

Bearing Handbook for Electric Motors





Prolong your life

The life of your electric motors—
with INSOCOAT® bearings from SKF®.



Conventional motor bearings get “fried” by the electrical current passing through them. The result is premature failure and high maintenance costs. The SKF® solution is INSOCOAT® inverter-duty bearings that require no rework prior to mounting.

These drop-in replacement bearings feature a coating of aluminum oxide on the inner or outer ring, providing an insulating barrier which prevents electrical current from causing microscopic “melting” of the bearing. In addition, INSOCOAT bearings are treated with a sealant that resists humid environments, heat and chemicals.

INSOCOAT bearings are 100% performance tested to 1,000 V DC with a minimum ohmic resistance of 50 MΩ and available for shaft diameters up to 155 mm.

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Installation tips for reliable bearing operation

- 1. Handle with care.** Never pound directly on a bearing or ring. If a bearing is dropped, it is best not to install it. Store bearings horizontally in a dry place in their original unopened package and never place bearings on a dirty surface; periodically turn over sealed and shielded bearings to prevent grease from settling to one side.
- 2. Inspect the shaft and housing.** Check for size and damage; remove nicks and burrs with emery paper, and wipe clean with a soft cloth. Replace or repair shafts and housings showing obvious signs of wear or damage. A shaft placed in a vise for mounting should be protected from vise jaws with a sheet of soft metal.
- 3. Avoid overheating.** During heat-mounting operations, never bring a flame in direct contact with the bearing and never heat beyond 230° F. Also, immediately hold a heat-mounted bearing in place against the shaft shoulder until it cools and locks in place. Otherwise, the bearing may creep away from the proper position.
- 4. Use identical replacement bearings.** Replacement bearings should be identical to the bearings they replace. Contact an SKF Authorized Distributor or SKF for interchange information.
- 5. Use the right tool for the job.** Induction heaters, oil injection kits, and hydraulic nuts are among the specialized tools available for mounting and dismounting bearings over 4 in. O.D. Their use lowers the possibility of damaging bearings and speeds the process.
- 6. Pay attention to the bearing's press fit.** For bearings with an O.D. *less than 4 inches*, cold mounting with a press or appropriate mounting tool is acceptable. Pressure should be applied to the ring with the interference fit, or both the inner ring and outer ring simultaneously to avoid Brinelling the raceways. Applying pressure to the ring with the loose fit only will Brinell the raceways and result in noise and potentially premature failure.

7. The contact between the bearing ring and a properly machined and dimensioned bearing seat should not require the use of bonding agents to prevent movement or turning.
8. **Don't wash new bearings.** Bearing manufacturers take great care to package and ship bearings that are dirt-free and ready for lubrication. There's usually no need to wash them or remove the protective slushing compound.
9. **Proper lubrication is critical.** Bearing manufacturers evaluate several factors before determining the type of lubricant required for specific bearings. Be sure to follow their recommendations. Temperature and contamination conditions will influence the frequency of lubrication changes.
10. **Rotate idle bearings.** Bearings installed in equipment that is subject to vibration while the shafts are stationary may incur false brinelling damage, which also occurs when equipment is not properly protected during shipment. It can appear as bright, polished depressions on the inner and/or outer races, as well as on the rolling elements.
11. **Look for danger signs.** Keep alert for three sure signs of improper bearing operation: excessive noise and increases in vibration and temperature. Troubleshooting instruments like hand-held vibration pens, digital thermometers, and electronic stethoscopes help spot bearings in poor operating conditions.
12. **Find the cause of bearing failures.** Bearings are built to last, so frequent failures may point to an installation or lubrication problem. SKF bearing analysis experts can identify the cause of bearing failure and help you prevent it in the future.

Speed ratings

There is a speed limit to which rolling bearings can be operated. Generally, it is the operating temperature that can be permitted with respect to the lubricant being used or to the material of the bearing components that sets the limit. The speed at which this limiting bearing temperature is reached depends on the frictional heat generated in the bearing (including any externally applied heat) and the amount of heat that can be transported away from the bearing. Bearing type and size, internal design, load, lubrication and cooling conditions as well as cage design, accuracy and internal clearance all play a part in determining speed capability. In the accompanying tables two speeds are listed: (Thermal) Reference Speed and (Kinematic) Limiting Speed.

Warning: The new Reference and Limiting Speeds are not to be used as a direct substitution for the previous Oil and Grease speed ratings. Consult SKF to determine the actual reference speed limit for your operating conditions.

Reference speeds

The reference speed for a given bearing represents the permissible operating speed of said bearing when subjected to the specific operating conditions of load, lubrication type and method as outlined in ISO 15312. This standard has been established for oil lubrication but is also valid for grease and uses the following reference conditions:

- A temperature increase of 90° F (50° C) above an ambient temperature of 68° F (20° C), (thus a bearing temperature of 158° F (70° C), measured on the bearing stationary outer ring or housing washer.
- Radial bearing: a constant radial load, being 5% of the basic static load rating C_0 .
- Thrust bearing: a constant axial load, being 2% of the basic static load rating C_0 .
- Open bearings with Normal clearance.

For oil lubricated bearings:

- Lubricant: mineral oil without EP-additives having a kinematic viscosity at 158° F (70° C) of: $v = 12 \text{ mm}^2/\text{s}$ (ISO VG32) for radial bearings, and $v = 24 \text{ mm}^2/\text{s}$ (ISO VG68) for thrust roller bearings
- Oil bath with the oil reaching up to the middle of the rolling element in the lowest position.

For grease lubricated bearings:

- Regular lithium soap grease with mineral base oil having a viscosity of 100 to 200 mm^2/s at 104° F (40° C) (e.g. ISO VG 150).
- Filling approximately 30% of the free space in the bearing.

The reference temperature will be reached after 10 to 20 hours running time. Under these specific conditions the reference speed for oil and grease lubrication will be equal.

Speeds above the reference speed

It is possible to operate bearings at speeds above the reference speed if the friction within the bearing can be reduced, for example by lubrication systems with small, accurately measured quantities of lubricant or when heat can be removed from the bearing by circulating oil lubrication with cooling of the oil, by cooling ribs on the housing, or by directed cooling air streams.

