Bearings with solid grease

CAT.No.3022-9/E

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Bearings with solid grease

Solid grease

"Solid grease" is a lubricant composed mainly of lubricating grease and ultra-high molecular weight polyethylene. Solid grease has the same viscosity as ordinary grease at normal temperature, but as a result of a special heat treatment process, this grease solidifies retaining a large proportion of the lubricant in it. Thanks to this solidification, the grease does not easily leak from the bearing, even when the bearing is subjected to strong vibrations or centrifugal force, helping to extend bearing life.
Bearings with solid grease are available in two types: the spot-pack type in which solid grease is injected onto the cage, and the full-pack type in which all empty space within the bearing is filled with solid grease. Spot-pack solid grease is standard for deep groove ball bearings, small size ball bearings, and bearing units. Full-pack solid grease is standard for self-aligning ball bearings, spherical roller bearings, and needle roller bearings.

Features

(1) Reduced lubricant leakage

Because the base oil is retained in a solid matrix, it is less likely to leak out of the bearing. During operation, temperature rise and/or centrifugal force will cause a gradual release of the base oil into the raceway groove. Eliminating grease leakage from the bearing ensures a consistent supply of lubricant and prevents contamination of the surrounding environment.

(2) Superior lubrication

Bearings with solid grease resist oil leakage prolonging bearing life in applications where high centrifugal force or vibration are present. The solid lubricant does not emulsify when exposed to water also extending both grease and bearing life.

(3) Low torque characteristics

The running torque of spot-pack bearings with solid grease is lower than that of bearings using standard lubricants. With conventional greases, a shearing resistance is created as the grease is channeled out of the raceway groove. Spot-pack bearings with solid grease do not experience shear resistance resulting in a lower running torque.

(4) Sealing effect

Though solid grease protects a bearing against ingress of foreign matters (water, dust, etc.), it is not a sufficient means of sealing. Therefore, for applications that need reliable sealing performance, we recommend the use of integral contact type rubber seals (deep groove ball bearings, bearing units) and or external seals.

(5) Highly safe

Food-grade solid grease is NSF[1)] H1[2)] approved (grease code LP09; NSF Reg. 158287) and has a high level of safety.

Note:1) National Sanitation Foundation
2) A lubricant that can be used in areas where there is a possibility of accidental contact with food.

Major components in solid greases

Table 1 shows the major components in solid greases.

Table 1 Major components in solid greases

Solid grease (code)	Resin	Lubricant
General-purpose solid grease (LP03)	Ultra-high molecular weight polyethylene	Li-mineral oil grease
Food-grade solid grease (LP09)	Ultra-high molecular weight polyethylene	Urea-synthetic oil grease

Precautions

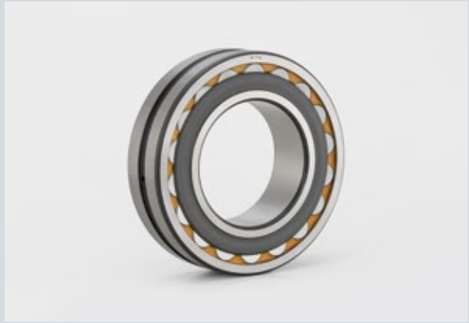
Avoid use in presence of splashing organic solvent (acetone, benzene, kerosene, etc.).

●Solid grease filling options

Bearings with general-purpose solid grease

Deep groove ball bearings
(spot-pack)

Bearing units
(spot-pack)



Spherical roller bearings
(full-pack)

Needle roller bearings
(full-pack)

Bearings with food-grade solid grease

Unit ball insert bearings
(spot-pack)

1 Availability

(1) Bearings with general-purpose solid grease (LP03)

● Rolling bearing of standard steel

Table 2 shows the manufacturable range. Bearings are not corrosion resistant materials.

