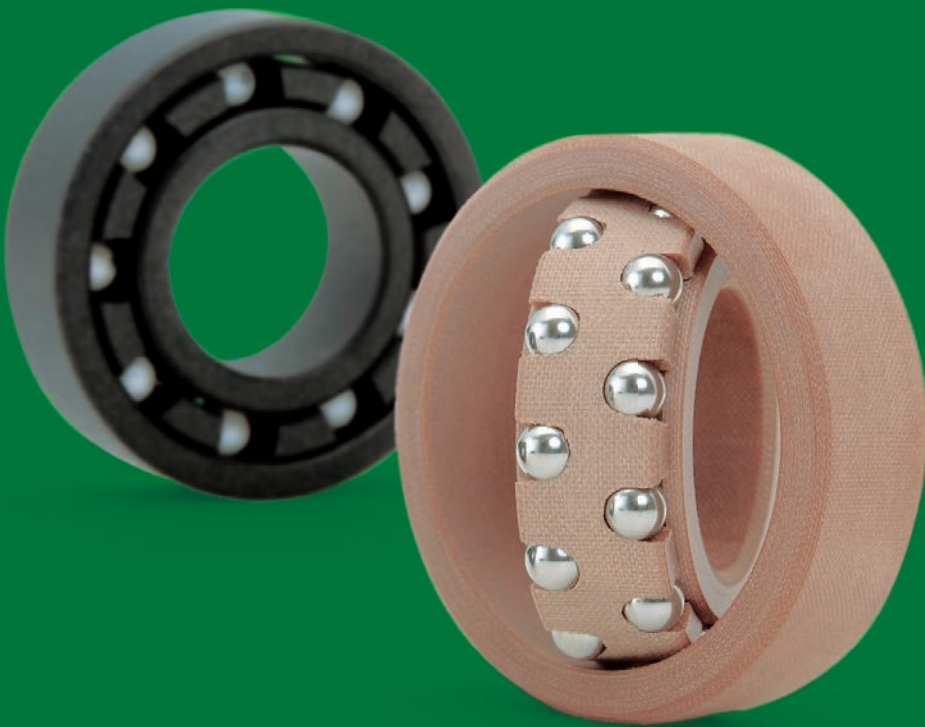
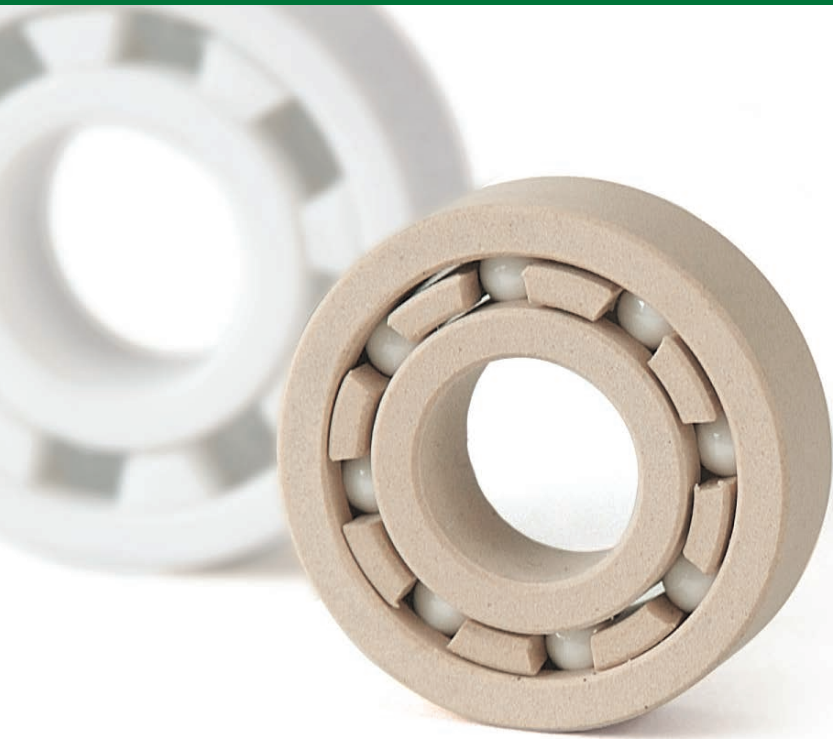


**Self-lubricating Plastic Ball Bearings for  
Special Environments: Dry, Wet, Chemical, Magnetic, Etc.**

# **UKB Ball Bearings**



**Kashima Bearings, Inc.**



Kashima Bearings, Inc. began as a plastic manufacturer that has always striven to satisfy the needs of customers.

Today, we are proud to have earned our customers' trust and satisfaction due to our commitment to providing solutions of the highest quality and value.

## General Characteristics of Plastic Bearings:

- Self-lubricating: no need for grease or other sticky lubricants
- Water-safe: no corrosion when exposed to, or submerged in, (salt) water
- Chemically-resistant: outstanding performance in numerous environments
- Temperature-Resistant: appropriate from low to quite high
- Non-magnetic: unaffected by magnetic fields of any power
- Non-conductive: electrically insulating buffer between housing and shaft
- Highly-machinable: freedom to design as desired
- Light-weight: reduces friction and momentum, as well as overall weight burden
- Tailorable: broad selection of suitable plastics to choose from
- Widespread-utility: suitable for various industries: food, medical, chemical, technical, etc.

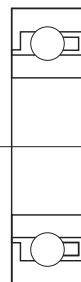
### Basic deep groove model

One side shielded bearing



### Specific deep groove model

Double shielded bearings



Note: The shields are a design concept and do not provide actual protection.

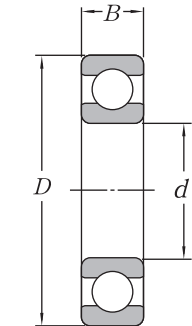
Flange bearings



Note: We also offer double shielded flange bearings.

# Product Selection and Dimensions

## ① Deep-groove ball-bearings



Main dimensions

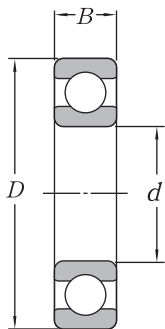
Dimensions in mm			Product code
d	D	B	
10	19	5	6800
	22	6	6900
	26	8	6000
	30	9	6200
	35	11	6300
12	21	5	6801
	24	6	6901
	28	7	16001
	28	8	6001
	32	10	6201
15	37	12	6301
	24	5	6802
	28	7	6902
	32	8	16002
	32	9	6002
17	35	11	6202
	42	13	6302
	26	5	6803
	30	7	6903
	35	8	16003
20	35	10	6003
	40	12	6203
	47	14	6303
	32	7	6804
	37	9	6904
22	42	8	16004
	42	12	6004
	47	14	6204
	52	15	6304
	44	12	60/22
	50	14	62/22