Any increase in speed above the reference speed without taking any of these precautions would only cause bearing temperature to rise excessively. An increase of bearing temperature means that lubricant viscosity is lowered and film formation is made more difficult, leading to even higher friction and further temperature increases. If, at the same time, the operational clearance in the bearing is reduced because of increased inner ring temperature, the final consequence would be bearing seizure.

Limiting speeds

The speed limit is determined by criteria that include: the stability and or strength of the cage, lubrication of cage guiding surfaces, centrifugal and gyratory forces acting on the rolling elements, and other speed-limiting factors. Experience gained from laboratory tests and practical applications indicates that there are maximum speeds that should not be exceeded for technical reasons or because of the very high costs involved.

Limiting Speeds shown in the tables are based on the demands of high speed running applications and are valid only for the specific design and cage design shown in the tables. It is possible to run bearings faster than the limiting speeds, but several factors must be reviewed and improved such as the running accuracy, cage material, lubrication, heat dissipation and design of the bearing. It is therefore advisable to contact SKF Applications Engineering for advice. For enclosed and open bearings using grease lubrication, additional parameters have to be considered such as lubrication of cage guiding surfaces and the shear strength of the lubricant, which is determined by the base oil and thickener.

Open ball bearings with low friction typically have Reference Speeds greater than the Limiting Speed. In these cases the permissible speed must be calculated from the operating conditions and the lower value between the permissible and Limiting speed used.

Speed ratings (RPM)

Deep groove ball bearings

6200 & 6300 series

Bearing	double sealed limiting r/min	double shielded limiting r/min	open limiting r/min	reference speed r/min
6200	17,000	28,000	34,000	56,000
6201	15,000	26,000	32,000	50,000
6202	13,000	22,000	28,000	43,000
6203	12,000	19,000	24,000	38,000
6204	10,000	17,000	20,000	32,000
6205	8,500	14,000	18,000	28,000
6206	7,500	12,000	15,000	24,000
6207	6,300	10,000	13,000	20,000
6208	5,600	9,000	11,000	18,000
6209	5,000	8,500	11,000	17,000
6210	4,800	8,000	10,000	15,000
6211	4,300	7,000	9,000	14,000
6212	4,000	6,300	8,000	13,000
6213	3,600	6,000	7,500	12,000
6214	3,400	5,600	7,000	11,000
6215	3,200	5,300	6,700	10,000
6216	3,000	4,800	6,000	9,500
6217	2,800	4,500	5,600	9,000
6218	2,600	4,300	5,300	8,500
6219	2,400	4,000	5,000	8,000
6220	2,400	3,800	4,800	7,500
6221	2,200	3,600	4,500	7,000
6222	–	3,400	4,300	6,700
6224	–	3,200	4,000	6,300
6226	–	3,000	3,600	5,600
6228	–	–	3,400	5,300
6230	–	–	3,200	5,000
6232	–	–	3,000	4,500
6234	–	–	3,800	4,300
6236	–	–	3,600	4,000
6238	–	–	3,400	3,800
6240	–	–	3,200	3,600

Warning: The new reference and limiting speeds **are not to be used** as a direct substitution for the previous oil and grease speed ratings. See page 4/5 or contact SKF Applications Engineering.

Speed Ratings (RPM)

Deep groove ball bearings
6200 & 6300 series

Bearing	double sealed limiting r/min	double shielded limiting r/min	open limiting r/min	reference speed r/min
6300	15,000	26,000	32,000	50,000
6301	14,000	22,000	28,000	45,000
6302	12,000	19,000	24,000	38,000
6303	11,000	17,000	22,000	34,000
6304	9,500	15,000	19,000	30,000
6305	7,500	13,000	16,000	24,000
6306	6,300	11,000	13,000	20,000
6307	6,000	9,500	12,000	19,000
6308	5,000	8,500	11,000	17,000
6309	4,500	7,500	9,500	15,000
6310	4,300	6,700	8,500	13,000
6311	3,800	6,300	8,000	12,000
6312	3,400	5,600	7,000	11,000
6313	3,200	5,300	6,700	10,000
6314	3,000	5,000	6,300	9,500
6315	2,800	4,500	5,600	9,000
6316	2,600	4,300	5,300	8,500
6317	2,400	4,000	5,000	8,000
6318	2,400	3,800	4,800	7,500
6319	2,200	3,600	4,500	7,000
6320	–	3,400	4,300	6,700
6321	–	3,200	4,000	6,300
6322	–	–	3,800	6,000
6324	–	–	3,400	5,600
6326	–	–	3,200	5,000
–	–	–	–	–
6328	–	–	4,300	4,800
6330	–	–	4,000	4,300
6332	–	–	3,800	4,000
6334	–	–	3,400	3,800
6336	–	–	3,200	3,600
–	–	–	–	–
6338	–	–	3,000	3,400

Note: Low-friction seals (2RZ, 2RSL) and double shielded (2Z) bearings use same speed ratings. Single enclosure (Z, RSL, RZ) and open bearings use the same speed ratings.

Speed ratings (RPM)

Cylindrical roller bearings

N, NJ, NU 200 EC series

Bearing	reference speed r/min	limiting speed r/min
202 EC	22,000	26,000
203 EC	19,000	22,000
204 EC	16,000	19,000
205 EC	14,000	16,000
206 EC	13,000	14,000
207 EC	11,000	12,000
208 EC	9,500	11,000
209 EC	9,000	9,500
210 EC	8,500	9,000
211 EC	7,500	8,000
212 EC	6,700	7,500
213 EC	6,300	6,700
214 EC	6,000	6,300
215 EC	5,600	6,000
216 EC	5,300	5,600
217 EC	4,800	5,300
218 EC	4,500	5,000
219 EC	4,300	4,800
220 EC	4,000	4,500
221 EC	3,800	4,300
222 EC	3,600	4,000
224 EC	3,400	3,600
226 EC	3,200	3,400
228 EC	2,800	3,200
230 EC	2,600	2,800
232 EC	2,400	2,600
234 EC	2,200	2,400
236 ECMA	2,200	3,200
238 ECMA	2,000	3,000
240 ECMA	1,900	2,800

Warning: The new reference and limiting speeds **are not to be used** as a direct substitution for the previous oil and grease speed ratings. See page 4/5 or contact SKF Applications Engineering.