Table 2 Manufacturable range for general-purpose solid grease (LP03)

(○:standard △:special ×:not available)

Bearing	Type		Bearing size (Outside diameter)
	Spot-pack	Full-pack	
Deep groove ball bearings	○[1)]	△	up to 350 mm
Miniature & Small size ball bearings	○[1)]	×	(Bearing bore diameter from 6 to 9 mm)
Self-aligning ball bearings	×	○[1)]	up to 250 mm
Spherical roller bearings	×	○[1)]	up to 250 mm
Bearing units	○[1)]	△	up to 300 mm
Needle roller bearings	×	○[2)]	

1) Deep groove ball bearings with spot-pack configuration and ZZ shields are standard. Certain types and sizes of standard bearings listed in the table above are not available with solid grease. Please contact **NTN** Engineering by specifying the intended bearing type and size for details.
2) The bearing size for needle roller bearings vary depending on the bearing type, so please contact **NTN** Engineering for details.

● Stainless steel sealed deep groove ball bearings

A contact sealed deep groove ball bearing with spot-pack solid grease that uses stainless steel for the inner ring, outer ring, and cage. For details, please refer to the dimension table shown on page 6.

(2) Spot-pack configuration for bearings with food-grade solid grease (LP09)

● Stainless steel ball bearing inserts: F-UC204D1/LP09 to F-UC210D1/LP09

The housing can also be made of stainless steel, making it possible to use all stainless steel.

For details, see the special catalog "Bearing Units Stainless Series (CAT.No.3903/E)".

● Deep groove ball bearings made of stainless steel (outside diameter 350 mm or less)

Spot-pack and ZZ shield included as standard.

Please note that some model numbers are not compatible, so please contact **NTN** Engineering.

2 Allowable Temperature Range

Use the outer ring temperature of solid greased bearing in **Table 3**.

In addition, "heat fitting" is possible when installing, but please ensure that the maximum heating temperature is 100 ℃ or less for less than 2 hours and do not rotate bearing during this process.

Table 3 Allowable temperature range for bearings with solid grease

	Bearings with general-purpose solid grease (LP03)	Bearings with food-grade solid grease (LP09)
Allowable temperature range	-20 to 80 ℃ (Continuous operation: 60 ℃ or less)	-10 to 100 ℃ (Continuous operation: 80 ℃ or less)

3 Allowable Speed

Table 4 Allowable speed for bearings with solid grease

Bearing type	Load condition	Allowable Speed (dn value) [1)]		
		General-purpose		Food-grade
		Spot-pack	Full-pack	Spot-pack
Deep groove ball bearings	Radial load	20×10^4	5×10^4	10×10^4 [3)]
Miniature & Small size ball bearings	Radial load	20×10^4	—	—
Self-aligning ball bearings	Radial load	—	3×10^4	—
Spherical roller bearings	Radial load	—	3×10^4	—
	$\frac{\text{Axial load}}{\text{Radial load}} \leq 0.3$	—	2×10^4	—
Bearing units	Radial load	12×10^4	3×10^4	10×10^4
Needle roller bearings	Radial load	—	3×10^4 [2)]	—

1) dn = bearing bore diameter d (mm) × rotational speed n (min^{-1})
2) $F_W \cdot n$ = roller inscribed circle diameter F_W (mm) × rotational speed n (min^{-1})
3) If intending to exceed allowable speed, please contact **NTN** Engineering.

4 Necessary Minimum Load

A minimum radial load is required to prevent skidding of the rolling elements when using full-pack solid grease. The minimum load required is approximately 1 % of the bearing dynamic load rating.

Please contact **NTN** Engineering for details.

5 Performance Test Data

(1) Lubricant Leakage Test

Non-shielded/sealed test bearings (spot-pack) were subjected to a centrifugal acceleration of 3 000 G (5 000 min^{-1}) for a period of 4 hours. Lubricant leakage from the **NTN** bearings with solid grease was approximately 2 wt% for the horizontally mounted condition (A), and approximately 5 wt% for the vertically mounted condition (B).

[Standard grease filled bearings using contact (LU) and non-contact (LB) seals were also subjected to the above test. Within 10 minutes after starting the test, centrifugal force caused the seals to become displaced allowing the grease to expel.]

