

SKF corrosion resistant ball bearings for the food and beverage industry



A range of bearing solutions for extreme environments

Food and beverage industry regulations are placing ever greater demands on the production of safe food. To meet these regulations, plus the requirements of food safety management systems such as Hazard Analysis & Critical Control Points (HACCP), the industry is applying new bearing technologies. These include use of lubricants registered by NSF as acceptable for incidental contact with food, seal material that is optically detectable and food safe should the seal be damaged or fail.



A range of bearing solutions designed to comply with food processing guidelines and regulations

When machine components directly contact foodstuffs, there is a risk that any lubricant leakage will contaminate the product. To avoid this, food safety management systems and regulations require the use of lubricants registered as acceptable with incidental food contact for use in and around food processing areas.

Taking that recommendation one step further, a developing industry trend is to use lubricants registered as acceptable with incidental food contact for use in and around food processing areas plant-wide. This avoids the possibility that an unsuitable lubricant is mistakenly applied to a critical position.

In addition, to prevent bacterial growth, food processing machinery is often subjected to the application of caustic antibacterial cleansing agents followed by high pressure wash downs that can wash out grease and dramatically increase the risk of corrosion of standard carbon steel bearings, leading to costly unplanned stops.

In some specific food and beverage production processes superior corrosion resistance is sometimes required to provide a reliable service life of bearings. In such cases new solutions are available, with materials offering ultimate corrosion resistance, superior performance, advanced lubricants and with sealing solutions that meet industry needs.



In challenging process environments, hygienic washdowns require corrosion-resistant bearings to keep assets reliable and HACCP compliant.

SKF Food Line stainless steel deep groove ball bearings

Reliable, food safety compliant solutions for wet and corrosive environments



In order to comply with guidelines, the new SKF Food Line stainless steel deep groove ball bearing (suffix VP311) is being introduced as a reliable solution that meets industry needs and requirements:

- High quality grease suitable for typical food and beverage application conditions, registered by NSF as category H1*
- The seals are made from synthetic rubber, coloured blue for optical detectability should any fragments enter the food stream, and complying with US Food and Drug Administration (FDA) and European Community (EC) recommendations**

SKF Food Line stainless steel deep groove ball bearings offer high corrosion resistance for virtually all food and beverage environments.

Compliance with food safety requirements make the new SKF Food Line stainless steel deep groove ball bearings an ideal solution for virtually all applications in food and beverage processes.

Food safe

- Prelubricated with a high quality grease registered by NSF as category H1*
- Nitrile rubber seal material is coloured blue for optical detectability and is compliant with FDA and EC category 3 recommendations**

Increased protection against corrosion

- Stainless steel (440C) for inner ring, outer ring, rolling elements and cage
- Stainless steel backing plate for the seal

SKF Food line stainless steel deep groove ball bearings, metric									
Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designation
			dynamic	static		Reference speed	Limiting speed		
d	D	B	C	C ₀	P _u				
mm			N		N	r/min		kg	–
8	22	7	1 990	780	34	–	22 000	0,0117	W 608-2RS1/VP311
10	26	8	3 970	1 960	83	–	19 000	0,0185	W 6000-2RS1/VP311
	30	9	4 360	2 320	100	–	16 000	0,0304	W 6200-2RS1/VP311
12	28	8	4 420	2 360	102	–	16 000	0,0198	W 6001-2RS1/VP311
	32	10	5 720	3 000	127	–	15 000	0,0362	W 6201-2RS1/VP311
15	32	9	4 880	2 800	120	–	14 000	0,0288	W 6002-2RS1/VP311
	35	11	6 370	3 600	156	–	13 000	0,0442	W 6202-2RS1/VP311
17	35	10	4 940	3 150	137	–	13 000	0,0385	W 6003-2RS1/VP311
	40	12	8 060	4 750	200	–	12 000	0,0647	W 6203-2RS1/VP311
20	42	12	8 060	5 000	212	–	11 000	0,0657	W 6004-2RS1/VP311
	47	14	10 800	6 550	280	–	10 000	0,1047	W 6204-2RS1/VP311
25	47	12	8 710	5 850	250	–	9 500	0,077	W 6005-2RS1/VP311
	52	15	11 700	7 650	335	–	8 500	0,1291	W 6205-2RS1/VP311
30	55	13	11 400	8 150	355	–	8 000	0,113	W 6006-2RS1/VP311
	62	16	16 500	11 200	480	–	7 000	0,1958	W 6206-2RS1/VP311
35	62	14	13 800	10 200	440	–	6 700	0,1475	W 6007-2RS1/VP311
	72	17	22 100	15 300	655	–	6 000	0,2792	W 6207-2RS1/VP311
40	68	15	14 600	11 400	490	–	6 300	0,1856	W 6008-2RS1/VP311
	80	18	25 100	17 600	750	–	5 600	0,3578	W 6208-2RS1/VP311