Speed ratings (RPM)

Cylindrical roller bearings

N, NJ, NU 300 EC series

Bearing	reference speed r/min	limiting speed r/min
303 EC	15,000	20,000
304 EC	15,000	18,000
305 EC	12,000	15,000
306 EC	11,000	12,000
307 EC	9,500	11,000
308 EC	8,000	9,500
309 EC	7,500	8,500
310 EC	6,700	8,000
311 EC	6,000	7,000
312 EC	5,600	6,700
313 EC	5,300	6,000
314 EC	4,800	5,600
315 EC	4,500	5,300
316 EC	4,300	5,000
317 EC	4,000	4,800
318 EC	3,800	4,500
319 EC	3,600	4,300
320 EC	3,200	3,800
321 EC	3,200	3,800
322 EC	3,000	3,400
324 EC	2,800	3,200
326 EC	2,400	3,000
328 EC	2,400	2,800
330 EC	2,200	2,600
332 EC	2,000	2,400
334 EC	1,700	2,200
336 EC	1,600	2,200
338 EC	1,500	2,000
340 ECMA	1,400	2,400

Recommended shaft and housing diameters

Deep groove ball bearings

6200 series

Bearing	brg. bore dia. (mm)	shaft dia. (in.)		ISO toler- ance	brg. outside dia. (mm)	housing dia. (in.) (ISO tolerance H6)	
		max.	min.			max.	min.
6200	10	0.3939	0.3936	j5	30	1.1816	1.1811
6201	12	0.4726	0.4723	j5	32	1.2604	1.2598
6202	15	0.5908	0.5905	j5	35	1.3786	1.3780
6203	17	0.6695	0.6692	j5	40	1.5754	1.5748
6204	20	0.7878	0.7875	k5	47	1.8510	1.8504
6205	25	0.9847	0.9844	k5	52	2.0479	2.0472
6206	30	1.1815	1.1812	k5	62	2.4416	2.4409
6207	35	1.3785	1.3781	k5	72	2.8353	2.8346
6208	40	1.5753	1.5749	k5	80	3.1503	3.1496
6209	45	1.7722	1.7718	k5	85	3.3474	3.3465
6210	50	1.9690	1.9686	k5	90	3.5442	3.5433
6211	55	2.1660	2.1655	k5	100	3.9379	3.9370
6212	60	2.3628	2.3623	k5	110	4.3316	4.3307
6213	65	2.5597	2.5592	k5	120	4.7253	4.7244
6214	70	2.7565	2.7560	k5	125	4.9223	4.9213
6215	75	2.9534	2.9529	k5	130	5.1191	5.1181
6216	80	3.1502	3.1497	k5	140	5.5128	5.5118
6217	85	3.3472	3.3466	k5	150	5.9065	5.9055
6218	90	3.5440	3.5434	k5	160	6.3002	6.2992
6219	95	3.7409	3.7403	k5	170	6.6939	6.6929
6220	100	3.9377	3.9371	k5	180	7.0876	7.0866
6221	105	4.1350	4.1344	m5	190	7.4814	7.4803
6222	110	4.3318	4.3312	m5	200	7.8751	7.8740
6224	120	4.7255	4.7249	m5	215	8.4657	8.4646
6226	130	5.1194	5.1187	m5	230	9.0562	9.0551
6228	140	5.5131	5.5124	m5	250	9.8436	9.8425
6230	150	5.9071	5.9061	m6	270	10.6312	10.6299
6232	160	6.3008	6.2998	m6	290	11.4186	11.4173
6234	170	6.6945	6.6935	m6	310	12.2060	12.2047
6236	180	7.0882	7.0872	m6	320	12.5998	12.5984
6238	190	7.4821	7.4810	m6	340	13.3872	13.3858
6240	200	7.8758	7.8747	m6	360	14.1746	14.1732

Note: Diameters shown are based on normal loads, operating temperatures, and current industry fitting practices. See SKF Bearing Installation and Maintenance Guide (#140-710) for specific tolerance classes and corresponding fits.

Recommended shaft and housing diameters

Deep groove ball bearings

6300 series

Bearing	brg. bore dia. (mm)	shaft dia. (in.)		ISO toler- ance	brg. outside dia. (mm)	housing dia. (in.) (ISO tolerance H6)	
		max.	min.			max.	min.
6300	10	0.3939	0.3936	j5	35	1.3786	1.3780
6301	12	0.4726	0.4723	j5	37	1.4573	1.4567
6302	15	0.5908	0.5905	j5	42	1.6541	1.6535
6303	17	0.6695	0.6692	j5	47	1.8510	1.8504
6304	20	0.7878	0.7875	k5	52	2.0479	2.0472
6305	25	0.9847	0.9844	k5	62	2.4416	2.4409
6306	30	1.1815	1.1812	k5	72	2.8353	2.8346
6307	35	1.3785	1.3781	k5	80	3.1503	3.1496
6308	40	1.5753	1.5749	k5	90	3.5442	3.5433
6309	45	1.7722	1.7718	k5	100	3.9379	3.9370
6310	50	1.9690	1.9686	k5	110	4.3316	4.3307
6311	55	2.1660	2.1655	k5	120	4.7253	4.7244
6312	60	2.3628	2.3623	k5	130	5.1191	5.1181
6313	65	2.5597	2.5592	k5	140	5.5128	5.5118
6314	70	2.7565	2.7560	k5	150	5.9065	5.9055
6315	75	2.9534	2.9529	k5	160	6.3002	6.2992
6316	80	3.1502	3.1497	k5	170	6.6939	6.6929
6317	85	3.3472	3.3466	k5	180	7.0876	7.0866
6318	90	3.5440	3.5434	k5	190	7.4814	7.4803
6319	95	3.7409	3.7403	k5	200	7.8751	7.8740
6320	100	3.9377	3.9371	k5	215	8.4657	8.4646
6321	105	4.1350	4.1344	m5	225	8.8594	8.8583
6322	110	4.3318	4.3312	m5	240	9.4499	9.4488
6324	120	4.7255	4.7249	m5	260	10.2375	10.2362
6326	130	5.1194	5.1187	m5	280	11.0249	11.0236
6328	140	5.5131	5.5124	m5	300	11.8123	11.8110
6330	150	5.9071	5.9061	m6	320	12.5998	12.5984
6332	160	6.3008	6.2998	m6	340	13.3872	13.3858
6334	170	6.6945	6.6935	m6	360	14.1746	14.1732
6336	180	7.0882	7.0872	m6	380	14.9620	14.9606
6338	190	7.4821	7.4810	m6	400	15.7494	15.7480
6340	200	7.8758	7.8747	m6	420	16.5370	16.5354

Note: Diameters shown are based on normal loads, operating temperatures, and current industry fitting practices. See SKF Bearing Installation and Maintenance Guide (#140-710) for specific tolerance classes and corresponding fits.