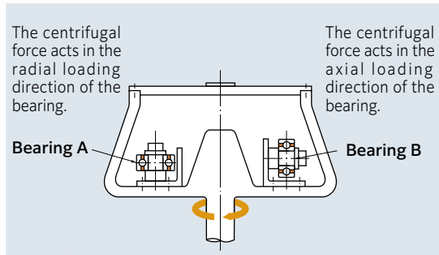


Fig. 1 Lubricant leakage test method

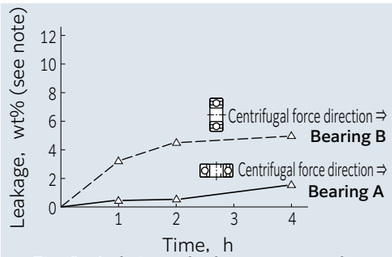


Fig. 2 Lubricant leakage test results

Note) Leakage: weight ratio of leaked lubricant compared to the amount (100 %) of general-purpose solid grease (LP03) filled.

Table 5 Lubricant leakage test conditions

	Bearing A	Bearing B
Test bearings	6201 [General-purpose solid grease (LP03), spot-pack, open type] 6201LLU (Li-mineral oil grease, with contact type seals on both sides) 6201LLB (Li-mineral oil grease, with non-contact type seals on both sides)	
Centrifugal acceleration	3 000 G (5 000 min^{-1})	
Bearing rotational speed	Static	
Bearing fixing	The centrifugal force acts in the radial loading direction of the bearing.	The centrifugal force acts in the axial loading direction of the bearing.
Test time	4 hours: The bearings were weighed every hour and lubricant leakage (weight ratio) was determined.	

(2) Rotational Torque Test

When tested, the required torque to rotate **NTN** bearings with spot-pack solid grease was less than bearings with Li-diester greases (acknowledged low-torque greases).

Full-pack required greater torque than Li-diester to rotate.

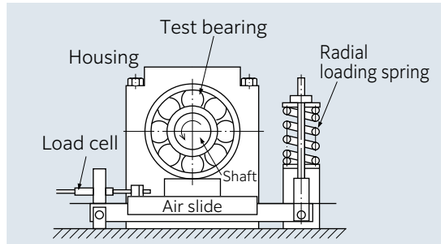


Fig. 3 Rotational torque test equipment

Table 6 Rotational torque test conditions

	Test conditions
Test bearing	6204ZZ
Test grease	General-purpose solid grease (LP03), various Li-based greases
Amount of grease fill	30 % of free space [for greases other than general-purpose solid grease (LP03)]
Load	Radial load : 39 N
Rotational speed	1 800, 3 600, 7 200 min^{-1}

Table 7 Rotational torque test results Unit: $\times10^{-4}$ N·m

Rotational speed (min^{-1})		1 800	3 600	7 200
Li-mineral oil grease		230	385	550
Li-polyol ester grease		145	265	383
Li-diester grease		90	315	403
General-purpose solid grease (LP03)	Spot-pack	63	113	190
	Full-pack	340	—	—

(3) Salt Water Test

A salt water test was performed to compare the performance of bearings with solid grease to that of bearings using a conventional lubricant (Li-mineral oil grease). As noted in **Table 9, NTN** bearings with solid grease were found to out perform standard bearings although some surface deterioration was detected.

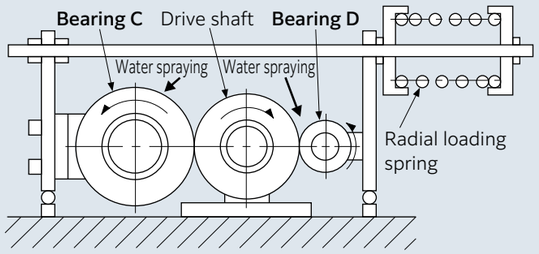


Fig.4 Salt water test equipment

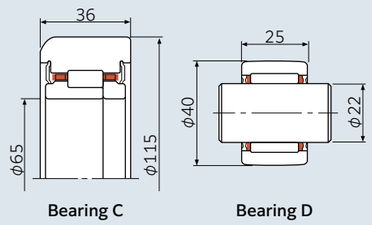


Fig.5 Test bearings

Table 8 Salt water test conditions

	Bearing C	Bearing D
Load	Radial load : 157 N	
Rotational speed	50 min^{-1} (outer ring)	144 min^{-1} (outer ring)
Volume of sprayed water	9 ℓ/min	
Salt concentration	5 wt%	
Operating cycle	Total running time 496 hours. (5 hour run+3 hour break)×62 cycles	

Table 9 Salt water test results

	General-purpose solid grease (LP03)		Li-mineral oil grease	
	Bearing C	Bearing D	Bearing C	Bearing D
Ease of hand rotation	△	△	×	×
Amount of lubricant remaining	○	○	×	×
Lubricant deterioration	△	△	×	×
Water invasion resistance	○	○	×	×

Symbol definition ○: Good △: Fair (some deterioration detected) ×: Poor

1. Product overview

(1) Having an inner ring, outer ring, and cage each made of a stainless steel, this unique series of contact seal type deep groove ball bearings have a spot-pack with general-purpose solid grease (LP03).