Dimensions in mm			Product code
d	D	B	
25	37	7	6805
	42	9	6905
	47	8	16005
	47	12	6005
	52	15	6205
28	62	17	6305
	52	12	60/28
	58	16	62/28
	42	7	6806
	47	9	6906
30	55	9	16006
	55	13	6006
	62	16	6206
	72	19	6306
	58	13	60/32
32	65	17	62/32
	47	7	6807
	55	10	6907
	62	9	16007
	62	14	6007
35	72	17	6207
	80	21	6307
	52	7	6808
	62	12	6908
	68	9	16008
40	68	15	6008
	80	18	6208
	90	23	6308

Dimensions in mm			Product code
d	D	B	
45	58	7	6809
	68	12	6909
	75	10	16009
	75	16	6009
	85	19	6209
50	100	25	6309
	65	7	6810
	72	12	6910
	80	16	6010
	90	20	6210
55	110	27	6310
	72	9	6811
	80	13	6911
	90	18	6011
	100	21	6211
60	120	29	6311
	78	10	6812
	85	13	6912
	95	18	6012
	110	22	6212
65	130	31	6312
	85	10	6813
	90	13	6913
	100	18	6013

- Flange bearings possible for all (add NR to end of product code)
- Custom sizes welcome

## ② Miniature ball-bearings



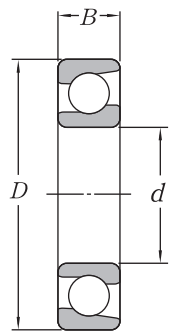
Main dimensions

Dimensions in mm			Product code
d	D	B	
3	10	4	623
4	11	4	694
	12	4	604
	13	5	624
	16	5	634
	13	4	695
5	14	5	605
	16	5	625
	19	6	635
	15	5	696
	17	6	606
6	19	6	626
	22	7	636

Dimensions in mm			Product code
d	D	B	
7	17	5	697
	19	6	607
	22	7	627
	26	9	637
	16	4 or 5	688
8	19	6	698
	22	7	608
	24	8	628
	28	9	638
	17	4 or 5	689
9	20	6	699
	24	7	609
	26	8	629
	30	10	639

- Flange bearings possible for all (add NR to end of product code)
- Custom sizes welcome
- ※ Select a B value for the widths of 688 and 699.

③ Angular-contact ball-bearings

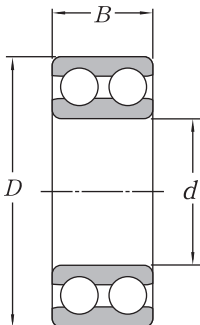


Main dimensions

Dimensions in mm			Product code
d	D	B	
10	26	8	7000
	30	9	7200
	35	11	7300
12	28	8	7001
	32	10	7201
	37	12	7301
15	32	9	7002
	35	11	7202
	42	13	7302
17	35	10	7003
	40	12	7203
	47	14	7303
20	42	12	7004
	47	14	7204
	52	15	7304
25	47	12	7005
	52	15	7205
	62	17	7305

Dimensions in mm			Product code
d	D	B	
30	55	13	7006
	62	16	7206
	72	19	7306
35	62	14	7007
	72	17	7207
	80	21	7307
40	68	15	7008
	80	18	7208
	90	23	7308
45	75	16	7009
	85	19	7209
	100	25	7309
50	80	16	7010
	90	20	7210
	110	27	7310

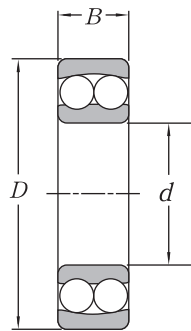
- Flange bearings possible for all (add NR to end of product code)
- Custom sizes welcome



Main dimensions

Dimensions in mm			Product code
d	D	B	
10	30	14.3	5200
12	32	15.9	5201
15	35	15.9	5202
	42	19	5302
17	40	17.5	5203
	47	22.2	5303
20	47	20.6	5204
	52	22.2	5304
25	52	20.6	5205
	62	25.4	5305
30	62	23.8	5206
	72	30.2	5306
35	72	27	5207
	80	34.9	5307
40	80	30.2	5208
	90	36.5	5308
45	85	30.2	5209
	100	39.7	5309
50	90	30.2	5210
	110	44.4	5310

④ Self-aligning ball-bearings



Double row self-aligning bearings are also available.

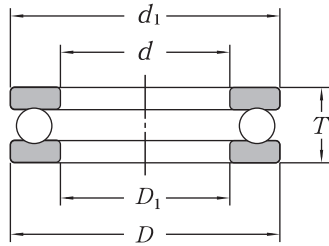
Main dimensions

Dimensions in mm			Product code
d	D	B	
10	30	9	1200
	30	14	2200
	35	11	1300
	35	17	2300
12	32	10	1201
	32	14	2201
	37	12	1301
	37	17	2301
15	35	11	1202
	35	14	2202
	42	13	1302
	42	17	2302
17	40	12	1203
	40	16	2203
	47	14	1303
	47	19	2303
20	47	14	1204
	47	18	2204
	52	15	1304
	52	21	2304

Dimensions in mm			Product code
d	D	B	
25	52	15	1205
	52	18	2205
	62	17	1305
	62	24	2305
30	62	16	1206
	62	20	2206
	72	19	1306
	72	27	2306
35	72	17	1207
	72	23	2207
	80	21	1307
	80	31	2307
40	80	18	1208
	80	23	2208
	90	23	1308
	90	33	2308

- Custom sizes welcome

## ⑤ Thrust ball-bearings



Main dimensions

Dimensions in mm					
d	D	T	d <sub>1</sub>	D <sub>1</sub>	Product code
10	24	9	24	11	51100
	26	11	26	12	51200
12	26	9	26	13	51101
	28	11	28	14	51201
15	28	9	28	16	51102
	32	12	32	17	51202
17	30	9	30	18	51103
	35	12	35	19	51203
20	35	10	35	21	51104
	40	14	40	22	51204
25	42	11	42	26	51105
	47	15	47	27	51205
30	52	18	52	27	51305
	47	11	47	32	51106
	52	16	52	32	51206
	60	21	60	32	51306

Dimensions in mm					
d	D	T	d <sub>1</sub>	D <sub>1</sub>	Product code
35	52	12	52	37	51107
	62	18	62	37	51207
	68	24	68	37	51307
40	60	13	60	42	51108
	68	19	68	42	51208
	78	26	78	42	51308
45	65	14	65	47	51109
	73	20	73	47	51209
	85	28	85	47	51309
50	70	14	70	52	51110
	78	22	78	52	51210
	95	31	95	52	51310

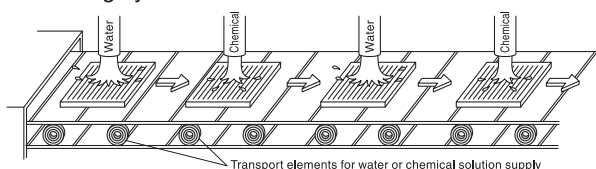
- Custom sizes welcome
- Although the "D" and "d" dimensions are equal, their dimensional tolerances differ.