* Lubricant registered by NSF as category H1 (lubricant acceptable with incidental food contact for use in and around food processing areas). The NSF registration confirms it fulfills the requirements listed in the US Food and Drug Administrations guidelines under 21 CFR section 178.3570.

** FDA (21 CFR section 177.2600 "Rubber articles intended for repeated use" in food manufacture, preparation and transportation including aqueous and fatty foods) and EC (conformity to the overall migration requirements of the German BfR recommendations for food contact materials, recommendation XXI for category 3 materials).

MRC Ultra corrosion-resistant sealed deep groove ball bearings

Breakthrough in bearing life – with ultimate corrosion resistance

In applications with harsh or extreme environments, MRC Ultra corrosion-resistant sealed deep groove ball bearings are designed for superior corrosion resistance, longer fatigue life and significantly improved reliability. These innovative bearings are ideal for applications in freezing, abrasive, wet and corrosive environments typically encountered in food processing machinery. They help to cut costs and drive innovation.

Inner and outer rings are made from high nitrogen corrosion-resistant stainless steel (HNCR). Combined with ceramic balls, the corrosion resistance and fatigue life of MRC Ultra corrosion-resistant sealed deep groove ball bearings is far superior to bearings made from 52100 and 440C stainless steels.

- Seal reinforcements and cages are stainless steel
- High quality grease, suitable for typical food and beverage application conditions registered by NSF as category H1*.
- The seals are made from synthetic rubber, coloured blue for optical detectability should any fragments enter the food stream, and complying with US Food and Drug Administration (FDA)***

All of this combines to make MRC Ultra corrosion-resistant sealed deep groove ball bearings optimal for use in the food and beverage industry.

Benefits

- Reduce unplanned downtime
- Improve reliability
- Reduce maintenance costs
- Boost productivity
- Extend bearing service life



The chosen bearing material, the blue rubber seals and selected grease meet relevant industry standards and make these bearings optimal for use in particularly aggressive applications.

HNCR stainless steel: the material differences

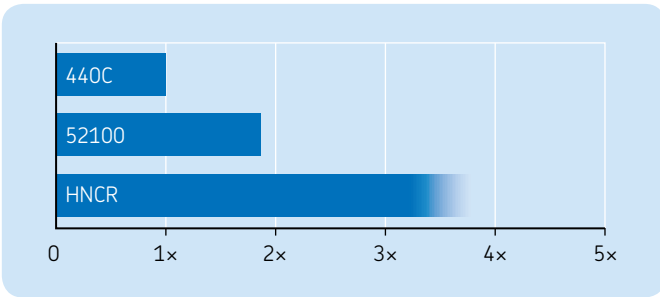
HNCR stainless steel is able to offer far greater corrosion resistance than 52100 and 440C stainless steels due to the nitrogen content. As indicated in the chart below, the material composition of 52100 and 440C steel includes no nitrogen at all.

Stainless steel	C	N	CR
52 100	1,00	–	1,45
440C	1,08	–	17,00
HNCR	0,38	0,20	15,00

HNCR stainless steel also offers greater material “cleanliness” than 52100 and 440C, with almost no presence of sulfides, aluminates, silicates, or globular oxides. The absence of these non-metallic contaminants contributes to extended bearing service life, as does the extremely homogeneous structure.

Hardness and fatigue life

The HNCR stainless steel inner and outer rings used in MRC Ultra corrosion-resistant sealed deep groove ball bearings are martensitic through-hardened and tempered to 58 HRC. Based on test data from both rotating beam and rolling contact fatigue, HNCR stainless steel yields a significantly longer fatigue life compared to 52100 and 440C.



