown to cushion and eliminate clatter in operation

Pillow Blocks

- Made of aluminum alloy
- Pillow blocks are interchangeable with industry standard ball bearing pillow blocks
- Critical centerline dimensions hold accuracy within $\pm .001$ " on inch sizes and $\pm .015$ mm on metric sizes

FINISHES:

- Clear anodized finish (Standard)

Standard pillow blocks have built-in self-alignment in all directions:

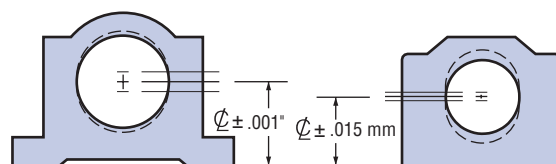
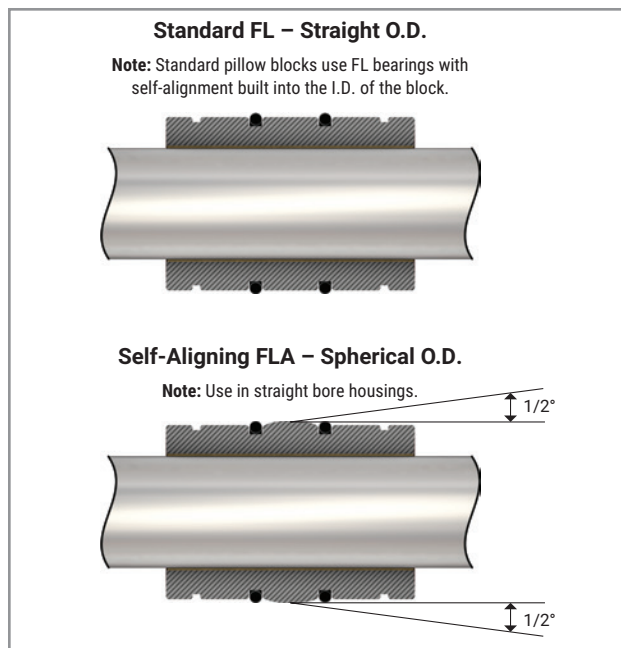
- Standard pillow blocks have $1/2^\circ$ misalignment from centerline
- This feature is built into the housing with a spherical radius at the midpoint of the block
- This self-aligning capability will allow for some shaft deflection and misalignment

Rigid or straight bore housings are available:

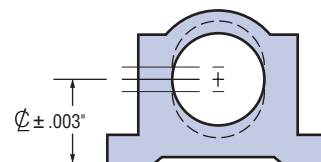
- This does not allow for any self-alignment and provides a very rigid assembly
- They are typically used in single shaft applications

Open Bearings Orientation

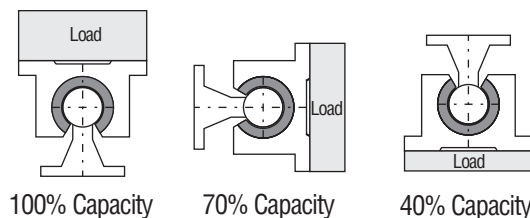
Simplicity bearings can operate in any orientation. Load capacities will vary on open bearings depending on the orientation in which they are being used.



SIMPLICITY = TIGHTER TOLERANCES



INDUSTRY STANDARD



Plain Bearings Simplicity®

Load Capacity Of Liner

Simplicity bearings can carry from 4 to 20 times the load of a linear ball bearing.

BEARING MATERIAL	STATIC LOAD CAPACITY
FrelonGOLD®	3000 psi or 210.9 kgf/cm ²
Frelon® J / Frelon® W	1500 psi or 105.45 kgf/cm ²

- Allows the engineer to maintain performance in a smaller designed package
- Example: Simplicity 1/2" I.D. = 1" I.D. linear ball bearing
- Shock loads and vibration are absorbed
- Metal-to-metal contact is eliminated providing a smoother, quieter running assembly

Speed Characteristics

Exceeding these speeds causes frictional heat and accelerates liner wear.

