

Applications and performance of SPACEA Series bearings

Bearings for clean rooms (clean conditions, air)

Bearings that are to be used in clean rooms in factories producing LCDs, semiconductors or pharmaceuticals

must be able to function for long periods without affecting the cleanliness of the air in the room.

• Operating conditions

Speed: 10~500 rpm
 Bearing temperature: room temperature~60°C
 Atmosphere: air

• Performance requirements

Low dust generation
 High durability

• Bearing specifications

Type: deep-groove ball bearing with cage
 Lubrication: Clean Grease LG2
 Material: martensite stainless steel

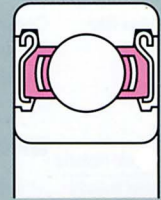


Fig. 14 Bearing for clean environment

Fig. 15 Silicon wafer transporter robot

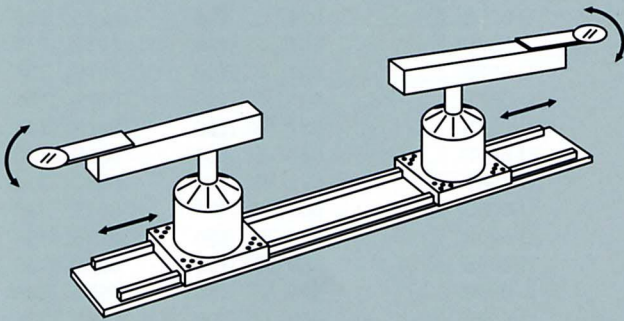
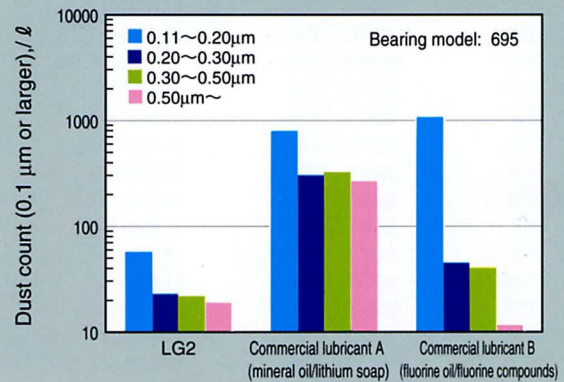


Fig. 16 Distribution of dust particles generated by bearings using three types of lubricant



Bearings for LCD, semiconductor and hard disk production machinery (clean conditions, air-vacuum)

Bearings for sputtering, CVD, ion implantation and other devices used in semiconductor manufacturing must not only function in high vacuums, high temperatures and clean conditions, but are frequently exposed to

atmospheric air. They are also subject to the adhesion of chemical reactants in the film coating process. Under these conditions, it is essential that they be extremely durable.

• Operating conditions

Speed: 10~500 rpm
 Bearing temperature: room temperature~200°C
 Vacuum: 10⁻⁶ Pa~atmospheric pressure

• Performance requirements

Lubricity in both air and vacuum
 Low dust generation

• Bearing specifications

Type: deep-groove ball bearing with cage
 Lubrication: Special Fluororesin Coating
 Material: martensite stainless steel

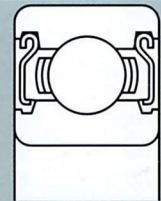


Fig. 17 Bearing for clean environment

Fig. 18 Sputtering transporter device

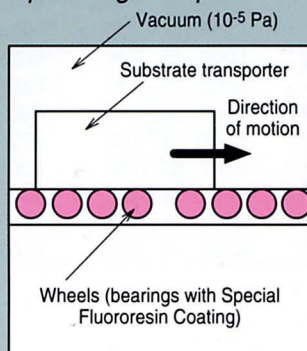
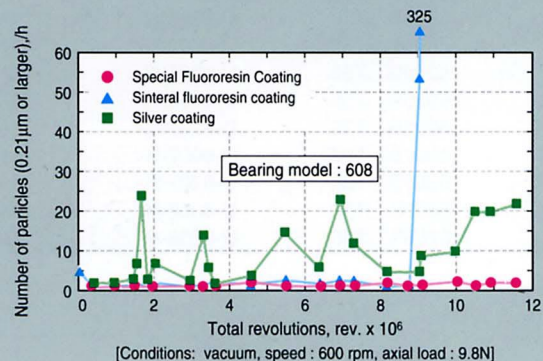


Fig. 19 Change in dust count of bearings over time



Bearings for cleaning devices (strong acids, etc.)