## ⑥ Variety of unique ball-bearing designs

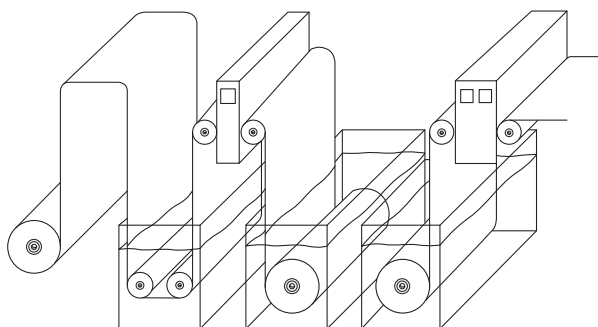
Select a non-standard design, or create your own, in large or small lots.



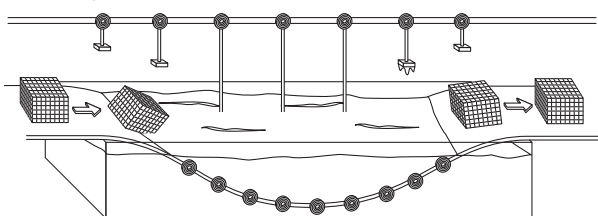
Cleaning systems



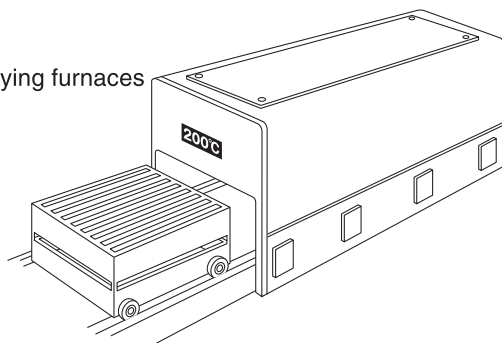
Film surface treatment devices



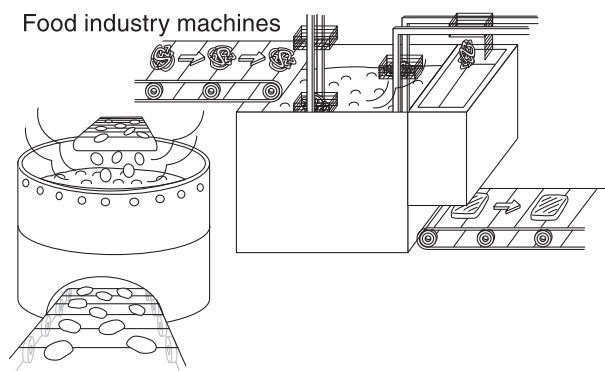
Plating equipment



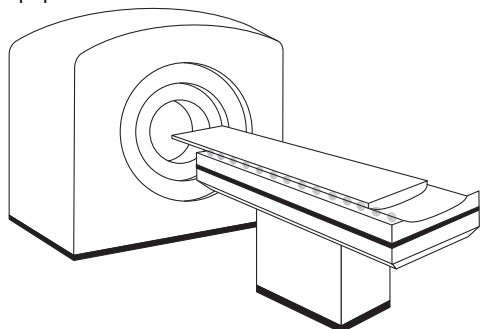
Drying furnaces



Food industry machines



Medical equipment



## Application Examples:

- Glass substrate cleaning devices
- Wafer cleaning machinery
- Etching devices
- Cleaning and coating systems for electronic parts
- Surface treatment devices
- Plating equipment
- Clean-room equipment
- Film cleaning machinery
- Devices for the chemical treatment of films
- Conveyor machinery
- Analysis equipment
- Testing equipment
- NC devices and control systems
- Medical equipment
- Medical parts
- Spray diffusers
- Robots
- Driers
- Pump systems
- Food processing machinery
- Stirring equipment for the food industry
- Kneading equipment for the food industry
- Transport elements for the food industry
- Refrigeration equipment

...and many others.



# Product Overview - Materials

Phenol



PTFE



UHMW



PP



PEEK



PPS



PCTFE



Carbon



**Bearings produced  
with your choice  
of polymer.**

## Overview of Products - Plastic Types

Deep-groove ball-bearings  
(flanged as well)



Miniature ball-bearings (double-row as well)



Angular-contact  
ball-bearings



Self-aligning  
ball-bearings



Thrust  
ball-bearings



## Other Types

Ceramic bearings



Titanium bearings



Non-standard designs



Standard cages are made from PK or PT.  
(Please contact us for other options.)

Standard cages are made from PK or PT.  
(Please contact us for other options.)

# Research Data – Dry Environment Wear

## PEEK Bearings

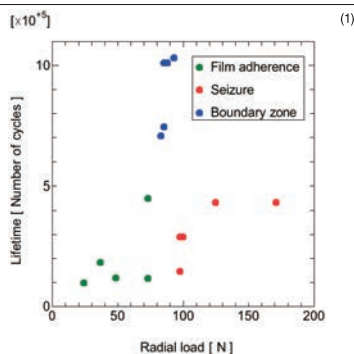
According to dry-condition tests performed by our company, pairing PEEK bearing races with PTFE cages offers some benefits:

- Reduces wear-enhancing durability and extending usable life
- Allows a much wider range of working environments

Below are some excerpts of research published and presented at international scientific conferences.



### PEEK-only Radial Bearings



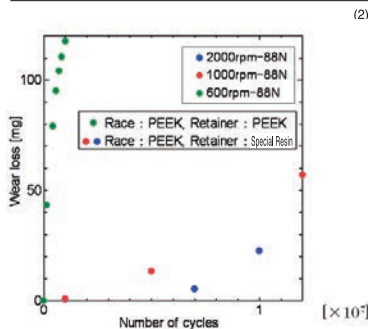
Rotation speed : 600rpm,  
Total number of rotation:  $1.0 \times 10^6$

Bearings used for tests: 6205  
Bearing races / Retainer: PEEK  
Bearing balls: Alumina

This graph shows PEEK wear at steady speed 600rpm and at different loads. Under the conditions marked green wear and debris adhesion to bearing balls occurs, leading to poor performance. Under the conditions marked red wear increases due to high loading. Blue colour represents a "boundary region", where the material wear is minimal. It was found that employed under conditions from within this region the wear amount in PEEK bearings will be very inconsiderable.

< From: >  
Hitonobu Koike, Yuji Kashima et. al.  
Tribology International, Vol. 49, pp. 30-38, (2012, May)  
doi: 10.1016/j.triboint.2011.12.005.  
Hitonobu Koike, Yuji Kashima et. al. Advanced  
Materials Research, Vols. 154-155 (2010) pp. 1288-1291.  
doi: 10.4028/www.scientific.net/AMR.154-155.1288.