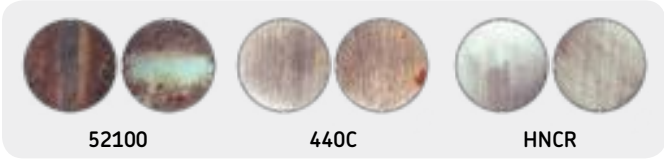
Rolling contact fatigue test

MRC ultra corrosion-resistant deep groove ball bearings not only offer far greater corrosion resistance compared to bearings with inner and outer rings made from 440C stainless steel, they also deliver from two to three times the fatigue life.

* Lubricant registered by NSF as category H1 (lubricant acceptable with incidental food contact for use in and around food processing areas). The NSF registration confirms it fulfills the requirements listed in the US Food and Drug Administrations guidelines under 21 CFR section 178.3570.

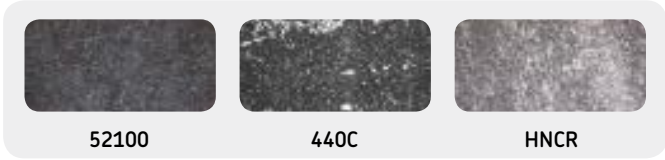
***FDA (CFR 21 section 177.2600 for ‘Rubber articles intended for repeated use’ for use in contact with aqueous and fatty foods)

Extreme corrosion resistance



The presence of nitrogen combined with the high chromium content in HNCR stainless steel delivers superior corrosion resistance. The US Navy Corrosion Test Method photos (above) show the comparative corrosion resistance of 52100, 440C and HNCR after just two weeks. HNCR continued to exhibit zero signs of corrosion after a year-long salt bath immersion.

A close look at structural consistency



As these microscopic photos reveal, HNCR stainless steel has a much more homogeneous structure compared with 440C. The large carbides in 440C can present stress raisers that may lead to premature bearing failure under dynamic loading.

MRC metric range of ultra corrosion-resistant sealed deep groove ball bearings

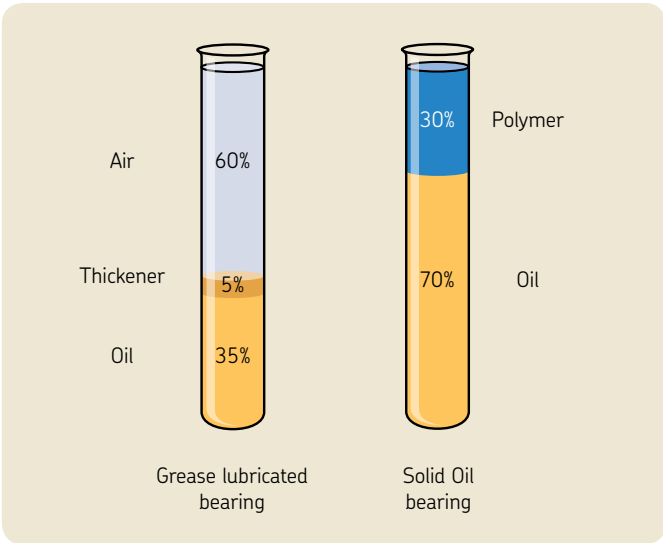
Principal dimensions						Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designation
						dynamic	static		Reference speed	Limiting speed		
d	D	B	C	C ₀	P _u							
mm	in.	mm	in.	mm	in.	N		N	r/min		kg	–
10	0.3937	30	1.1811	9	0.3543	5 100	2 370	–	–	17 000	–	200SZZ-HNCR-HYB
12	0.4724	32	1.2598	10	0.3937	6 800	3 050	–	–	15 000	–	201SZZ-HNCR-HYB
15	0.5906	35	1.3780	11	0.4331	7 600	3 700	–	–	13 000	–	202SZZ-HNCR-HYB
17	0.6693	40	1.5748	12	0.4724	9 550	4 760	–	–	12 000	–	203SZZ-HNCR-HYB
20	0.7874	47	1.8504	14	0.5512	12 800	6 580	–	–	10 000	–	204SZZ-HNCR-HYB
25	0.9843	52	2.0472	15	0.5906	14 000	7 830	–	–	8 500	–	205SZZ-HNCR-HYB
30	1.1811	62	2.4409	16	0.6299	19 500	11 300	–	–	7 500	–	206SZZ-HNCR-HYB
35	1.3780	72	2.8346	17	0.6693	25 500	15 300	–	–	6 300	–	207SZZ-HNCR-HYB
40	1.5748	80	3.1496	18	0.7087	30 700	19 000	–	–	5 600	–	208SZZ-HNCR-HYB
45	1.7717	85	3.3465	19	0.7480	33 200	21 600	–	–	5 000	–	209SZZ-HNCR-HYB
50	1.9685	90	3.5433	20	0.7874	35 100	23 200	–	–	4 800	–	210SZZ-HNCR-HYB
10	0.3937	26	1.0236	8	0.3150	4 620	1 960	–	–	19 000	–	100KSZZ-HNCR-HYB
12	0.4724	28	1.1024	8	0.3150	5 070	2 360	–	–	17 000	–	101KSZZ-HNCR-HYB
15	0.5906	32	1.2598	89	3.5039	5 590	2 850	–	–	14 000	–	102KSZZ-HNCR-HYB
17	0.6693	35	1.3780	10	0.3937	6 050	3 250	–	–	13 000	–	103KSZZ-HNCR-HYB
20	0.7874	42	1.6535	12	0.4724	9 360	5 000	–	–	11 000	–	104KSZZ-HNCR-HYB
25	0.9843	47	1.8504	12	0.4724	11 200	6 550	–	–	9 500	–	105KSZZ-HNCR-HYB
30	1.1811	55	2.1654	13	0.5118	13 200	8 270	–	–	8 000	–	106KSZZ-HNCR-HYB
8	0.3150	22	0.8661	7	0.2756	3 250	1 360	–	–	23 000	–	38ZZ-HNCR-HYB
10	0.3937	22	0.8661	6	0.2362	2 510	1 120	–	–	19 000	–	1900SZZ-HNCR-HYB
12	0.4724	24	0.9449	6	0.2362	2 890	1 460	–	–	18 000	–	1901SZZ-HNCR-HYB
15	0.5906	28	1.1024	7	0.2756	4 030	2 040	–	–	16 000	–	1902SZZ-HNCR-HYB
17	0.6693	30	1.1811	7	0.2756	4 360	2 320	–	–	14 000	–	1903SZZ-HNCR-HYB
20	0.7874	37	1.4567	9	0.3543	6 380	3 680	–	–	12 000	–	1904SZZ-HNCR-HYB
25	0.9843	42	1.6535	9	0.3543	7 030	4 530	–	–	10 000	–	1905SZZ-HNCR-HYB