Recommended shaft and housing diameters

Cylindrical roller bearings

N, NJ, NU 200 EC series

Bearing	brg. bore dia. (mm)	shaft dia. (in.)		ISO toler- ance	brg. outside dia. (mm)	housing dia. (in.) (ISO tolerance H6)	
		max.	min.			max.	min.
202	15	0.5911	0.5906	k6	35	1.3786	1.3780
203	17	0.6698	0.6693	k6	40	1.5754	1.5748
204	20	0.7880	0.7875	k6	47	1.8510	1.8504
205	25	0.9849	0.9844	k6	52	2.0479	2.0472
206	30	1.1817	1.1812	k6	62	2.4416	2.4409
207	35	1.3788	1.3784	m5	72	2.8353	2.8346
208	40	1.5756	1.5752	m5	80	3.1503	3.1496
209	45	1.7725	1.7721	m5	85	3.3474	3.3465
210	50	1.9693	1.9689	m5	90	3.5442	3.5433
211	55	2.1667	2.1662	n5	100	3.9379	3.9370
212	60	2.3635	2.3630	n5	110	4.3316	4.3307
213	65	2.5604	2.5599	n5	120	4.7253	4.7244
214	70	2.7574	2.7567	n6	125	4.9223	4.9213
215	75	2.9543	2.9536	n6	130	5.1191	5.1181
216	80	3.1511	3.1504	n6	140	5.5128	5.5118
217	85	3.3483	3.3474	n6	150	5.9065	5.9055
218	90	3.5451	3.5442	n6	160	6.3002	6.2992
219	95	3.7420	3.7411	n6	170	6.6939	6.6929
220	100	3.9388	3.9379	n6	180	7.0876	7.0866
221	105	4.1362	4.1354	p6	190	7.4814	7.4803
222	110	4.3330	4.3322	p6	200	7.8751	7.8740
224	120	4.7267	4.7259	p6	215	8.4657	8.4646
226	130	5.1208	5.1198	p6	230	9.0562	9.0551
228	140	5.5145	5.5135	p6	250	9.8436	9.8425
230	150	5.9082	5.9072	p6	270	10.6312	10.6299
232	160	6.3019	6.3009	p6	290	11.4186	11.4173
234	170	6.6956	6.6946	p6	310	12.2060	12.2047
236	180	7.0893	7.0883	p6	320	12.5998	12.5984
238	190	7.4834	7.4823	p6	340	13.3872	13.3858
240	200	7.8771	7.8760	p6	360	14.1746	14.1732

Note: *Diameters shown are based on normal loads, operating temperatures, and current industry fitting practices. See SKF Bearing Installation and Maintenance Guide (#140-710) for specific tolerance classes and corresponding fits.*

Recommended shaft and housing diameters

Cylindrical roller bearings

N, NJ, NU 300 EC series

Bearing	brg. bore dia. (mm)	shaft dia. (in.)		ISO toler- ance	brg. outside dia. (mm)	housing dia. (in.) (ISO tolerance H6)	
		max.	min.			max.	min.
303	17	0.6698	0.6693	k6	47	1.8510	1.8504
304	20	0.7880	0.7875	k6	52	2.0479	2.0472
305	25	0.9849	0.9844	k6	62	2.4416	2.4409
306	30	1.1817	1.1812	k6	72	2.8353	2.8346
307	35	1.3788	1.3784	m5	80	3.1503	3.1496
308	40	1.5756	1.5752	m5	90	3.5442	3.5433
309	45	1.7725	1.7721	m5	100	3.9379	3.9370
310	50	1.9693	1.9689	m5	110	4.3316	4.3307
311	55	2.1667	2.1662	n5	120	4.7253	4.7244
312	60	2.3635	2.3630	n5	130	5.1191	5.1181
313	65	2.5604	2.5599	n5	140	5.5128	5.5118
314	70	2.7574	2.7567	n6	150	5.9065	5.9055
315	75	2.9543	2.9536	n6	160	6.3002	6.2992
316	80	3.1511	3.1504	n6	170	6.6939	6.6929
317	85	3.3483	3.3474	n6	180	7.0876	7.0866
318	90	3.5451	3.5442	n6	190	7.4814	7.4803
319	95	3.7420	3.7411	n6	200	7.8751	7.8740
320	100	3.9388	3.9379	n6	215	8.4657	8.4646
321	105	4.1362	4.1354	p6	225	8.8594	8.8583
322	110	4.3330	4.3322	p6	240	9.4499	9.4488
324	120	4.7267	4.7259	p6	260	10.2375	10.2362
326	130	5.1208	5.1198	p6	280	11.0249	11.0236
328	140	5.5145	5.5135	p6	300	11.8123	11.8110
330	150	5.9082	5.9072	p6	320	12.5998	12.5984
332	160	6.3019	6.3009	p6	340	13.3872	13.3858
334	170	6.6956	6.6946	p6	360	14.1746	14.1732
336	180	7.0893	7.0883	p6	380	14.9620	14.9606
338	190	7.4834	7.4823	p6	400	15.7494	15.7480
340	200	7.8771	7.8760	p6	420	16.5370	16.5354

Note: *Diameters shown are based on normal loads, operating temperatures, and current industry fitting practices. See SKF Bearing Installation and Maintenance Guide (#140-710) for specific tolerance classes and corresponding fits.*