### PEEK-only and PEEK Hybrid Radial Bearings



Bearings used for tests: 6205  
Marked green:

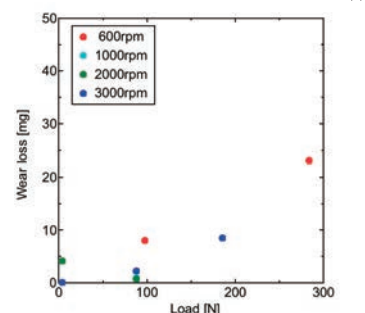
Bearing races / Retainer: PEEK  
Bearing balls: Alumina

Marked blue and red:  
Bearing races: PEEK  
Retainer: Special Resin  
Bearing balls: Alumina

This graph shows wear at steady load and at different speeds. When compared to PEEK-only bearing, PEEK Hybrid components achieved lower wear and longer life, even at high speeds. At low speeds, seizure markings were observed on the PEEK-only bearing surfaces. Replacing the retainer with a Special Resin one eliminated this problem and enhanced service life.

< From: >  
Hitonobu KOIKE, Yuji KASHIMA et. al.  
Advanced Materials Research (2013) inpress)

### PEEK Hybrid Radial Bearings



Bearings used for tests: 6205

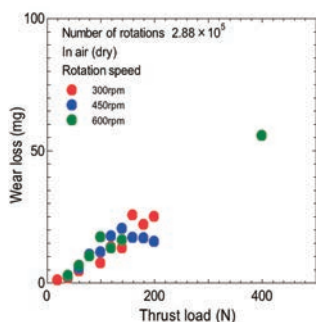
Bearing races: PEEK  
Retainer: Special Resin  
Bearing balls: Alumina

This graph shows wear at different loads and speeds - the amount of wear in PEEK Hybrid bearings was insignificant.

In long-running tests the hybrid bearings showed much better wear resistance compared to the PEEK-only components under all conditions.

< From: >  
Hitonobu KOIKE, Yuji KASHIMA et. al.  
Advanced Materials Research (2013) inpress)

### PEEK-only Radial Bearings

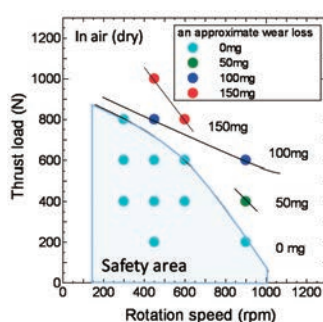


Bearings used for tests: 6205  
Bearing races / Retainer: PEEK  
Bearing balls: Alumina

This graph shows wear at different loads and speeds. It was concluded that wear depends on speed rather than load (for comparison with PPS data, see data in point (8)).

< From: >  
Koshiro Mizobe, Yuji Kashima et. al. Applied Mechanics and Materials Journal  
Vol. 567, pp. 66-70, (2012).

### PEEK Hybrid Thrust Bearings - PV diagram



Bearings used for tests: 51305  
Bearing races: PEEK  
Retainer: Special Resin  
Bearing balls: Alumina

The graph shows the range of use for the tested component. Almost no wear was observed under the conditions marked blue.

< From: >  
Koshiro Mizobe, Yuji Kashima et. al. Applied Mechanics and Materials Journal  
Vol. 567, pp. 66-70, (2012).

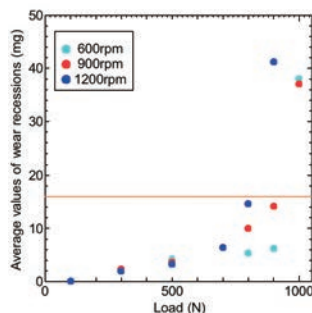


## PTFE w. Filler Thrust Bearings

(6)



Bearings used for tests: 51305  
Bearing races / Retainer:  
PTFE with filler  
Bearing balls: Alumina



Under dry conditions and at low speeds, the wear amount as well as the dependence of wear on the operational were low. Inconsistent wear data was obtained from tests at different speeds and at higher loads. It was concluded that the components provide the best performance at loads under 800N.

< From: >

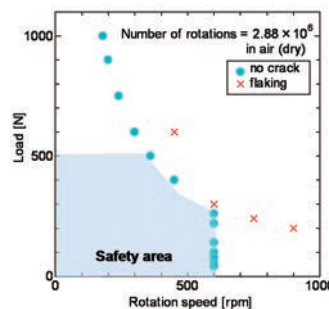
Takashi Honda, Yuji Kashima et. al., 52nd Meeting of the Science Council of Japan on Material Engineering, Vol. 52, pp. 295-296 (22.10.2009)

## UHMWPE Thrust Bearings – PV diagram

(7)



Bearings used for tests: 51305  
Bearing races / Retainer :  
UHMWPE  
Bearing balls: Soda-lime glass



Heat generation is a factor that must be taken under careful consideration in UHMWPE bearing applications. The graph on the left is the material's PV diagram. Marked blue are load and speed conditions most adequate for safe operation. Although minimal wear amount does occur, from the tests performed by our company it was concluded that the optimal working speed is up to 600rpm and load – up to 500N.

< From: >

Shintaro HAZEYAMA, Yuji KASHIMA et. al. (2013, in press)

## PPS Thrust Bearings

The graph on the left shows wear loss in PPS bearings during the performed tests.

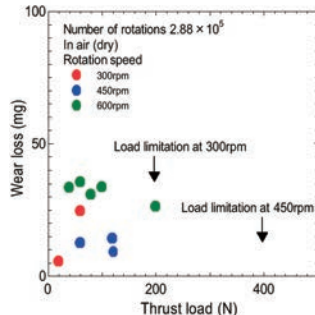
No consistent tendencies in speed or weight dependence could be established, however it was concluded that the range of use under dry conditions is wider for hybrid components, as it can be seen in the graph on the right.

(For comparison with PEEK data, see point (4))



### PPS wear amount

(8)



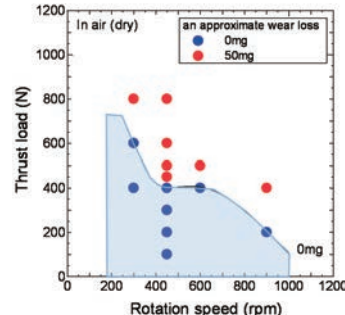
Bearings used for tests: 51305  
Bearing races / Retainer: PPS  
Bearing balls: Alumina  
Wear test were performed at different speeds and loads. Peeling occurred at 300rpm/200N and at 450rpm/200N.  
(For comparison with PEEK data, see point (4))

< From: >

Koshiro Mizobe, Yuji Kashima et. al. Advanced Materials Research Vol. 566, pp. 157-161. (2012). doi: 10.4028/www.scientific.net/AMR.566.157.)

### Hybrid PPS bearings PV Diagram

(9)



Bearing used for tests: 51305  
Bearing races: PPS  
Retainer: Special Resin  
Bearing balls: Alumina  
Wear was very low in bearings tested under the conditions within range marked blue. The performance of the hybrid PPS components was highly superior compared to PPS-only components. From the PV graph it can be concluded that 400N is the load capacity limit for this type of bearing.