BEARING MATERIAL	NO LUBE CONTINUOUS MOTION	NO LUBE INTERMITTENT MOTION	WITH LUBRICATION*
FrelonGOLD®	300 sfm	825 sfm	825 sfm
	60 in./sec.	165 in./sec.	165 in./sec.
	1.524 m/sec.	4.19 m/sec.	4.19 m/sec.
Frelon® J / Frelon® W	140 sfm	400 sfm	400 sfm
	28 in./sec.	80 in./sec.	80 in./sec.
	.711 m/sec.	2.03 m/sec.	2.03 m/sec.

*Depending on the lubrication used, loads, and frequency of continuous or intermittent motion, speeds can be in excess of the numbers shown.

Performance Ratings (for Linear Motion)

Plain bearings are rated by their limiting PV, which is a combination of load over a given surface area and the velocity.

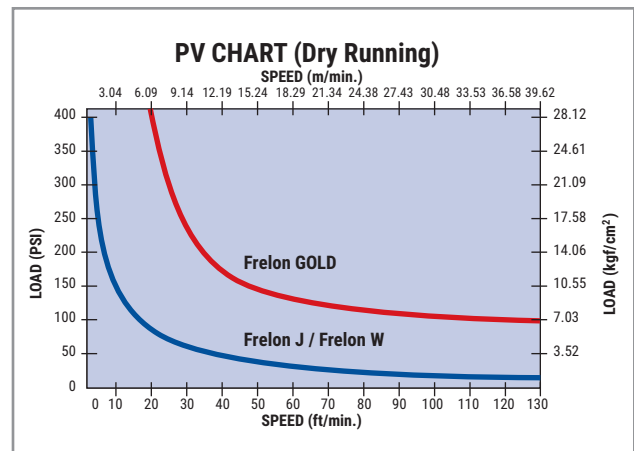
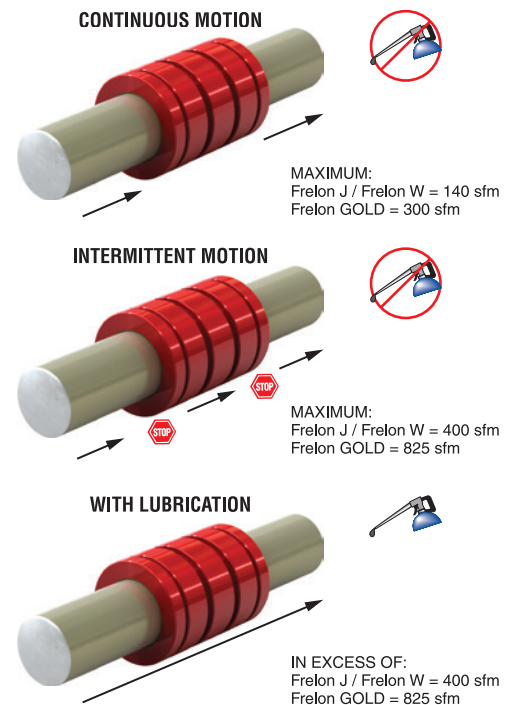
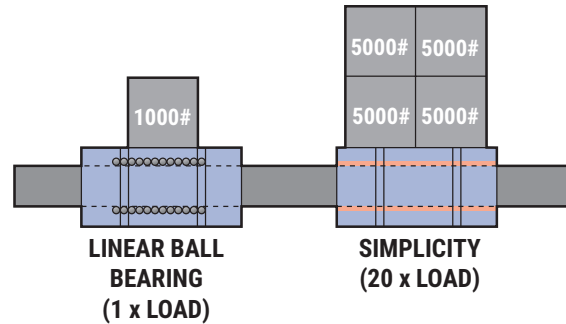
BEARING MATERIAL	MAX. "PV"	MAX. "P"	MAX. "V" (NO LUBRICATION)
FrelonGOLD®	20000 (psi x ft./min.)	3000 psi	300 sfm
	430 (kgf/cm ² x m/min.)	210.9 kgf/cm ²	91.44 m/min.
Frelon® J / Frelon® W	10000 (psi x ft./min.)	1500 psi	140 sfm
	215 (kgf/cm ² x m/min.)	105.45 kgf/cm ²	42.66 m/min.