Bearings that are to be used in cleaning devices are likely to be exposed to corrosive gases or liquids and must have high corrosion resistance.

• Operating conditions

Speed: 10~500 rpm
 Bearing temperature: room temperature~60°C
 Atmosphere: corrosive gases or liquids

• Performance requirements

Strong resistance to corrosive atmospheres

• Bearing specifications

Type: deep-groove ball bearing with cage
 Lubrication: fluororesin
 Material: high corrosion resistance ceramics

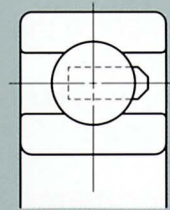


Fig. 20 Bearing for corrosive environment

Fig. 21 Cleaning device

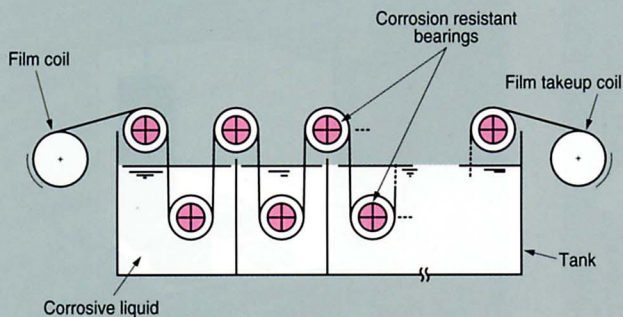
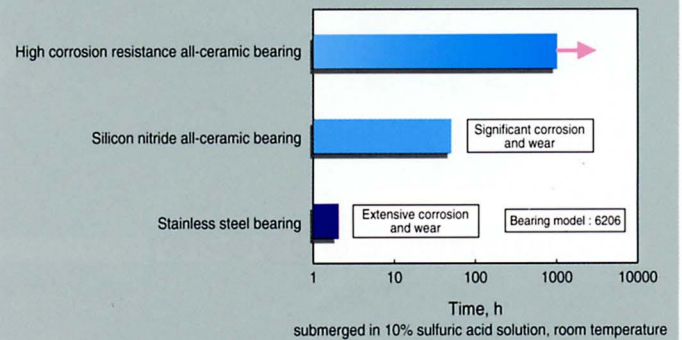


Fig. 22 Endurance life of high corrosion resistance ceramic bearings



Bearings for cleaning devices (weak acids, etc.)

Bearings that are to be used in cleaning devices for LCD and semiconductor production will be exposed to corrosive liquids and vapors such as weak acids or weak alkalis. They must therefore have enduring resistance to corrosion.

• Operating conditions

Speed: 10~500 rpm
 Bearing temperature: room temperature~100°C
 Atmosphere: corrosive gases or liquids (weak acids, alkalis, etc.)

• Performance requirements

Long-lasting resistance to corrosive atmospheres

• Bearing specifications

Type: deep-groove ball bearing with cage
 Lubrication: fluororesin
 Material: ceramics

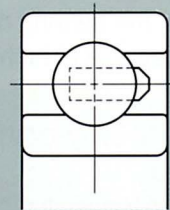


Fig. 23 Bearing for corrosive environment

Fig. 24 Semiconductor production device (polishing process)