Shoulder dimensions for shafts and housings

Deep groove ball bearings

6200 series

Bearing	d mm	shaft shoulder		D mm	housing shoulder		shaft & housing corner
		d _a min. in	d _a max. in		D _a max. in	D _a min in	max. in
6200	10	0.5591	0.5906	30	1.0157	0.9757	0.0236
6201	12	0.6378	0.6496	32	1.0945	1.0545	0.0236
6202	15	0.7559	0.7638	35	1.2136	1.1736	0.0236
6203	17	0.8346	0.8661	40	1.4094	1.3694	0.0236
6204	20	1.0079	1.0236	47	1.6299	1.5899	0.0394
6205	25	1.2047	1.2402	52	1.8268	1.7868	0.0394
6206	30	1.4016	1.4216	62	2.2205	2.1805	0.0394
6207	35	1.6535	1.6735	72	2.5591	2.5191	0.0394
6208	40	1.8504	1.8704	80	2.8740	2.8340	0.0394
6209	45	2.0470	2.0670	85	3.0709	3.0309	0.0394
6210	50	2.2441	2.2641	90	3.2677	3.2277	0.0394
6211	55	2.5197	2.5397	100	3.5827	3.5427	0.0591
6212	60	2.7165	2.7365	110	3.9764	3.9364	0.0591
6213	65	2.9134	2.9334	120	4.3701	4.3301	0.0591
6214	70	3.1102	3.1302	125	4.5669	4.5269	0.0591
6215	75	3.0710	3.0910	130	4.7638	4.7238	0.0591
6216	80	3.5827	3.6027	140	5.0787	5.0387	0.0787
6217	85	3.7795	3.7995	150	5.4724	5.4324	0.0787
6218	90	3.9764	4.1339	160	5.8661	5.8261	0.0787
6219	95	4.2126	4.3701	170	6.2205	6.1805	0.0787
6220	100	4.4094	4.6063	180	6.6142	6.5342	0.0787
6221	105	4.6063	4.8819	190	7.0079	6.9279	0.0787
6222	110	4.8031	4.8431	200	7.4016	7.3216	0.0787
6224	120	5.1969	5.2369	215	7.9921	7.9121	0.0787
6226	130	5.6693	5.7093	230	8.5039	8.4239	0.0984
6228	140	6.0630	6.1030	250	9.2913	9.2113	0.0984
6230	150	6.4567	6.4967	270	10.0787	9.9987	0.0984
6232	160	6.8504	6.8904	290	10.8661	10.7861	0.0984
6234	170	7.3622	7.4022	310	11.5354	11.4554	0.1181
6236	180	7.7559	7.7959	320	11.9291	11.8491	0.1181
6238	190	8.1496	8.1896	340	12.7165	12.6365	0.1181
6240	200	8.5433	8.5833	360	13.5039	13.4239	0.1181

Shoulder dimensions for shafts and housings

Deep groove ball bearings

6300 series

Bearing	d mm	shaft shoulder		D mm	housing shoulder		shaft & housing corner
		d _a min. in	d _a max. in		D _a max. in	D _a min in	max. in
6300	10	0.5591	0.6102	35	1.2126	1.1726	0.0236
6301	12	0.6929	0.7129	37	1.2362	1.1962	0.0394
6302	15	0.8110	0.8268	42	1.4331	1.3931	0.0394
6303	17	0.8898	0.9252	47	1.6299	1.5899	0.0394
6304	20	1.0630	1.0830	52	1.7717	1.7317	0.0394
6305	25	1.2598	1.2798	62	2.1654	2.1254	0.0394
6306	30	1.4567	1.4767	72	2.5591	2.5191	0.0394
6307	35	1.7323	1.7523	80	2.7953	2.7553	0.0591
6308	40	1.9291	1.9491	90	3.1890	3.1490	0.0591
6309	45	2.1260	2.1460	100	3.5827	3.5427	0.0591
6310	50	2.3228	2.3428	110	3.9764	3.9364	0.0787
6311	55	2.5984	2.6184	120	4.2913	4.2513	0.0787
6312	60	2.8346	2.8546	130	4.6457	4.6057	0.0787
6313	65	3.0315	3.0515	140	5.0394	4.9994	0.0787
6314	70	3.2283	3.2483	150	5.4331	5.3931	0.0787
6315	75	3.4252	3.4452	160	5.8268	5.7868	0.0787
6316	80	3.6220	3.6420	170	6.2205	6.1805	0.0787
6317	85	3.8976	3.9176	180	6.5354	6.4554	0.0984
6318	90	4.0945	4.1145	190	6.9291	6.8491	0.0984
6319	95	4.2913	4.7244	200	7.3228	7.2428	0.0984
6320	100	4.4882	4.5282	215	7.9134	7.8334	0.0984
6321	105	4.6850	4.7250	225	8.3071	8.2271	0.0984
6322	110	4.8819	4.9219	240	8.8976	8.8176	0.0984
6324	120	5.2756	5.3156	260	9.6850	9.6050	0.0984
6326	130	5.7874	5.8274	280	10.3543	10.2743	0.1181
6328	140	6.1811	6.2211	300	11.1417	11.0617	0.1181
6330	150	6.5748	6.6148	320	11.9291	11.8491	0.1181
6332	160	6.9685	7.0085	340	12.7165	12.6365	0.1181
6334	170	7.3622	7.4022	360	13.5039	13.4239	0.1181
6336	180	7.7559	7.7959	380	14.2913	14.2113	0.1181
6338	190	8.2677	8.3077	400	14.9606	14.8806	0.1575

Minimum radial load requirements

Cylindrical roller bearings

200 EC series

Bearing	minimum radial load required @		
	900 rpm	1800 rpm	3600 rpm
202	13 lb.	13 lb.	13 lb.
203	18	18	18
204	23	25	27
205	32	32	36
206	45	47	52
207	61	66	70
208	77	81	93
209	93	97	108
210	106	113	128
211	131	142	160
212	160	174	198
213	189	207	239
214	212	232	270
215	237	259	304
216	273	302	356
217	315	349	419
218	358	401	486
219	405	455	554
220	457	515	634
221	511	581	718
222	567	648	810
224	668	769	969
226	778	902	
228	936	1110	
230	1098	1304	
232	1282	1536	
234	1457	1750	
236	1610	1954	
238	1849	2271	
240	2087	2586	

Note: Minimum radial loads are necessary for satisfactory rolling bearing operation. This is particularly true for roller bearings running at high speeds, where inertia forces and friction from the lubricant may cause damaging sliding—rather than rolling—movements between the rollers and raceways.