PV = The performance measurement of plain bearings

PV = P x V where P = pressure (load) in psi (kgf/cm²)

V = velocity (speed) in sfm (m/min.)

Note: All three parameters must be met by an application for the bearing to perform properly.



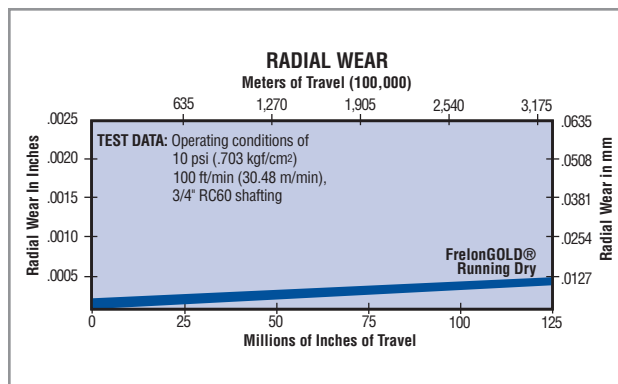
Plain Bearings Simplicity®

Wear Rate/Life Expectancy

The life expectancy of a Simplicity bearing is dependent on application parameters:

- Shaft hardness, surface finish, and preparation
- Length of travel
- Temperature
- Contamination
- Running clearance
- Lubrication
- Speed

The Radial Wear chart gives a guideline for a typical application at 10 psi (.703 kgf/cm²) traveling at 100 ft./min. (30.48 m/min.).



Factors Affecting Wear Rate/Life

Shafting requirements for Frelon® bearing materials include:

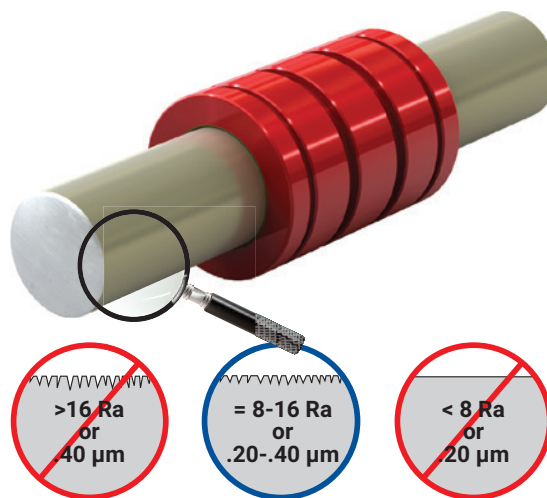
BEST PERFORMANCE:

- Finish of 8–12 Ra
- Hardness of RC 60

ACCEPTABLE PERFORMANCE:

- Finish of 8–16 Ra
- Hardness of RC 35
- Surface finish requirements apply to all Frelon bearing materials
- Rougher shafting can be used, but both bearing and shafting will wear at accelerated rates and binding may occur

Note: Consult factory if using chrome plated shafting that is polished to < 8 Ra.