# Research Data – Wet Environment Wear

## PEEK Bearings

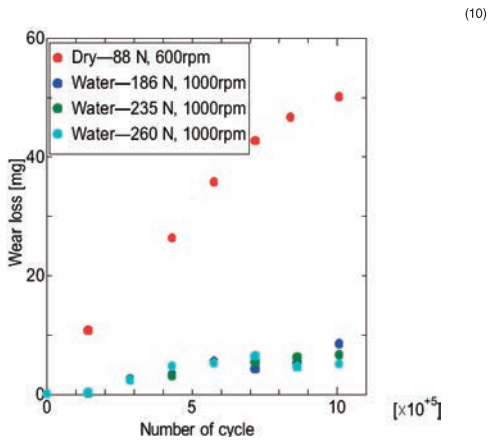
Load and speed must be carefully considered in submerged uses of PEEK bearings. The graph on the left is wear data obtained at a steady speed under different loads. No cracking could be observed at loads up to 260N. (For comparison, data from a dry-condition test under 88N is provided.)

The graph on the right is wear data obtained from tests performed at different speeds and loads. As you can see, the amount of wear was very low; however, peeling did occur at higher speeds and greater loads.

Thus, in wet conditions, the usable life of PEEK components depends most on load; furthermore, the range of suitable environments is larger for wet environments than for dry environments.



### PEEK Radial Bearings

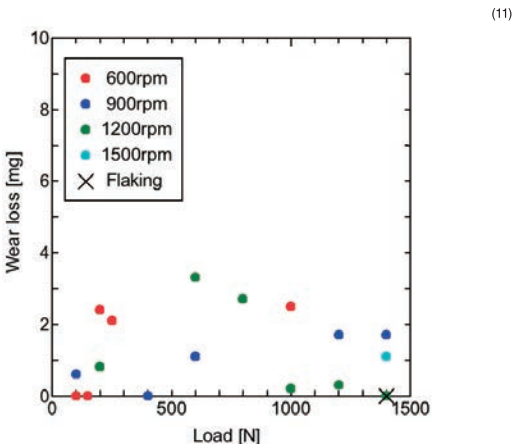


Bearings used for tests: 6205  
Bearing races / Retainer: PEEK  
Bearing balls: Alumina

Tests showed that failure of PEEK bearings working under water occurs due to cracking. From tests ran until  $1.0 \times 10^6$  cycles it was however concluded that no cracking occurs at loads up to 260N. The amount of wear under such load is low – below 10mg. Total number of rotation:  $1.0 \times 10^6$

< From: >  
Hitonobu Koike, Yuji Kashima et. al. Advanced Materials Research Vols. 217-218 (2011) pp. 1260-1265. doi: 10.4028/www.scientific.net/AMR.217-218.1260.  
Advanced Materials Research Vol. 566 (2012) pp. 109-114, doi: 10.4028/www.scientific.net/AMR.566.109.

### PEEK Thrust Bearings

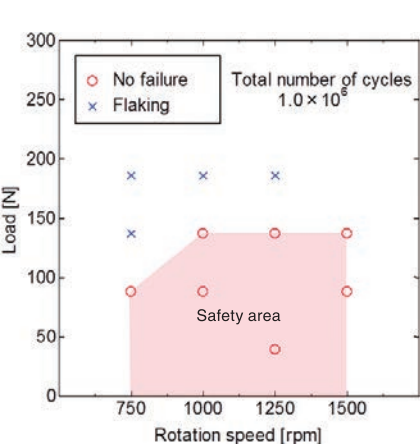


Bearings used for tests: 51305  
Bearing races / Retainer: PEEK  
Bearing balls: Alumina

After  $1.0 \times 10^6$  cycles, the wear amount was lower than 5mg for all conditions. At high loads and high speeds the risk of peeling occurs.

< From: >  
Takashi Honda, Yuji Kashima et. al., Tribology Congress of the Japanese Society of Tribologists (18.05.2009)  
Shunsuke OYAMA, Yuji KASHIMA et. al. (Advanced Materials Research, Vol. 566, (2012), pp. 197-202. doi: 10.4028)  
Takashi HONDA, Yuji KASHIMA, Advanced Materials Research Vols. 154-155 (2011) pp. 1713-1716, doi: 10.4028/www.scientific.net/AMR.154-155.1713

## PPS Radial Bearings



Bearings used for tests: 6205  
Bearing races / Retainer: PPS  
Bearing balls: Alumina

PPS bearings life is determined by the occurrence of peeling rather than wear. In the graph the load/speed marked conditions for operation with low wear are marked blue.

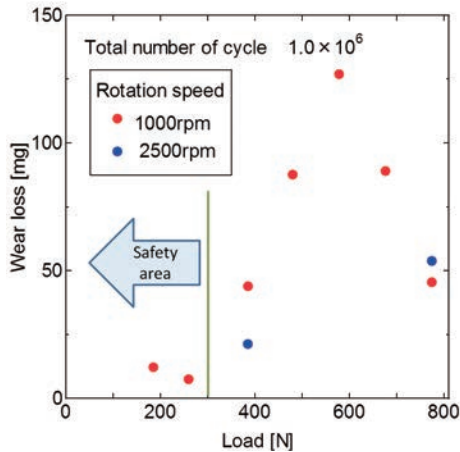
< From: >  
Oyama, Kida, Kashima et. al. (2013 in press)  
Data presented at an international conference in Shanghai.



## PTFE with filler

### PTFE w. Filler Radial Bearings

(13)



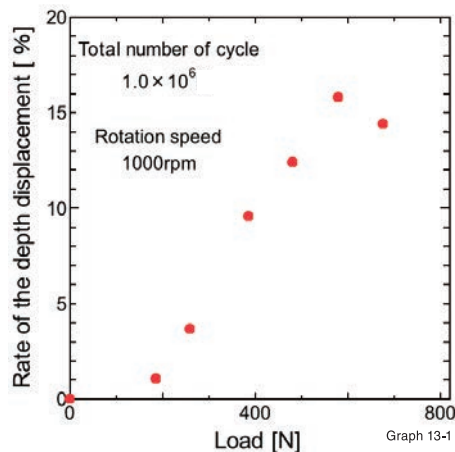
Bearings used for tests: 6205  
Bearing races / Retainer:  
PTFE with filler  
Bearing balls: Alumina

In these tests the wear amount was 10mg for loads up to 300N and exceeds this amount for higher loads 500~700N. No dependence on rotational speed could be observed.

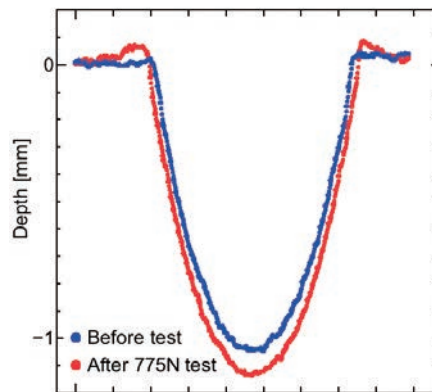
< From: >  
Shunsuke Oyama, Yuji Kashima et. al.  
(2013 in press)  
Data presented at an international conference in Dubai.