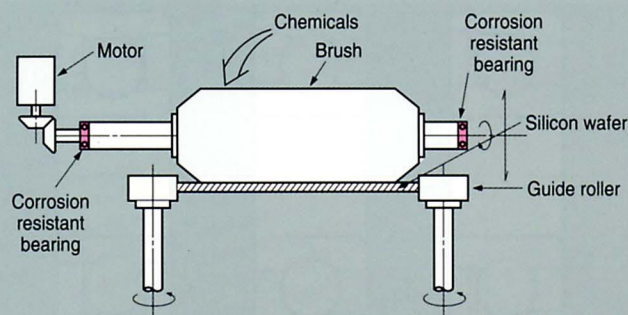
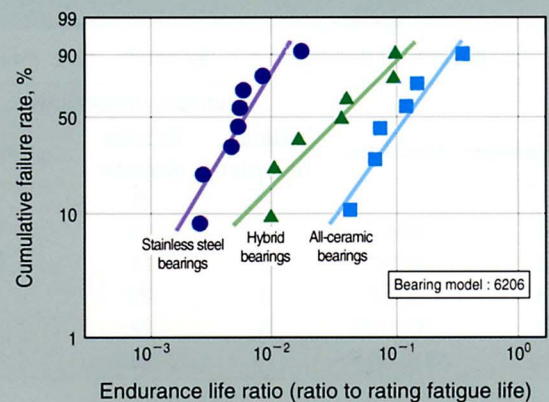


Fig. 25 Endurance life of corrosion resistant bearings in water



Applications and performance of SPACEA Series bearings

Bearings for food processing machinery (water)

Bearings that are to be used in food processing and washing machinery will be exposed to water and must

have enduring resistance to corrosion.

• Operating conditions

Speed: 10~1,000 rpm
 Bearing temperature: room temperature~80°C
 Atmosphere: water droplets or submersion in water

• Performance requirements

Corrosion resistance

• Bearing specifications

Type: deep-groove ball bearing
 Lubrication: waterproof grease
 Material: inner & outer rings - martensite stainless steel
 balls - ceramics

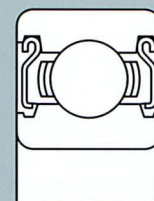


Fig. 26 Bearing for corrosive environment

Fig. 27 Raw material preparation device (food processing)

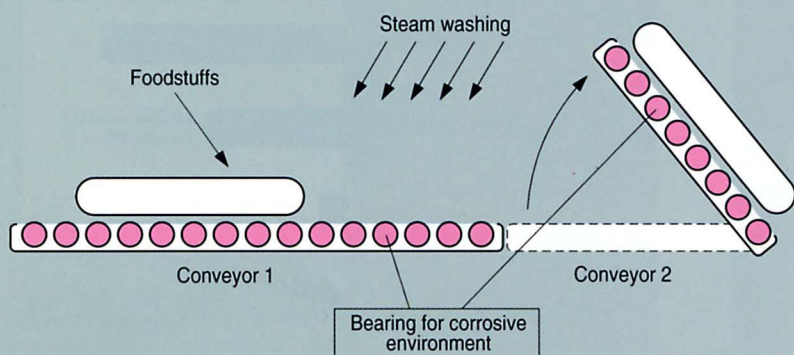
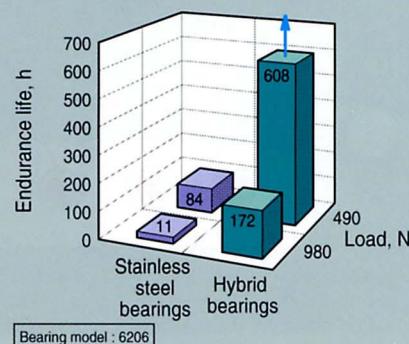


Fig. 28 Endurance life of hybrid bearings



Bearings for X-ray tubes and X-ray bearing units (vacuums, high temperatures, high speeds)

X-ray tubes with rotating anodes are constructed as shown in Fig. 29. The anode rotates at high speed to disperse the heat caused by the impact of electrons, therefore, the bearing that supports the anode must not only be capable of high speeds but also have high load

capacity. Especially for X-ray tubes which must be capable of high output, the SPACEA Series includes integrated bearing units in which the inner ring and axis are made in one section for additional mounting accuracy and rigidity.