Cantilevered Loads

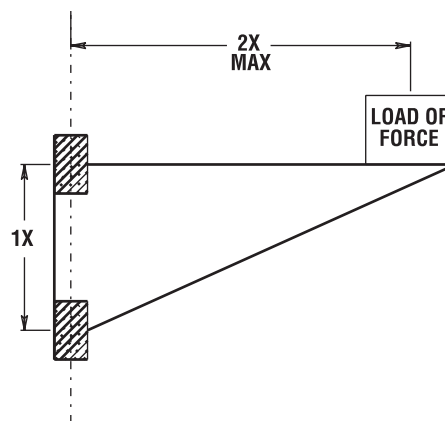
- Maximum 2:1 ratio
- 1x = bearing separation on same shaft
- 2x = distance from shaft to load or force

Example: If 2x equals 10" then 1x must be at least 5"

CAUTION Binding will occur if the 2:1 ratio is exceeded.



2:1 Ratio Information



PERFORMANCE

Plain Bearings Simplicity®

Transfer Process Of Liner To Shaft

The interaction of the Frelon® material and the shafting creates a natural, microscopic transfer of the Frelon to the running surface. A thin film is deposited on the shaft, and the valleys in the surface finish are filled in with Frelon material during the initial break-in period. This transfer creates the self-lubricating condition of Frelon riding on Frelon.

This break-in period varies depending on several criteria:

1. Preparation of the shafting prior to installation – it is best to clean the shafting with a 3-in-1 type oil before installing the bearings. This ensures that the surface will receive a full transfer of material.
2. Speed, load, and length of stroke specific to the application – typically the initial transfer process will take approximately 50-100 strokes of continuous operation. The running clearance on the bearing will increase an average of .0002" to .0005", depending on the length of the stroke and surface requiring the transfer.
3. How often the shafting is cleaned – if the shafting is cleaned regularly, increased wear will be seen in the bearings. This is due to the transfer process being performed over and over again.

CAUTION Do not repeatedly clean the shafting with alcohol. This will remove the previously transferred material entirely and increase the wear to the bearing liner.

CAUTION Do not use smooth chrome shafting with Frelon bearings. The surface finish is less than 8 Ra and does not maintain proper transfer of Frelon material. This will result in accelerated wear.

Lubrication

- Reduce friction up to 50%
- Minimize wear of liner
- Reduce heat buildup allowing greater speeds – actual speeds achieved are dependent on type of lubricant and frequency of application
- Aid in cleaning the shafting for a proper transfer process. – a minimum of initial lubrication of Simplicity bearings is strongly recommended

Chemical Resistance

Simplicity bearings stand up to harsh environments and provide excellent performance in a submerged condition.

FrelonGOLD® – the fillers in the material can be attacked by deionized water and other harsh chemicals

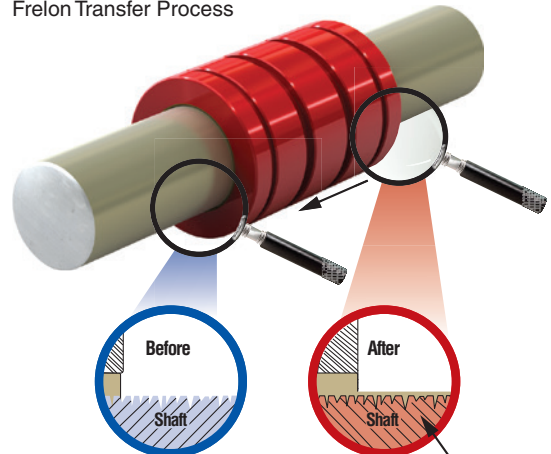
Frelon J – almost universal chemical inertness: Only molten sodium and fluorine at elevated temperatures and pressures show any signs of attack

Frelon W – A white colored food-grade liner that is FDA compliant

Anodized Aluminum Shell (Standard) – good chemical resistance in most industrial applications

316 Stainless Steel Shell (Optional) – excellent chemical and corrosion resistance in harsh environments

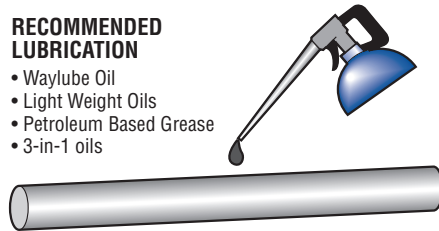
Frelon Transfer Process



At break-in, Frelon deposits a microscopic film on the shaft and fills the valleys in the surface finish creating a Frelon-on-Frelon running condition that is true self-lubrication.