At 300N, the amount of wear was low, at any rotational speed. It started increasing rapidly at loads over 500N. At higher loads, race-deformation occurred due to creep; PTFE with filler was the material which deformed the most. Graph 13-1 shows the rate of the race groove changes; Graph 13-2 is the visual depiction of the groove, both before and after testing.



Graph 13-1

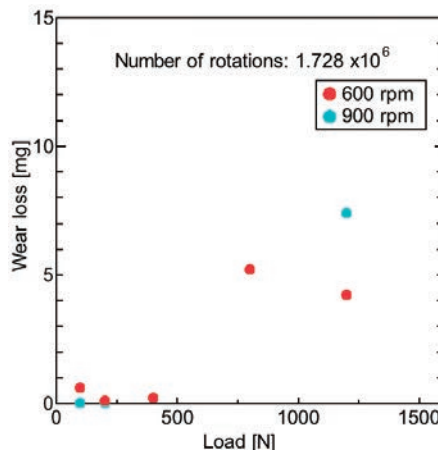
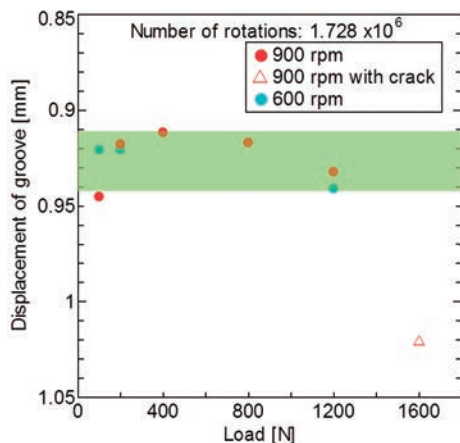


Graph 13-2

At 400N, race deformation began, and wear-loss was significant (over 50 mg); at about 600N, it reaches a plateau. Thus, safe working-conditions can be determined from Graph 13-1.

### Thrust bearings – PTFE with filler

(14, 15)



Bearing used for tests: 51305  
The graph on the left shows changes in the race groove shape at 600rpm, 900rpm and different loads. On the right – relevant wear loss.

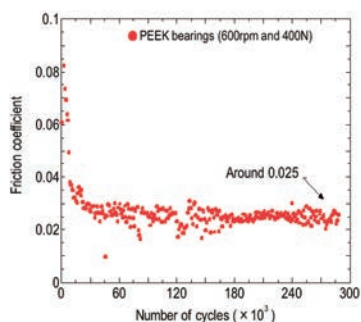
It is possible to use this type of bearing for loads until 1200N as the deformation as well as wear were extremely low (below 10mg at 1200N).

< From: >  
Kiyoto Itakura, Yuji Kashima et. al. (2013 in press)  
Data presented at an international conference in Shanghai.

# Research Data – Coefficient of Friction

Data presented on this page were obtained from tests performed with a bearing-endurance tester developed by our company. The objective was to compare the performance of hybrid and non-hybrid pieces. (Non-hybrid were PEEK-only or PPS-only.) Open-air tests up to  $2.88 \times 10^5$  revolutions showed the coefficient of friction was lower in the hybrid bearings. (Load and speed data are given in each graph).

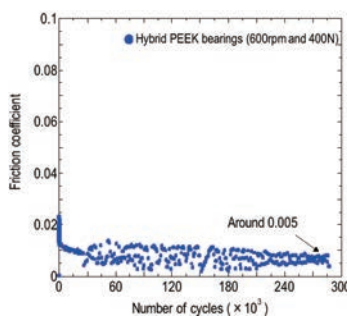
## PEEK-only Bearings



Bearing races / Retainer:  
PEEK  
Bearing balls: Alumina

< From: >  
Koshiro MIZOBE, Yuji KASHIMA et. al. (in press)

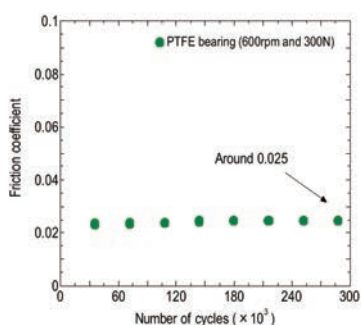
## PEEK Hybrid Thrust Bearings



Bearing races: PEEK  
Retainer: Special Resin  
Bearing balls: Alumina

< From: >  
Koshiro MIZOBE, Yuji KASHIMA et. al. (in press)

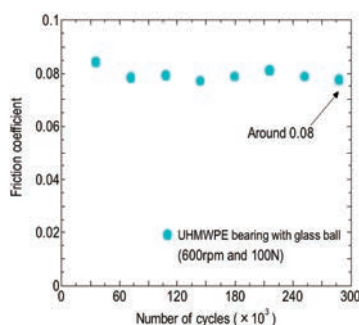
## PTFE w. Filler Thrust Bearings



Bearing races / Retainer:  
PTFE with filler  
Bearing balls: Alumina

< From: >  
Takashi Honda, Yuji Kashima et. al., 52nd Meeting of the Science Council of Japan on Material Engineering, Vol. 52, pp. 295-296 (22.10.2009)

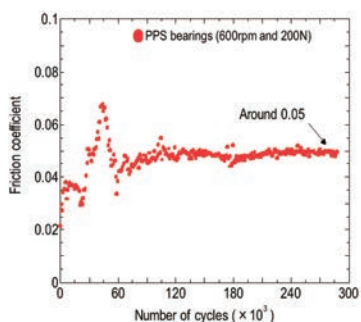
## UHMWPE Thrust Bearings



Bearing races / Retainer:  
UHMWPE  
Bearing balls:  
Soda-lime-glass

< From: >  
Takashi Honda, Yuji Kashima et. al., 52nd Meeting of the Science Council of Japan on Material Engineering, Vol. 52, pp. 295-296 (22.10.2009)

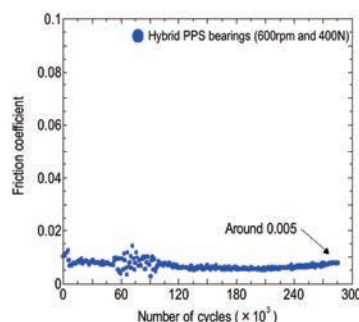
## PPS Thrust Bearings



Bearing races / Retainer:  
PPS  
Bearing balls: Alumina

< From: >  
Koshiro MIZOBE, Yuji KASHIMA, Advanced Materials Research (Trance Tech Publications, ISSN: 1022-6680), (in press)

## PPS Hybrid Thrust Bearings



Bearing races: PPS  
Retainer: Special Resin  
Bearing balls: Alumina

< From: >  
Koshiro MIZOBE, Yuji KASHIMA, Advanced Materials Research (Trance Tech Publications, ISSN: 1022-6680), (in press)



# Materials and Typical Use-cases

## < For dry environments >



PEEK  
UKB○○○○PKPT-A  
UKB○○○○PKPT-S



PTFE with filler  
UKB○○○○PT-A  
UKB○○○○PT-S



PPS  
UKB○○○○PSPT-A  
UKB○○○○PSPT-S

Smooth and clean performance for long periods (with no need for lubricants)

## < For wet environments >



PEEK  
UKB○○○○PK-S



UHMW-PE  
UKB○○○○PE-S  
UKB○○○○PE-G



PP  
UKB○○○○PP-S  
UKB○○○○PP-G

Suitable for use-cases of both infrequent moisture and complete submersion (for misty environments, please consult us)

## < For chemical environments >



PTFE with Special Filler  
UKB○○○○PT-A



PPS  
UKB○○○○PS-A



UKB○○○○PE-G  
(Glass balls cannot be used in alkaline environments.)