(2) Bearing accuracy
The dimensional accuracy and running accuracy of this series of bearings are equivalent to JIS Class 0 bearings.

(3) Radial internal clearance
The radial internal clearance values of this bearing series are in **Table 10**. The values in this table differ from those specified in the JIS standard.

Table 10 Radial internal clearance

Nominal bore diameter d mm		Radial internal clearance μm	
Over	Incl.	Min.	Max.
—	10	6	17
10	18	6	20
18	30	8	22
30	40	11	25

Can also be used with food-grade solid grease (LP09)

(4) **Table 11** and **Table 12** shows the inner and outer ring markings.

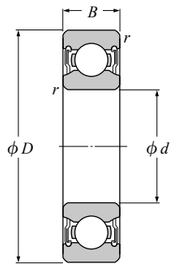
Table 11 SSN0 series

Designation	Marking	
	Inner ring	Outer ring
SSN000LL	SS	SS
SSN001LL	SS	SS
SSN002LL	SS	SS
SSN003LL	SS	SMT, SS6003, JAPAN
SSN004LL	SS	SMT, SS6004, JAPAN
SSN005LL	SS	SMT, SS6005, JAPAN
SSN006LL	SS	SMT, SS6006, JAPAN
SSN007LL	SMT, SS6007, JAPAN	SS
SSN008LL	SMT, SS6008, JAPAN	SS

Table 12 SSN2 series

Designation	Marking	
	Inner ring	Outer ring
SSN200LL	SS	SMT, SS6200, JAPAN
SSN201LL	SS	SMT, SS6201, JAPAN
SSN202LL	SS	SMT, SS6202, JAPAN
SSN203LL	SS	SMT, SS6203, JAPAN
SSN204LL	SS	SMT, SS6204, JAPAN
SSN205LL	SS	SMT, SS6205, JAPAN
SSN206LL	SMT, SS6206, JAPAN	SS
SSN207LL	SMT, SS6207, JAPAN	SS
SSN208LL	SMT, SS6208, JAPAN	SS

2. Dimension table



Contact seal type (LL)

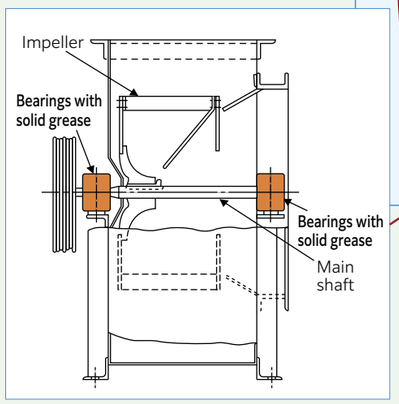
Boundary dimensions mm				Basic load rating dynamic kN	static kN	Bearing number	Reference[2] (Standard bearing)
d	D	B	$r_{s\,min}$[1]	C_r	C_{0r}		
10	26	8	0.3	3.50	1.96	**SSN000LL/LP03**	6000
	30	9	0.6	3.95	2.39	**SSN200LL/LP03**	6200
12	28	8	0.3	3.95	2.39	**SSN001LL/LP03**	6001
	32	10	0.6	5.25	3.05	**SSN201LL/LP03**	6201
15	32	9	0.3	4.30	2.86	**SSN002LL/LP03**	6002
	35	11	0.6	5.85	3.75	**SSN202LL/LP03**	6202
17	35	10	0.3	4.60	3.25	**SSN003LL/LP03**	6003
	40	12	0.6	7.35	4.80	**SSN203LL/LP03**	6203
20	42	12	0.6	7.20	5.05	**SSN004LL/LP03**	6004
	47	14	1	9.90	6.65	**SSN204LL/LP03**	6204
25	47	12	0.6	7.75	5.85	**SSN005LL/LP03**	6005
	52	15	1	10.8	7.85	**SSN205LL/LP03**	6205
30	55	13	1	10.2	8.25	**SSN006LL/LP03**	6006
	62	16	1	15.0	11.3	**SSN206LL/LP03**	6206
35	62	14	1	12.3	10.3	**SSN007LL/LP03**	6007
	72	17	1.1	19.8	15.4	**SSN207LL/LP03**	6207
40	68	15	1	12.9	11.5	**SSN008LL/LP03**	6008
	80	18	1.1	22.4	17.8	**SSN208LL/LP03**	6208