RECOMMENDED LUBRICATION

- Waylube Oil
- Light Weight Oils
- Petroleum Based Grease
- 3-in-1 oils



NOT RECOMMENDED

- WD-40
- PTFE Sprays
- Fluorocarbons
- Silicon Oils, Grease or Spray

WD40® is a registered trademark of the WD40 company



[More Information about Simplicity's Chemical Resistance](#)



Plain Bearings Simplicity®

Temperature

Simplicity bearings can operate in a wide range of temperatures (-400°F to +400°F) (-240°C to +204°C). Depending on the materials housed in the pillow block and the size of bearing

- Maintains the same performance characteristics
- The thin liner allows heat to dissipate through the bearing shell

Thermal Expansion

The standard bearing I.D. options are designed for use in most industrial applications.

For temperatures below 0°F, the standard I.D. is recommended (FL series).

For extreme high temperatures, the Compensated I.D. bearing is recommended (FLC) for the increased running clearance.

CAUTION *It is always best to inspect actual size at extreme temperatures to ensure proper running clearance.*

Rotary Applications

Simplicity bearings will operate very well in rotary applications if applied properly.

Stationary rotary applications do not allow the heat to be spread over an extended area. It is retained in the I.D. of the bearing limiting speed and load.

- MAX rotary speed (No lube/continuous motion)
- 40 sfm (12.2 m/min.) for standard precision I.D. clearances
- 140 sfm (42.6 m/min.) for compensated I.D. clearances

$$V(\text{sfm}) = .262 \times d \times \text{RPM}$$

d = shaft diameter (inches)
RPM = revolutions per minute

- Properly maintained lubrication can increase these speeds dramatically

CAUTION *It is always best to do specific testing for rotary applications above these limits where lubrication is to be used.*

Vacuums/Outgassing/Cleanrooms

Due to self-lubrication, low outgassing, and a minimum of particulate (buildup), Simplicity bearings are excellent in clean rooms and vacuums.

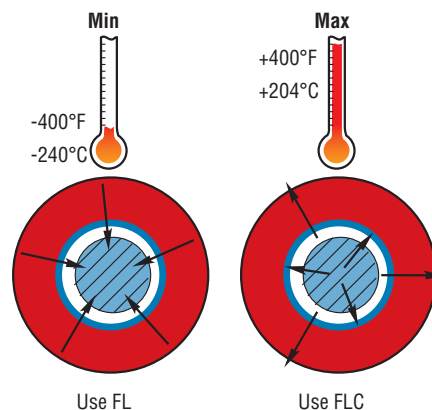
Testing has been done on the Frelon® materials in accordance with ASTM E-595-90 with acceptable maximums of 1.00% TML and .10% CVCM.

MATERIAL	%TML	%CVCM
FrelonGOLD®	0.00	0.00
Frelon J	0.18	0.01

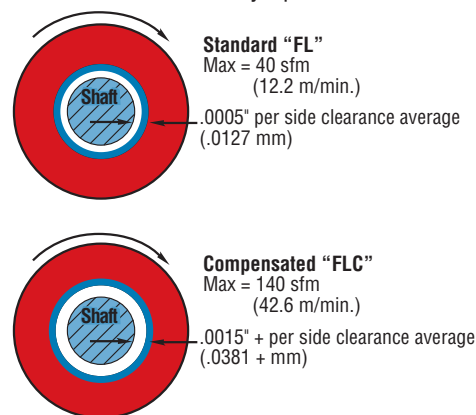
TML = Total Mass Loss

CVCM = Collected Volatile Condensable Materials

Temperature Extremes



Maximum Rotary Speeds



Submerged Applications

Simplicity bearings will provide excellent performance in a submerged condition.