Minimum radial load requirements

Cylindrical roller bearings

300 EC series

Bearing	minimum radial load required @		
	900 rpm	1800 rpm	3600 rpm
303	22 lb.	22 lb.	25 lb.
304	27	30	32
305	41	43	45
306	57	59	66
307	72	77	84
308	93	99	111
309	115	124	140
310	142	153	176
311	171	187	216
312	203	223	261
313	237	261	308
314	277	306	367
315	317	353	430
316	360	405	493
317	410	461	569
318	459	522	648
319	513	587	733
320	596	691	880
321	655	758	965
322	745	868	
324	889	1044	
326	1064	1275	
328	1226	1469	
330	1425	1726	
332	1645	2024	
334	1923	2429	
336	2181	2766	
338	2467	3170	
340	2788	3620	

Note: Minimum radial loads are necessary for satisfactory rolling bearing operation. This is particularly true for roller bearings running at high speeds, where inertia forces and friction from the lubricant may cause damaging sliding—rather than rolling—movements between the rollers and raceways.

Grease relube recommendation

Deep groove ball bearings

6200 series

Bearing	quantity	interval @		
		900 rpm	1800 rpm	3600 rpm
6200	.04 oz.	25,900 hr	23,400 hr	19,100 hr
6201	.07 oz.	25,600	22,900	18,400
6202	.07 oz.	25,200	22,200	17,300
6203	.07 oz.	24,800	21,500	16,100
6204	.10 oz.	24,200	20,400	14,500
6205	.12 oz.	23,600	19,400	13,100
6206	.15 oz.	22,700	18,000	11,300
6207	.19 oz.	21,900	16,700	9,700
6208	.23 oz.	21,100	15,600	8,510
6209	.25 oz.	20,600	14,800	7,690
6210	.28 oz.	20,100	14,100	6,950
6211	.33 oz.	19,400	13,100	5,970
6212	.38 oz.	18,600	12,100	5,130
6213	.43 oz.	17,900	11,200	4,410
6214	.47 oz.	17,500	10,700	3,980
6215	.50 oz.	17,100	10,200	3,600
6216	.55 oz.	16,400	9,400	3,090
6217	.65 oz.	15,800	8,730	2,660
6218	.74 oz.	15,200	8,090	2,280
6219	.84 oz.	14,700	7,500	1,960
6220	.95 oz.	14,100	6,950	

Note: The relubrication intervals shown are based on a good quality lithium based grease at a maximum temperature of 160° F, and a $C/p=15$. Reduce the interval by half for each 27° F above 160° F, or for vertical applications. (High temperature greases, like polyurea, can operate for longer periods of time than those listed above.) Lubricate more often in applications where there is a risk of heavy solid and chemical contamination. Consult manufacturer or SKF Application Engineering for details.

LGHP 2 ball and roller bearing grease

LGHP 2 is a polyurea-based grease designed for use in electric motors. Unlike many polyurea-based greases, which are inherently noisy during operation, LGHP 2 meets strict SKF noise requirements. Each batch is blended and selected for consistency and adherence to quietness standards. The grease is also recommended for applications where long life is required.

With LGHP 2, users can often avoid compatibility problems when relubricating bearings. LGHP 2 is the factory fill grease used in SKF bearings under the designation GXN.

Grease relube recommendation

Deep groove ball bearings

6300 series

Bearing	quantity	interval @		
		900 rpm	1800 rpm	3600 rpm
6300	.07 oz.	25,600 hr	22,800 hr	18,200 hr
6301	.07 oz.	25,300	22,400	17,400
6302	.11 oz.	24,800	21,500	16,100
6303	.11 oz.	24,400	20,700	15,000
6304	.12 oz.	23,900	19,900	13,800
6305	.16 oz.	23,000	18,400	11,900
6306	.21 oz.	22,100	17,100	10,200
6307	.26 oz.	21,400	16,000	8,950
6308	.32 oz.	20,600	14,800	7,690
6309	.39 oz.	19,900	13,800	6,610
6310	.46 oz.	19,100	12,800	5,680
6311	.54 oz.	18,400	11,800	4,880
6312	.63 oz.	17,700	11,000	4,190
6313	.72 oz.	17,100	10,200	3,600
6314	.81 oz.	16,400	9,410	3,090
6315	.92 oz.	15,800	8,730	2,660
6316	1.03 oz.	15,200	8,090	2,280
6317	1.14 oz.	14,700	7,500	1,960
6318	1.26 oz.	14,100	6,950	
6319	1.40 oz.	13,600	6,440	
6320	1.57 oz.	12,900	5,820	

Note: The relubrication intervals shown are based on a good quality lithium based grease at a maximum temperature of 160° F, and a $C_p=15$. Reduce the interval by half for each 27° F above 160° F, or for vertical applications. (High temperature greases, like polyurea, can operate for longer periods of time than those listed above.) Lubricate more often in applications where there is a risk of heavy solid and chemical contamination. Consult manufacturer or SKF Application Engineering for details.

Grease relube recommendation

Cylindrical roller bearings

N, NJ, NU 200 EC series

Bearing	quantity	interval @		
		900 rpm	1800 rpm	3600 rpm
202	.07 oz.	23,700 hr	19,600 hr	13,400 hr
203	.07 oz.	23,100	18,600	12,100
204	.10 oz.	22,200	17,200	10,400
205	.12 oz.	21,400	16,000	8,900
206	.15 oz.	20,200	14,300	7,090
207	.19 oz.	19,100	12,700	5,650
208	.23 oz.	18,200	11,500	4,640
209	.25 oz.	17,500	10,700	3,980
210	.28 oz.	16,800	9,900	3,420
211	.33 oz.	15,900	8,840	2,730
212	.38 oz.	15,000	7,890	2,170
213	.43 oz.	14,200	7,040	1,730
214	.47 oz.	13,700	6,520	1,490
215	.50 oz.	13,200	6,050	1,280
216	.55 oz.	12,400	5,400	1,020
217	.65 oz.	11,700	4,820	810
218	.74 oz.	11,100	4,300	640
219	.84 oz.	10,500	3,840	
220	.95 oz.	9,900	3,420	

Note: The relubrication intervals shown are based on a good quality lithium based grease at a maximum temperature of 160° F, and a $C/P=15$. Reduce the interval by half for each 27° F above 160° F, or for vertical applications. (High temperature greases, can operate for longer periods of time than those listed above.) Lubricate more often in applications where there is a risk of heavy solid and chemical contamination. Consult manufacturer or SKF Application Engineering for details.