Lubrication solutions can reduce maintenance costs and contamination risks

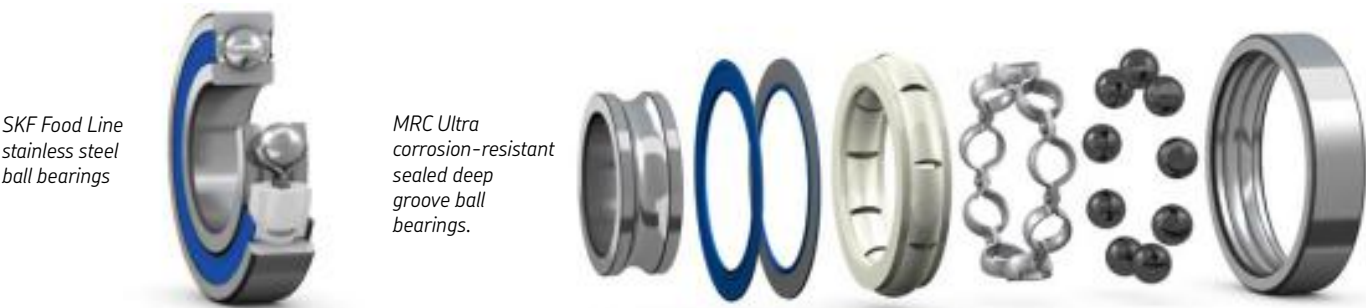
Solid Oil is a lubricating oil-saturated, polymer matrix that virtually fills the internal space in a bearing.

The polymer matrix has a porous structure with millions of micro-pores to hold the lubricating oil. The pores are so small that they retain the oil by surface tension. As the polymer matrix is pressed into the bearing and then cured, a very narrow gap forms around the rolling elements and raceways, enabling the bearing components to rotate freely. Oil is drawn from the matrix into these gaps, providing continual lubrication to the bearing. A bearing filled with Solid Oil contains two- to four-times more lubricating oil than a similar bearing filled with grease.