The bearings will employ the fluid as a lubricant showing increased velocities and wear life. Oils and non-salt water are especially effective.

Note: Please contact factory before specifying FrelonGOLD for submerged applications.

Plain Bearings Simplicity®

O-Rings

Used in standard pillow blocks and with self-aligning bearings.

Nitrile Buna 70 (standard) – A good general purpose rubber that is used in 98% of applications (-65°F to 275°F (-54°C to 135°C)).

Viton (special – designate with “V”) – Used only in high temperature applications up to 400°F (up to 204°C).



Seals

Use only in the most contaminated environments.

Polymod® (standard) – A high performance polymer modified material that reduces friction of a standard buna material by 50% and increases wear life.

Polymod is a registered trademark of Polymod Technologies, Inc.

Temperature: -20°F to +212°F

Urethane (special - designate with “U”) – A moly-impregnated urethane scraper that is only for the severest applications - friction is greatly increased!

Temperature: -40 to +200°F

Viton™ (special - designate with “V”) – A brand of synthetic rubber and fluoropolymer elastomer used only in high temperature applications.

Temperature: Up to +400°F

Attention: 90% of applications do not require seals when using Simplicity bearings. The liner has a natural ability to wipe particles from the shafting. Any particulate (metal, sand, etc.) that does enter the bearing will embed itself into the soft liner not scoring the shafting or locking mechanical parts.

When ordering a bearing with any internal features (seals or internal lubrication), the bearing may or may not be shipped with extra internal grooves in addition to those needed for the ordered option. Low volume orders are more likely to have additional grooves. The extra grooves will not negatively impact the performance of the bearing.

Also, internal grooves are typically an anodized surface; however, in the interest of the quickest possible delivery, the internal grooves may not be anodized.

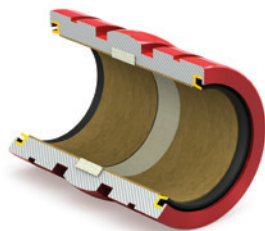
Lubrication System

Order with “JKM” modifier

Lubrication system includes:

Felt wick – Retains oil lubricants (remove when using grease lubrication). Wicks are glued in place on open bearings while they just sit in place on closed bearings.

Zerk fitting – Installed into pillow block, other housing, or directly into die sets PAC, PACM. (Standard lube fitting with 1/4-28 thread)



Bearing Alignment

Linear ball bearings will continue to operate in a misaligned condition, but can cause damage to the shafting and catastrophically fail.

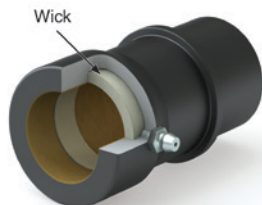
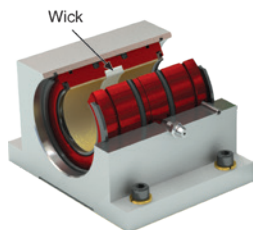
Simplicity bearings DO NOT tolerate misalignment. They simply stop moving without any damage to the shafting. Self-aligning housings aid in misalignment – up to 1/2° from centerline.

Note: Please refer to the tables in the installation section for possible solutions to misalignment.



[Misalignment Considerations—page 141](#)

ZERK FITTING IN HOUSING





Ordering information Linear Plain and Sleeve Bearings, Pillow Blocks

PLAIN BEARINGS

Series

FM - ISO metric plain bearing
FMT - compact ISO metric thin-wall series
FG - "FAG"™ thin-wall series
PSM - ISO metric plain sleeve bearing
PSFM - ISO metric flanged sleeve bearing

OD properties

Not specified - standard with straight outside diameter
A - balled, self-aligning (only for closed bearings)
 Only available for **FM** series

ID properties

Not specified - standard series precision inside diameter running clearance
C - compensating inside diameter running clearance
 Not applicable to **PSM**, **PSFM**

Closed or open

Not specified - standard series closed bearing
N - open series
 Only available for **FM** series

Bearing shell material

ONLY available for the **FM**, **FMT**, and **FG** series
Not specified - standard series aluminium alloy
***S** - 316 stainless steel
 *Special manufacture with zinc plating or anodizing not possible.