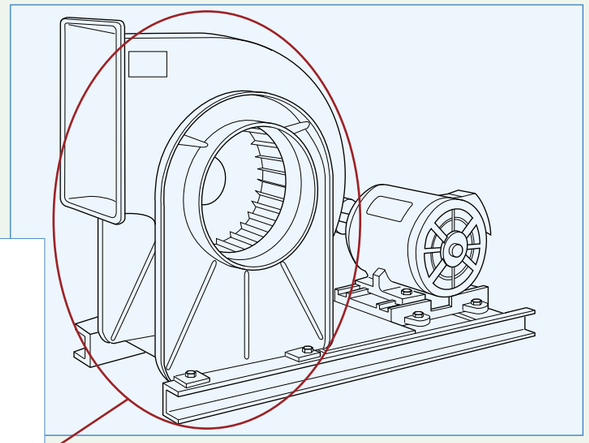
1) Smallest allowable dimension for chamfer dimension r.
2) The boundary dimensions are the same as the standard bearing listed (according to JIS B 1512).

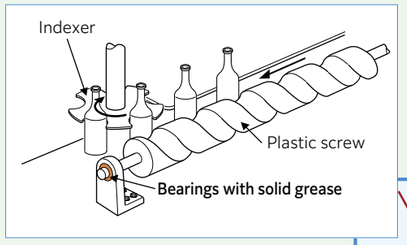
7 Applications

Fan blower support bearing

Lubricant suction prevention

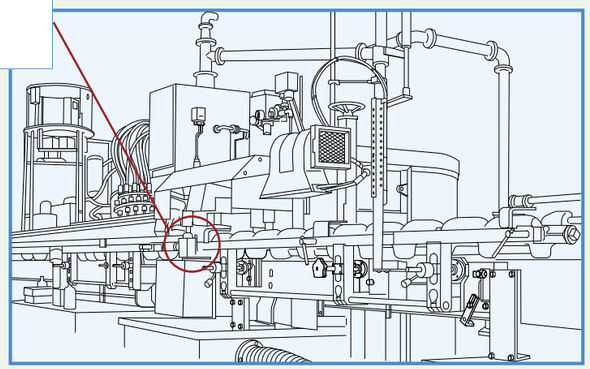






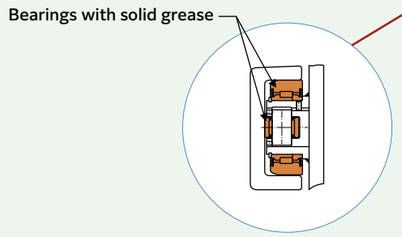
Support bearings for bottle feeder of filler on bottling line

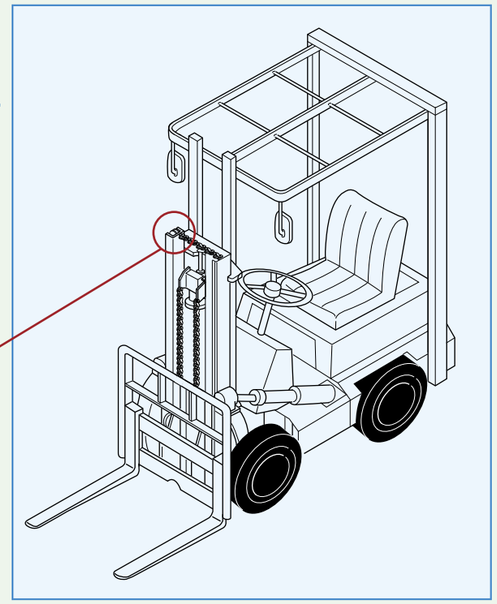
Prevention of lubricant leakage and product contamination