Compatible with most chemicals (for details and most suitable ball-materials, please consult us)

## < For other use cases >

### As insulator



UKB○○○○SD-G  
UKB○○○○SD-A

### For work in high temperatures 1



UKB○○○○PK-A

### For work in high temperatures 2



UKB○○○○SDH-A  
(SDH cannot be used in vapor environment.)

Perfect for other conditions where the use of metal is limited or impossible: electrical, magnetic, or with unique temperatures.



# Race & Cage Material Selection and Usage Guide

○ Recommended   ○ Satisfactory   △ Possible to use, but not recommended   × Not compatible

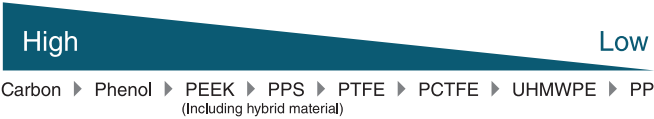
Application Material	Product code	Dry	Water (extended periods of time)	Water / seawater	Steam	Chemical environment				Magnetic environment	As insulator
						Acids	Alkaline	Organic liquids	Oil		
Phenol	SD	○	○	○	○	○	×	○	○	○	○
	SDK	○	○	○	○	○	×	○	○	×	×
	SDHG	○	△	△	×	○	×	○	○	×	×
PTFE	PT	○	○	○	○	○	○	○	○	○	×
	PTG	○	○	○	○	○	×	○	○	○	○
	PTE	○	○	○	○	○	○	○	○	○	○
	PTN	○	○	○	○	○	○	○	○	○	○
UHMWPE	PE	○	○	○	×	○	○	○	○	○	○
PP	PP	△	○	○	△	○	○	○	○	○	○
PEEK	PK	○	○	○	○	○	○	○	○	○	○
	PKG	○	○	○	○	○	○	○	○	○	×
PPS	PS	○	○	○	○	○	○	○	○	○	○
	PSG	○	○	○	○	○	○	○	○	○	×
PCTFE	PCT	○	○	○	○	○	○	○	○	○	○
PVDF	PV	○	○	○	○	○	○	○	○	○	○
Carbon	CY	○	○	○	○	○	○	○	○	○	×

Note: For details on compatibility with specific chemicals, please feel free to contact us.

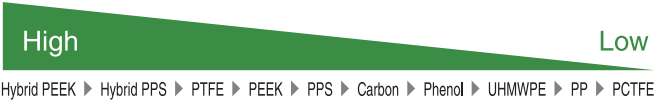
Full compatibility   Please contact us for compatibility details.

Temperature Material	Product code	Temperature										
		-200°C	-100°C	-50°C	-25°C	0°C	25°C	60°C	120°C	200°C	350°C	
Phenol	SD											
	SDK											
	SDHG											
PTFE	PT											
	PTG											
	PTE											
	PTN											
UHMWPE	PE											
PP	PP											
PEEK	PK											
	PKG											
PPS	PS											
	PSG											
PCTFE	PCT											
PVDF	PV											
Carbon	CY											

## [Material guide - Load]



## [Material guide - Speed]



## [Materials suitable for food-related applications]

- PTFE (PT, PTG, PTE, PTN)
- UHMWPE
- PP
- PEEK
- PPS
- PCTFE
- PVDF
- Carbon

# Ball Material Selection and Usage Guide

◎Recommended ○Satisfactory △Please contact us to discuss details. ×Not compatible

Application		Product code	Environment					Remarks
			Dry	Water	Chemical environment	High temperatures	As insulator	
Ceramic	Alumina Al <sub>2</sub> O <sub>3</sub>	A	◎	○	◎	◎	◎	Some chemicals may affect the components; please consult us before placing an order.
	Zirconium dioxide ZrO <sub>2</sub>	Z	◎	○	◎	◎	◎	
	Silicon nitride Si <sub>3</sub> N <sub>4</sub>	N	◎	○	◎	◎	◎	
	Silicon carbide SiC	C	◎	○	◎	◎	◎	
Stainless steel	SUS304	S	◎	◎	△	◎	×	Compatibility varies depending on the type of chemical solution.
	SUS316	S6						
Soda-lime glass		G	◎	○	△	○	◎	Not to be used in conditions of rapidly changing temperatures
Plastic	PP	PP	×	◎	○	See page 13	◎	Ideally used in liquids or at slower speeds
	PE	PE	×	◎	○		◎	
	PVDF	PV	×	◎	○		◎	
	PTFE	PTN	○	◎	◎		◎	
	PEEK	PK	○	○	◎		◎	

When placing an order, please use the product code as in the example below:

UKB 6002

Model number

PT

Outer & inner race material

SD PP  
SDK PK  
SDHG PKG  
PT PS  
PTG PSG  
PTE PCT  
PTN PV  
PE CY Etc.

(See page 13 for the list of product codes for race / cage materials.)

—

Cage material

Leave blank if same as outer & inner race material.  
\*1 (Leave blank if same as inner & outer race material.)

A

Ball material

A G  
Z PP  
N PE  
C PV  
S PTN  
S6 PK Etc.

(See page 14 for the list of product codes for ball materials.)

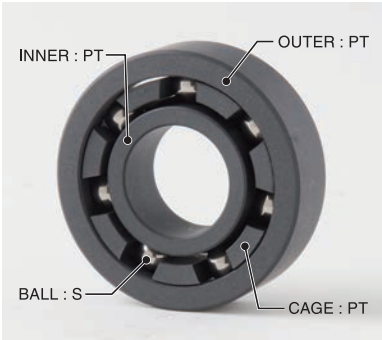
(-BL)

Double shielded bearings: BL  
Flange bearings: NR  
(Leave blank for simple, standard bearings, e.g., one-side shielded)

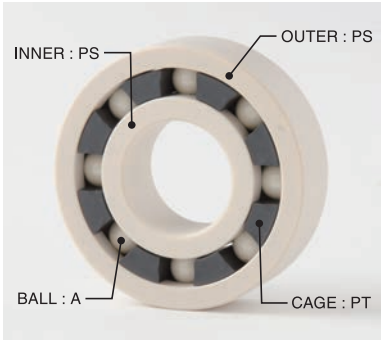
\*1 All bearing components are normally manufactured from the same type of material. For hybrid bearing solutions - please specify your choices.