Nominal shafting diameter

Metric units in mm

FM **16** - **DU**

Additional seals

DU - sealing rings made of urethane material saturated with molybdenum*
 * available sizes **FM20-FM80**

Liner material

Not specified - Standard Frelon GOLD® liner for hardened steel shafting with ceramic coating and for 440 stainless steel shafting
***E** - special Frelon J® liner for soft shafting (unplated aluminium, 300 stainless steel, etc.)
 * limited available, individual quotation
W - food-quality liner (contact PBC Linear before ordering)

Inside lubrication

Not specified - standard bearing – no lubricating system
JKM - drill hole and internal felt wick for storing and distributing oil.
 JMK available for sizes **FM12-FM80** only

Special modifications

Not specified - standard options
Q - absolutely no grease upon delivery (contact PBC Linear before ordering)

Note: Inch and JIS designations for selected parts available upon request.

The data and specifications in this publication have been carefully compiled and are believed to be accurate and correct. The user alone is responsible for determining whether PBC Linear products are suitable for a given application. PBC Linear's only obligation will be to repair or replace, without charge, any defective components promptly returned. No liability is assumed beyond such replacement. We reserve the right to make changes to specifications at any time. The most recent technical updates can be found at www.pbclinear.com.

Linear Plain and Sleeve Bearings, Pillow Blocks **Ordering information**

PLAIN BEARINGS WITH HOUSINGS/PILLOW BLOCKS



Series

- PM** - ISO metric bearing housing (FM)
- PACMx*** - ISO metric clamping sleeve
- SFPM** - ISO metric plain bearing with flange
- DFPM** - ISO metric double-length plain bearing with flange
- CFPM** - ISO metric double plain bearing with centre-mount flange

* Please specify the flange material.
In the part number, replace "x" with:
Z = aluminium or T = steel.

Note: metric flanged bearings have no separate bearing inserts.

Closed or open

- Not specified** - closed standard design
 - N** - open series
- Only available for **PM** series

Housing inside diameter characteristics

- Not specified** - standard series square flange
 - R** - round flange
- Only available for the **SFPM**, **DFPM**, and **CFPM** series

Housing only

- Not specified** - housing including bearing
- E** - empty housing WITHOUT bearing

Nominal shafting diameter

Metric units in mm

PM **16** - **D**

Bearing inside diameter characteristics

- Not specified** - standard series precision inside diameter running clearance
- C** - compensating inside diameter running clearance

Additional seals

- DU** - sealing rings made of urethane material saturated with molybdenum
- * available sizes **PM20-PM80**

Liner material

- Not specified** - Standard Frelon GOLD® liner for hardened steel shafting or aluminium with ceramic coating
- *E** - special Frelon J® liner for soft shafting (aluminium, 300 stainless steel, etc.)
- * limited available, individual quotation
- W** - food-quality liner (contact PBC Linear before ordering)

Inside lubrication

- Not specified** - standard bearing housing without lubricating system
 - JKM** - drill hole and internal felt wick for storing and distributing 1/4-28 Zerk
- Installation of Zerk fitting directly in the bearing housing, in another housing, or directly on the **PACM** clamping sleeves.

Special modifications

- Not specified** - standard options
- Q** - absolutely no grease upon delivery (contact PBC Linear before ordering)

Note: Inch and JIS designations for selected parts available upon request.

This catalogue and part numbering system is designed to represent all possibilities which are not present in standard parts. These are options only – combinations could lead to order numbers that represent unavailable parts.