While Solid Oil technology is suitable for open bearings and those with integral seals. It does not require seals to retain the lubricant in the bearing, even on vertical shafts. If a bearing arrangement already incorporates seals, however, they should be retained as an extra protection against contamination.



Rolling contact fatigue test
The Solid Oil matrix contains two- to four-times more oil than in conventional greased bearings, making relubrication unnecessary.



Both variants shown above can be provided with Solid Oil filling.

Relubrication-free

- Bearing 100% filled with Solid Oil matrix
- Supplied lubricated for life and cannot be relubricated

Resistant to washdowns

- The Solid Oil matrix is added into the bearing and then cured and cannot be washed out
- Solid oil is resistant to virtually all chemicals used in washdowns and does not emulsify in the presence of water

Food safe

- Virtually no leakage when running at high speeds
- Solid Oil variants W64F and W64FL (for lower operating temperatures) available with oil registered by NSF as category H1*

Increased protection against contaminants

- Efficient integral bearing seal
- Bearing filled with Solid Oil matrix providing secondary sealing



Is ingress of process material and high humidity causing downtime?

Solid Oil filled bearings are lubricated for life making relubrication unnecessary. The matrix fills free space in the bearing, supports integral seals and helps protect against contaminant ingress. It is resistant to emulsification in the presence of water. It can also, for example, be used in difficult to reach areas where manual relubrication is difficult.



Hygienic washdowns and sudden temperature shifts causing bearing failure?

Solid oil fills virtually all of the free space in a sealed bearing and therefore dramatically reduces the breathing effect that otherwise occurs in sealed bearings lubricated with grease when subjected to rapid temperature changes. This means that much less moisture is drawn into sealed bearings lubricated with solid oil under wash down conditions, limiting corrosion and lubricant degradation, resulting in extended service life.

Sealing solutions

For optimal bearing performance in wet environments, it is recommended to combine Solid Oil lubrication with integral seals. Under conditions of high pressure wash down, the solid oil matrix reinforces the effectiveness of integral seals by supporting them and resisting them from deflecting inwards and opening.