Grease relube recommendation

Cylindrical roller bearings

N, NJ, NU 300 EC series

Bearing	quantity	interval @		
		900 rpm	1800 rpm	3600 rpm
303	.07 oz.	22,500 hr	17,600 hr	10,800 hr
304	.12 oz.	21,800	16,600	9,610
305	.16 oz.	20,600	14,800	7,650
306	.21 oz.	19,500	13,200	6,090
307	.26 oz.	18,500	12,000	5,000
308	.32 oz.	17,500	10,700	3,980
309	.39 oz.	16,500	9,530	3,170
310	.46 oz.	15,600	8,510	2,530
311	.54 oz.	14,700	7,590	2,010
312	.63 oz.	13,900	6,780	1,600
313	.72 oz.	13,200	6,050	1,280
314	.81 oz.	12,400	5,400	1,020
315	.92 oz.	11,700	4,820	810
316	1.03 oz.	11,100	4,300	640
317	1.14 oz.	10,500	3,840	
318	1.26 oz.	9,900	3,420	
319	1.40 oz.	9,350	3,060	
320	1.57 oz.	8,670	2,630	

Note: The relubrication intervals shown are based on a good quality lithium based grease at a maximum temperature of 160° F, and a $C_p=15$. Reduce the interval by half for each 27° F above 160° F, or for vertical applications. (High temperature greases, can operate for longer periods of time than those listed above.) Lubricate more often in applications where there is a risk of heavy solid and chemical contamination. Consult manufacturer or SKF Application Engineering for details.

SKF vibration data @ 1 rpm inner ring rotation

Deep groove ball bearings

6200 series

Bearing	inner ring defect freq. (Hz)	outer ring defect freq. (Hz)	cage train freq. (Hz)	ball defect freq. (Hz)
6200	0.083	0.051	0.006	0.066
6201	0.074	0.042	0.006	0.057
6202	0.083	0.051	0.006	0.066
6203	0.082	0.051	0.006	0.066
6204	0.082	0.051	0.006	0.066
6205	0.090	0.060	0.007	0.079
6206	0.091	0.059	0.007	0.077
6207	0.091	0.059	0.007	0.077
6208	0.090	0.060	0.007	0.078
6209	0.099	0.068	0.007	0.085
6210	0.098	0.068	0.007	0.089
6211	0.099	0.068	0.007	0.087
6212	0.099	0.068	0.007	0.086
6213	0.107	0.076	0.007	0.095
6214	0.107	0.076	0.007	0.095
6215	0.107	0.076	0.007	0.095
6216	0.116	0.084	0.007	0.104
6216*	0.098	0.069	0.007	0.093
6217	0.107	0.076	0.007	0.096
6217*	0.098	0.069	0.007	0.092
6218	0.107	0.076	0.007	0.095
6219	0.098	0.068	0.007	0.090
6220	0.098	0.068	0.007	0.089
6221	0.099	0.068	0.007	0.088
6222	0.099	0.068	0.007	0.087
6224	0.089	0.061	0.007	0.090
6226	0.088	0.062	0.007	0.092
6228	0.097	0.070	0.007	0.100
6230	0.106	0.078	0.007	0.108
6232	0.114	0.086	0.007	0.116

*Old design, no longer produced

SKF vibration data @ 1 rpm inner ring rotation

Deep groove ball bearings

6300 series

Bearing	inner ring defect freq. (Hz)	outer ring defect freq. (Hz)	cage train freq. (Hz)	ball defect freq. (Hz)
6300	0.066	0.034	0.006	0.046
6301	0.066	0.034	0.006	0.046
6302	0.074	0.042	0.006	0.056
6303	0.074	0.042	0.006	0.057
6304	0.074	0.043	0.006	0.059
6305	0.074	0.043	0.006	0.059
6306	0.082	0.051	0.006	0.067
6307	0.082	0.051	0.006	0.067
6308	0.082	0.051	0.006	0.068
6309	0.083	0.051	0.006	0.065
6310	0.083	0.051	0.006	0.066
6311	0.082	0.051	0.006	0.067
6312	0.082	0.051	0.006	0.067
6313	0.082	0.051	0.006	0.067
6314	0.082	0.051	0.006	0.068
6314*	0.082	0.051	0.006	0.068
6315	0.082	0.051	0.006	0.069
6316	0.082	0.051	0.006	0.069
6317	0.082	0.051	0.006	0.069
6318	0.082	0.052	0.006	0.070
6319	0.082	0.052	0.006	0.070
6320	0.082	0.051	0.006	0.068
6321	0.082	0.051	0.006	0.068
6322	0.082	0.051	0.006	0.067
6324	0.081	0.052	0.007	0.073
6326	0.081	0.052	0.007	0.073
6328	0.081	0.052	0.007	0.073
6330	0.090	0.060	0.007	0.079

*Old design, no longer produced

SKF vibration data @ 1 rpm inner ring rotation

Cylindrical roller bearings

N, NJ, NU 200 EC series

Bearing	inner ring defect freq. (Hz)	outer ring defect freq. (Hz)	cage train freq. (Hz)	roller defect freq. (Hz)
202	0.112	0.071	0.006	0.071
203	0.112	0.071	0.006	0.070
204	0.112	0.071	0.006	0.072
205	0.129	0.088	0.007	0.083
206	0.129	0.087	0.007	0.083
207	0.138	0.095	0.007	0.087
208	0.138	0.095	0.007	0.089
209	0.146	0.104	0.007	0.096
210	0.154	0.113	0.007	0.104
211	0.163	0.120	0.007	0.106
212	0.155	0.112	0.007	0.100
213	0.155	0.112	0.007	0.101
214	0.163	0.120	0.007	0.107
215	0.172	0.128	0.007	0.113
216	0.172	0.128	0.007	0.114
217	0.163	0.120	0.007	0.107
218	0.163	0.120	0.007	0.108
219	0.164	0.119	0.007	0.103
220	0.164	0.120	0.007	0.104
221	0.155	0.112	0.007	0.101
222	0.163	0.120	0.007	0.106
224	0.163	0.120	0.007	0.106
226	0.164	0.120	0.007	0.105
228	0.181	0.136	0.007	0.115
230	0.181	0.136	0.007	0.115
232	0.181	0.136	0.007	0.116