• Operating conditions

Speed: 3,000~10,000 rpm
 Bearing temperature: 250~500°C
 Vacuum: 10⁻⁴~10⁻⁵ Pa

• Performance requirements

High rotational speed
 High load capacity

• Bearing specifications

Lubrication: lead coating, silver coating
 Material: high speed tool steel

Fig. 29 Corrosion resistant bearing

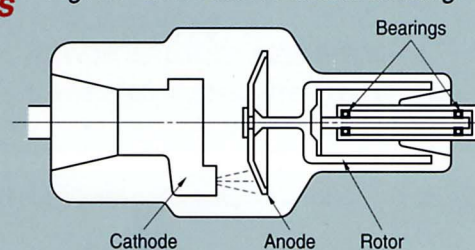


Table 5 Dimensions of bearings for X-ray tubes (Unit: mm)

Shaft diameter	Model No.	Boundary dimensions		
		Bore diameter <i>d</i>	Outside diameter <i>D</i>	Width <i>B</i>
6	626-F	6	19	6
6	B6-54-F	6	19	6
8	608-F	8	22	7
8	B8-10-F	8	22	7
10	B10-36-F	10	22	6

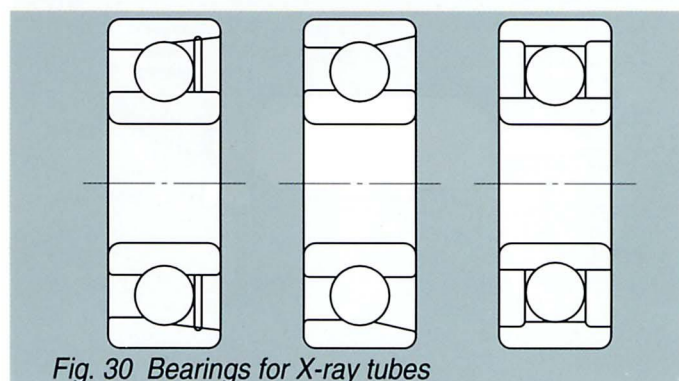


Fig. 30 Bearings for X-ray tubes

Fig. 31 X-ray tube bearing unit

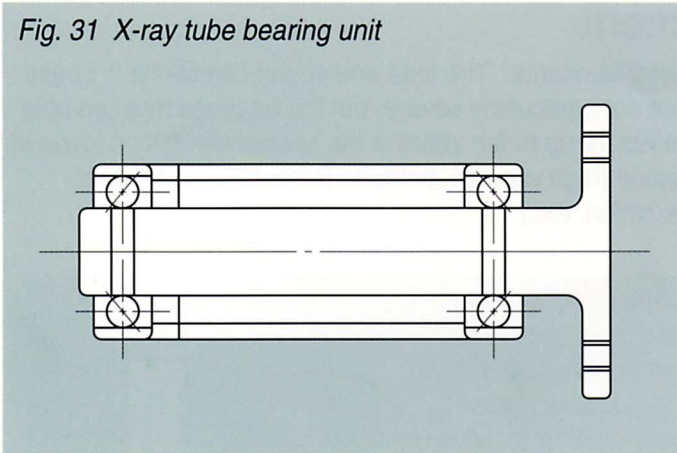
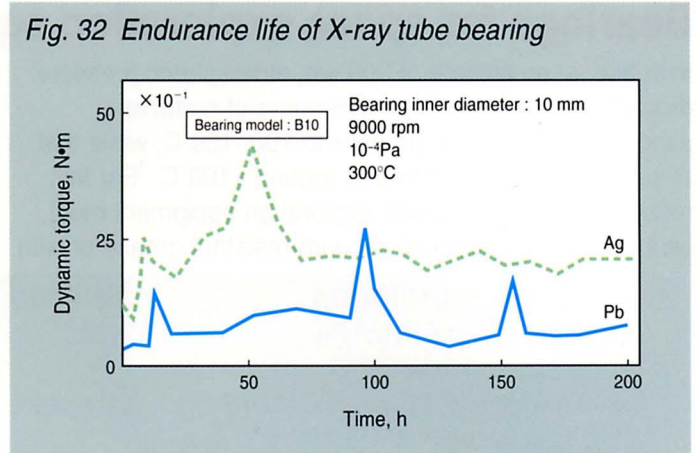


Fig. 32 Endurance life of X-ray tube bearing



Touchdown bearings for turbo molecular pumps (vacuums, high speeds)

In turbo molecular pumps with magnetic bearings, power cuts cause the magnetic bearings to lose their load-bearing capacity and the resulting contact between rotating and non-rotating parts leads to blade damage. To prevent such damage, it is best to use touchdown

bearings. In the event of a power cut, the rotor which is turning at high speed immediately comes into contact with the touchdown bearing and remains supported by it until the pump comes to a standstill.