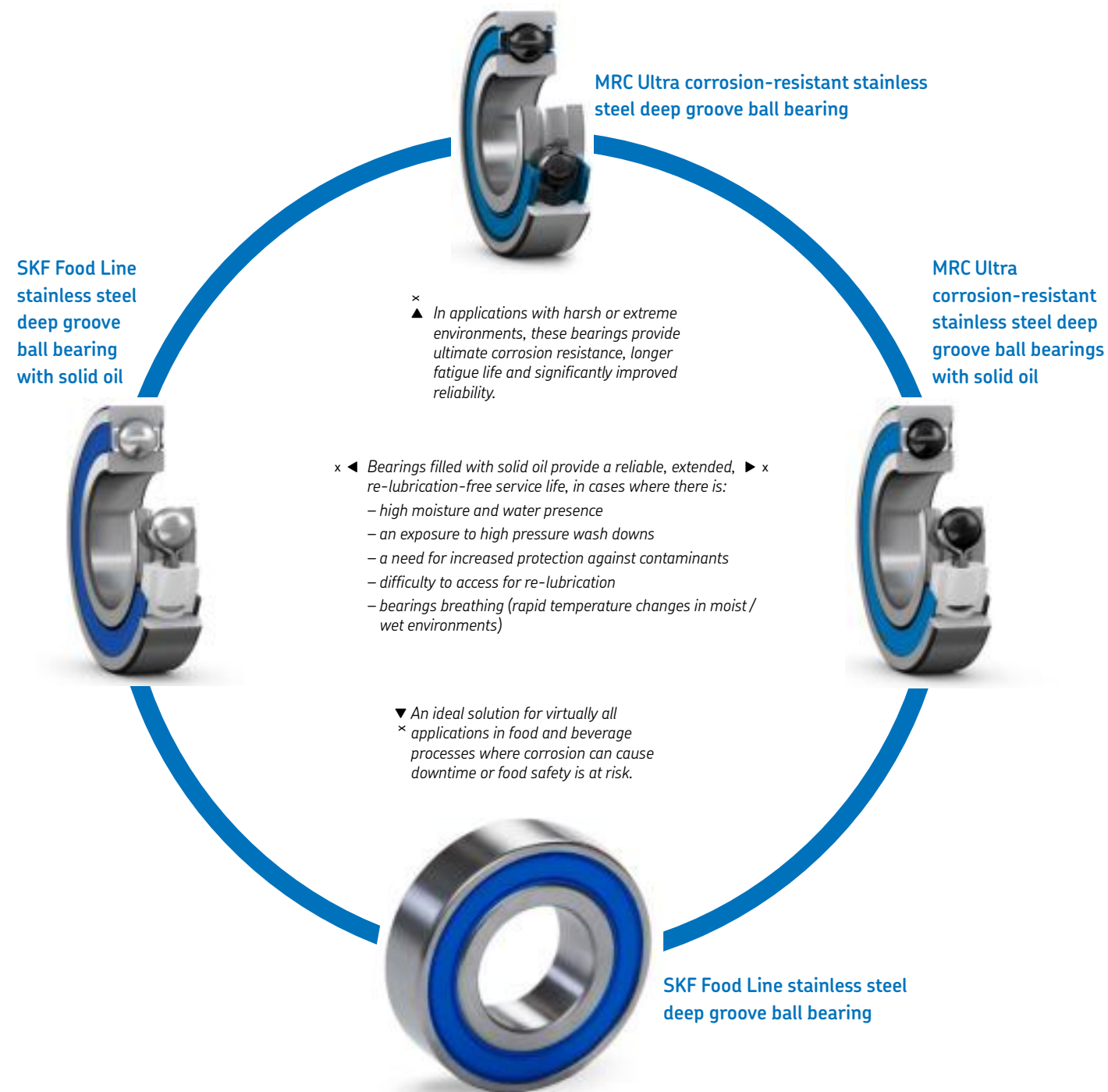
Speed limits

Bearings using Solid Oil would be suitable for most applications in the industry. They should however be checked regarding speed limits, please use product information from brochure 15894 EN.

Characteristics of Solid Oil variants		
Characteristic	W64F	W64FL
Base oil viscosity at 40 °C	220 cSt	32 cSt
at 100 °C	25 cSt	6 cSt
NSF H1 food grade	Yes	Yes
Operating temperatures	Max 85 °C continuous Max 95 °C intermittent Min -25 °C continuous	Max 85 °C continuous Max 95 °C intermittent Min -54 °C continuous
Relubrication-free	Yes	Yes

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Match the right bearing to your application



Other customized solutions

Unable to source bearings with the required grease specification?

SKF lubricated for life, custom grease filled bearings

In cases where a specific brand of lubricant, a specific grease fill or non-standard packaging or markings are needed, SKF offers a customized solution:

- Wide variety of bearing types available
- Seals or shields as required (size dependent)
- All grease fills possible (from 10 to 100%)
- Any customer specified grease can be used (e.g., if facility is restricted to the use of one grease manufacturer)
- Traceability code and new designation laser marking can be added
- Vacuum packaging possible on request



Explore the full range of SKF solutions for the food and beverage industry



Download our SKF capability catalogue at [skf.com/food and beverage](https://skf.com/food-and-beverage) – a source of inspiration for new technologies and value added solutions. The guide offers insights to how SKF has been able to support increases in asset reliability, improve operator safety, reduce waste of water, energy and lubricant consumption.



The Power of Knowledge Engineering

Combining products, people, and application-specific knowledge, SKF delivers innovative solutions to equipment manufacturers and production facilities in every major industry worldwide. Having expertise in multiple competence areas supports SKF Life Cycle Management, a proven approach to improving equipment reliability, optimizing operational and energy efficiency and reducing total cost of ownership.

These competence areas include bearings and units, seals, lubrication systems, mechatronics, and a wide range of services, from 3-D computer modelling to cloud-based condition monitoring and asset management services.

SKF's global footprint provides SKF customers with uniform quality standards and worldwide product availability. Our local presence provides direct access to the experience, knowledge and ingenuity of SKF people.



SKF BeyondZero

SKF BeyondZero is more than our climate strategy for a sustainable environment: it is our mantra; a way of thinking, innovating and acting.

For us, SKF BeyondZero means that we will reduce the negative environmental impact from our own operations and at the same time, increase the positive environmental contribution by offering our customers the SKF BeyondZero portfolio of

products and services with enhanced environmental performance characteristics.

For inclusion in the SKF BeyondZero portfolio, a product, service or solution must deliver significant environmental benefits without serious environmental trade-offs.



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PUB 65/P2 15962 EN · September 2015

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