Or, create your own design. (Depending on materials, minimum orders start at 10 pieces.)

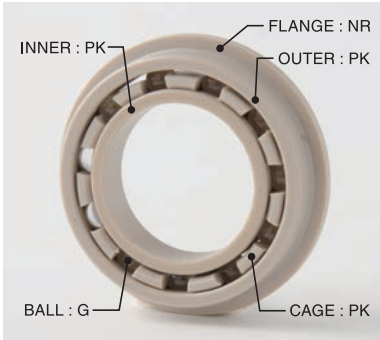
Below are examples of Bearing Codes.



UKB6203PT-S



UKB6005PSPT-A



UKB6804PK-G-NR

# Material Properties

## Outer-ring · Inner-ring · Cage material properties

Material Property	Phenol			PTFE				UHMWPE	PP	PEEK		PPS		PCTFE	PVDF	Carbon
	SD	SDK	SDHG	PT (black)	PTG (white)	PTE (beige)	PTN (white)			PK	PKG (black)	PS	PSG (black)			
Specific gravity	1.4	1.5	1.8	2.1	2.27	1.87	2.14 ~ 2.20	0.94	0.9	1.3	1.48	1.35	1.45	2.2	1.79	1.77
Compressive strength (MPa)	127 ~ 167	118 ~ 226	147 ~ 334	6.0 ~ 6.3	6.6 ~ 7.0	8.2 ~ 8.8	11.8	-	-	119	150	107	-	31 ~ 51	62	185
				(1% deformation)			max. 23°C			5% deformation		5% deformation		10% deformation	10% deformation	
Bend strength (MPa)	137 ~ 196	98	147 ~ 166	-	-	-	-	-	-	170	193	147	279	-	81	60
Tensile strength (MPa)	68 ~ 108	147	-	17.8	16.8	13.7	20 ~ 34	44.1	29.4 ~ 47.1	98	140	93	211	31 ~ 41	50	-
Elongation (%)	-	-	-	100	305	270	200 ~ 400	300 ~ 450	200 ~ 700	20	2.2	19	-	80 ~ 250	30	-
Hardness *1	36 ~ 40 (Brinell)	35 ~ 38 (Brinell)	111 (Rockwell M)	67 (Shore)	64 (Shore)	65 (Shore)	54 ~ 58 (Durometer)	67 ~ 69 (Shore)	90 (Rockwell M)	105 (Rockwell M)	99 (Rockwell M)	97 (Rockwell M)	104 (Rockwell M)	75 ~ 80 (Shore)	75 (Shore)	70 (Shore)
Linear thermal expansion coefficient (×10 <sup>-5</sup> /°C)	3.0 ~ 4.5	3.0 ~ 5.0	1.8 ~ 3.59	7.2 ~ 10.6	9.5 ~ 11.4	8.8 ~ 10.8	12.2 ~ 13.7	10 ~ 19	5.8 ~ 10	5.0	3.0	5.0	4.3	4.5 ~ 7.0	13.0	0.35
Water absorption (%)	0.6 ~ 1.0	0.2 ~ 0.9	0.5 ~ 1.0	0	<0.015	0	0	<0.01	<0.03	0.14 ~ 0.5	0.1	0.01	0.024	0.01	0.01	-

\*1 Currently, we are unable to provide comparison data for all methods of hardness tests.

Note: Typical values

## Ball material properties

	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Zirconium dioxide (ZrO <sub>2</sub> )	Silicon nitride (Si <sub>3</sub> N <sub>4</sub> )	Silicon carbide (SiC)
Density	3.6 ~ 3.9	6.0	3.2	3.1 ~ 3.3
Compressive strength (MPa)	2100 ~ 2300	6700	2400	2800
Young's modulus (GPa)	280 ~ 380	200 ~ 210	290 ~ 330	370 ~ 440
Poisson's ratio	0.23	0.31	0.28	0.16
Vickers hardness (MPa)	15 ~ 18	10 ~ 13	15 ~ 20	24
Thermal conductivity 20°C W/(m·K)	36	3	20 ~ 29	60 ~ 300

The above figures are typical values. The physical properties of ceramics vary greatly depending on the manufacturing process.

## Soda-lime glass

	Soda-lime glass
Density	2.5
Compressive strength (MPa)	590 ~ 1200
Young's modulus (GPa)	0.7
Poisson's ratio	0.25

The above figures are typical values

## Stainless steel

	SUS304	SUS316
Specific gravity	7.93	7.98
Tensile strength (N/mm <sup>2</sup> )	over 520	over 520
Elongation (%)	over 40	over 40
Brinell hardness	below 187	below 187
Thermal conductivity (100°C) (cal/cm·°C)	0.039	0.039
Thermal expansion coefficient (0 ~ 100°C×10 <sup>-6</sup> )	17.3	15.9

# Plastic Ball Bearing Issues

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## Calculating service life and performance limitations

---

Methods for estimating bearing life and performance limitations for plastic components are different from those for metals.

Metal components have a long history of usage, and their performance has been studied extensively.

This is not the case when it comes to plastic bearings. Service-life estimation methods are based on testing under specific working conditions and the wear-properties of a material. That's why our company puts tremendous effort into research and into establishing formulas specific to each polymer. When setting load limitations, we consider the mechanical strength of each plastic. As for calculating speed limitations, the most important considerations are wear and friction characteristics.

(Please contact us for specific data.)

## Engineering tolerance and gaps

---

All products are manufactured to the standard tolerance of H7, and they are checked for accuracy at a temperature of 24C ( $\pm 2$ C).

However, minor discrepancies may occur for various reasons: the tendency of some plastics to absorb water; the linear thermal expansion coefficient of the material; or simply the passage of time. Due to these factors, gaps ranging from tens to hundreds of microns may be present.

Still, we are sure we can meet your dimensional requirements by adjusting for your environment. Please consult us so we can determine the perfect bearing for your needs.

## Shaft and housing

---

H7 standard tolerance is the generally recommended bearing-shaft fit.

Housings are usually manufactured to this standard and bearings are inserted under pressure. In cases where a customer requires a light-interference fit, or a looser fit, we recommend using stoppers.

## Lubrication

---

Plastic bearings are self-lubricating, requiring no grease or oil for lubrication. Still, they are completely suitable for greasy or oily environments as well.

## Shielding

---

Flange type bearings are equipped with double-shielding; nevertheless, in environments with water or low-viscosity liquids, the shielding cannot completely prevent fine debris from entering.

## Non-magnetic properties

---

Being a non-magnetic material, plastic is a perfect match for magnetic environments.

## Pre-compression

---

We strongly recommend against any pre-compression of plastic bearings as it can deform their shape and seriously harm performance. (Applied to metal bearings, pre-compression ensures better accuracy and fit. This is NOT the case with plastic bearings.)

**kashimabearings.com**  
**english@kashima-kagaku.com**



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