• Operating conditions

Speed: 20,000~50,000 rpm
($d_m n$ value 2~3 million)

Vacuum: 10^{-1} Pa

• Performance requirements

Rapid follow-up

• Bearing specifications

Type: full-type deep-groove ball bearing, angular contact ball bearing

Lubrication: lead or molybdenum disulfide coating
Material: inner & outer rings, balls - bearing steel or martensite stainless steel (balls - ceramics)

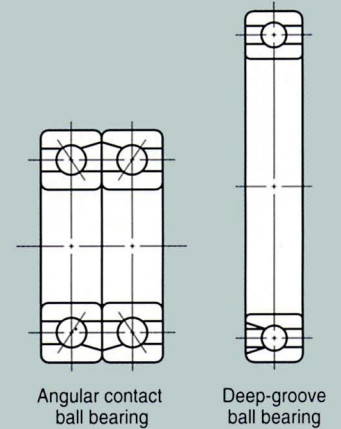


Fig. 33 Touchdown bearings

Fig. 34 Structure of turbo molecular pump

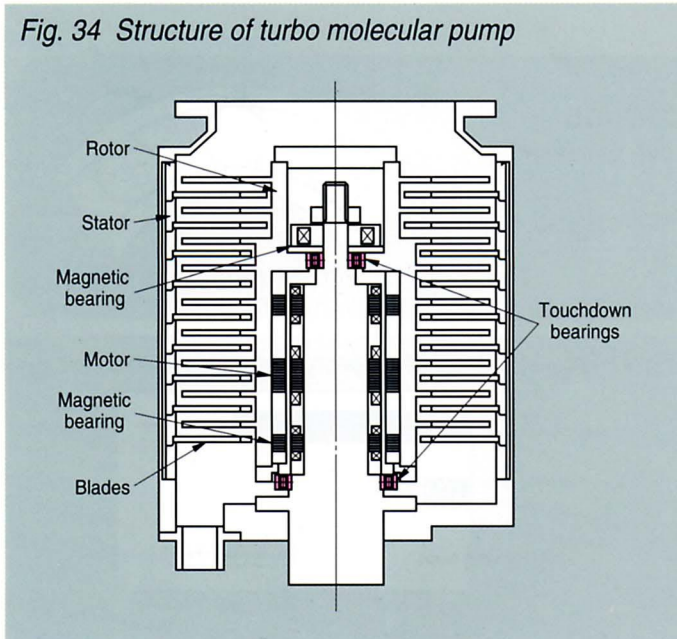
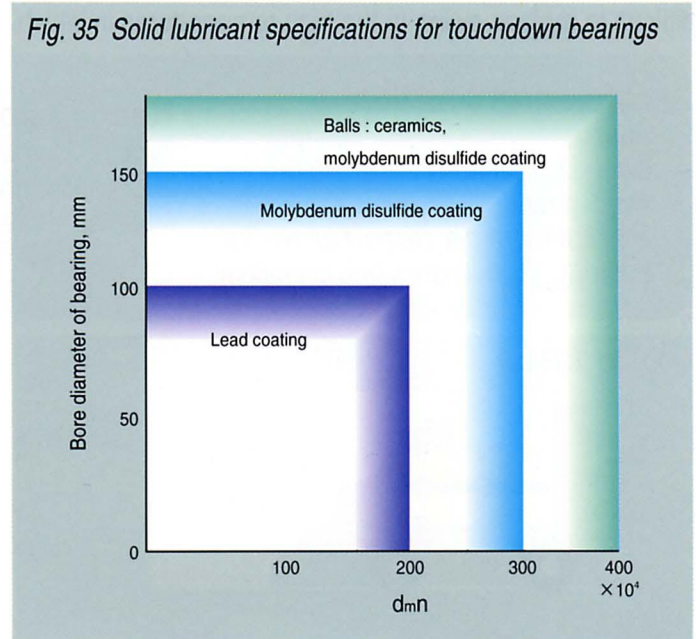