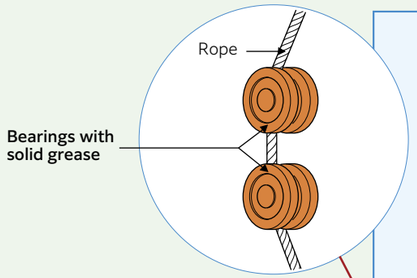


Forklift mast-roller

Prevention of lubricant emulsification and grease leakage. Prolonged bearing life.

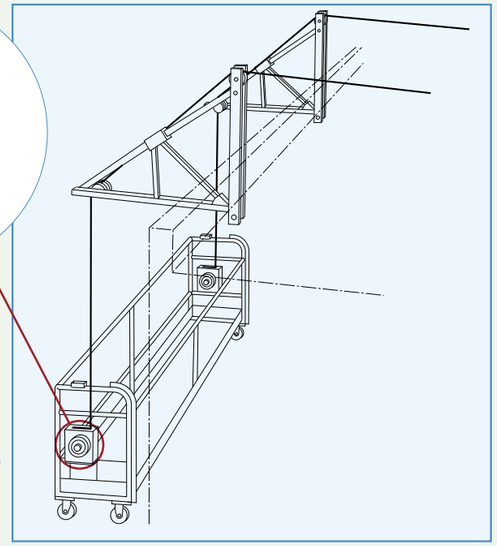




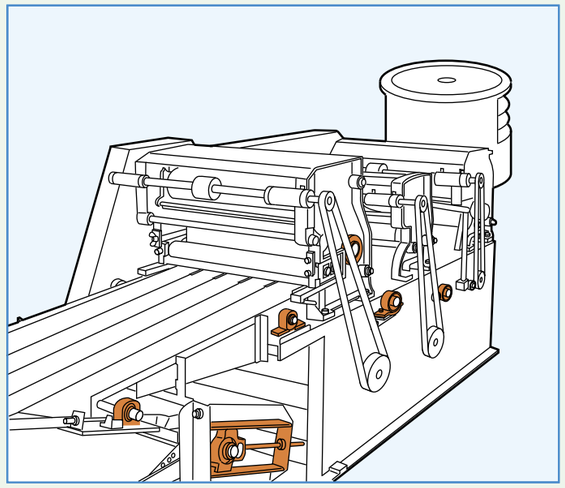


Guide roller for gondola rope

Prevention of lubricant emulsification and grease leakage. Extended maintenance intervals.



7 Applications



Noodle-making machine

Automatic wonton skin making line

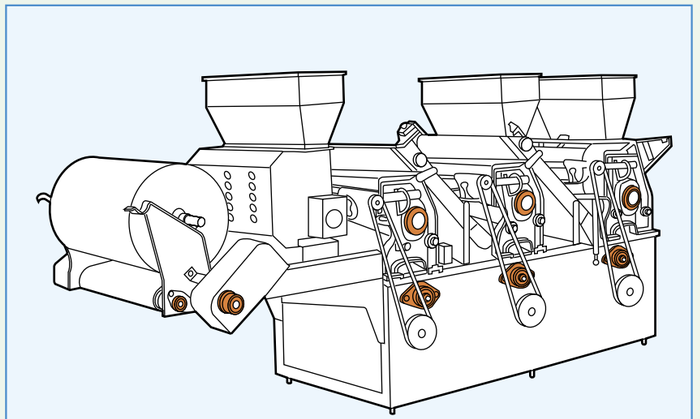


Table 13 Other applications

Machine applications	Required characteristics
Cranes, sheaves, conveyors, steel mill rollers, amusement machines, etc.	Bearings with long lubricant life
Multi-story parking lot, conveyors, etc.	Improved dust and water-proofing capability
Wire stranding machines etc.	Prevention of lubricant leakage (i.e. applications where the bearing is required to rotate about an axis other than its own)
Printing presses, textile machines, food machinery, etc.	Prevention of leaked lubricant (clean work environment)
Testing equipment, film stretching machines, etc.	Low torque

NTN corporation

◀ Sales Network