Fig. 35 Solid lubricant specifications for touchdown bearings



Applications and performance of SPACEA Series bearings

Bearings for space exploration equipment

In space, at an altitude of 300 km, atmospheric pressure drops to 10^{-5} Pa and the temperature of surfaces exposed to direct sunlight rises to 100~150°C, while that of surfaces unexposed falls to around -100°C. For this reason, bearings for space exploration equipment must be lubricated with special vacuum-resistant grease or with

solid lubricants. The load and speed conditions in space are not particularly severe, but the bearings must be able to run for up to ten years in the special conditions found in space (high vacuum, extreme temperature variation, radiation, etc.).

• Operating conditions

Vacuum: 10^{-7} ~ 10^{-4} Pa

Temperature: -100~150°C

• Performance requirements

Lubricity in vacuum and at high and low temperatures

Heat resistance of bearing material (owing to high-temperature baking)

• Bearing specifications

Type: full-type deep-groove ball bearing, angular contact ball bearing

Lubrication: (1) high vacuum grease
(2) lead, silver or molybdenum disulfide coating

Material: inner & outer rings, balls - martensite stainless steel
retainer - austenite stainless steel, fluororesin



Fig. 36 Bearing for manipulator

Fig. 37 Space station experiment module

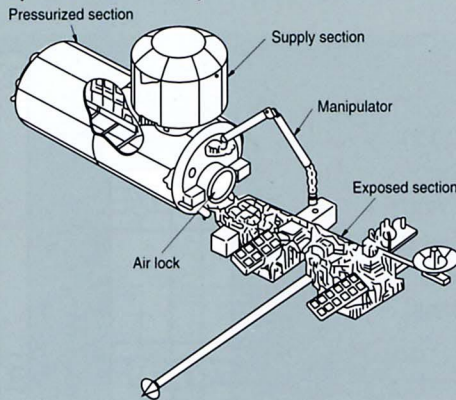
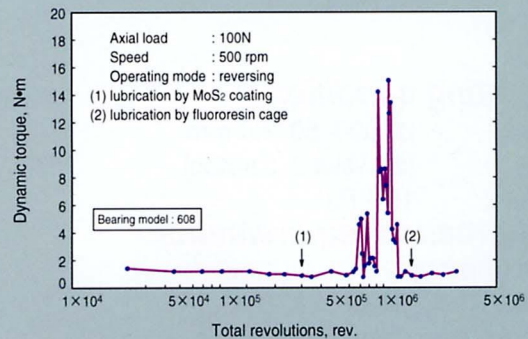


Fig. 38 Lubrication performance of bearing with MoS₂ coating and fluororesin cage



Bearings for kiln cars (high temperatures)

Bearings for the cars and conveyors used in heat treatment furnaces and kilns in the ceramics industry are difficult to replace owing to the high temperatures in which

they are used and must, as far as possible, be maintenance-free.

• Operating conditions

Speed: 10~500 rpm

Bearing temperature: up to 500°C

Atmosphere: air

• Performance requirements

Durability (maintenance-free operation)

• Bearing specifications

Type: deep-groove ball bearing

Lubrication: graphite

Material: martensite stainless steel, ceramics

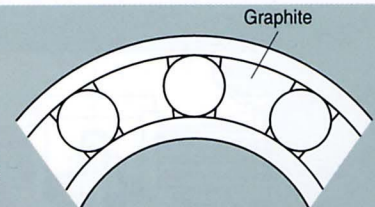


Fig. 39 Bearing for high temperature

Fig. 40 Kiln car

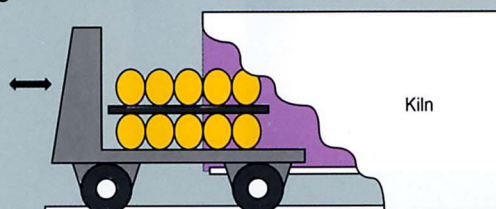


Fig. 41 Endurance life of high temperature bearings with solid lubricants