SKF vibration data @ 1 rpm inner ring rotation

Cylindrical roller bearings

N, NJ, NU 300 EC series

Bearing	inner ring defect freq. (Hz)	outer ring defect freq. (Hz)	cage train freq. (Hz)	roller defect freq. (Hz)
303	0.104	0.063	0.006	0.063
304	0.104	0.063	0.006	0.063
305	0.112	0.071	0.006	0.070
306	0.121	0.079	0.007	0.074
307	0.121	0.079	0.007	0.077
308	0.121	0.079	0.007	0.075
309	0.130	0.086	0.007	0.078
310	0.130	0.087	0.007	0.081
311	0.130	0.086	0.007	0.079
312	0.130	0.087	0.007	0.081
313	0.130	0.096	0.007	0.079
314	0.130	0.087	0.007	0.081
315	0.130	0.086	0.007	0.079
316	0.130	0.087	0.007	0.081
317	0.139	0.094	0.007	0.083
318	0.130	0.087	0.007	0.081
319	0.139	0.095	0.007	0.086
320	0.130	0.087	0.007	0.080
321	0.130	0.096	0.007	0.078
322	0.139	0.094	0.007	0.084
324	0.130	0.087	0.007	0.081
326	0.139	0.094	0.007	0.083
328	0.139	0.095	0.007	0.085
330	0.139	0.095	0.007	0.085
332	0.139	0.094	0.007	0.084

ABMA→SKF

Product number comparison

90	BC	03	J	PP	N	3	0	X	
1	2	3	4	5	6	7	8	9	10

6	3	18	2Z	N			C3		GJN
2	3	1	5	6	4	8	7	10	9

symbols		
ABMA	SKF	description
1. Bore diameter		
90	XX18	ABMA/5 = SKF exc. 17 = XX03 15 = XX02 12 = XX01 10 = XX00
2. Bearing type		
BC BL BN BA BT	6XXX XXX 7XXX CD 7XXX CC 7XXX ACD 7XXX B	Conrad maximum capacity angular contact (15°) angular contact (12°) angular contact (25°) angular contact (40°)
3. Dimension series		
00 02 03 04	X0XX X2XX X3XX X4XX	extra light light medium heavy
4. Cage type		
X J Y, K M	- J Y M	any type pressed steel pressed brass machined brass
5. Seals/shields or duplex mounting		
X P E RR UU TT	- Z RS,RS1,RS1H DB DF DT	character separator (PP ' 2Z, two shields) (EE ' 2RS, two seals) duplex back-to-back duplex face-to-face duplex tandem

ABMA→SKF

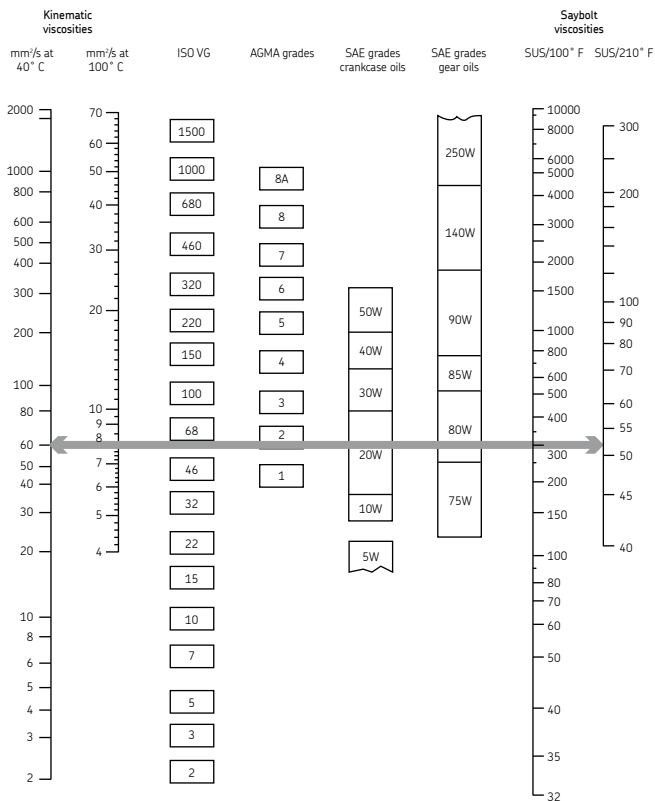
Product number comparison

90	BC	03	J	PP	N	3	0	X	
1	2	3	4	5	6	7	8	9	10

6	3	18	2Z	N			C3		G/JN
2	3	1	5	6	4	8	7	10	9

symbols		
ABMA	SKF	description
6. Snap ring and groove		
N	N	groove without ring
A	NB	groove without ring on same side as seal/shield
G	NR	groove with ring
C	NBR	groove with ring on same side as seal/shield
7. Radial clearance/preload		
0	-	normal clearance
1	C1	tighter than C2
2	C2	tighter than normal
3	C3	looser than normal
4	C4	looser than C3
5	C5	looser than C4
7	GA	light preload
8	GB	medium preload
9	GC	heavy preload
8. Tolerance class		
0	-	normal, ABEC1, ISO P7
6	P6	ABEC 3, ISO P6
5	P5	ABEC 5, ISO P5
4	P4	ABEC 7, ISO P4
2	P9A	ABEC 9
9. Lubricant		
X	-	any slush or grease
A	-	refer to manufacturer
10. Special features		
X26		(consult SKF Engineering)
X27	S0	heat stabilized to 150° C
X28	S1	heat stabilized to 200° C

Comparative Viscosity Classifications

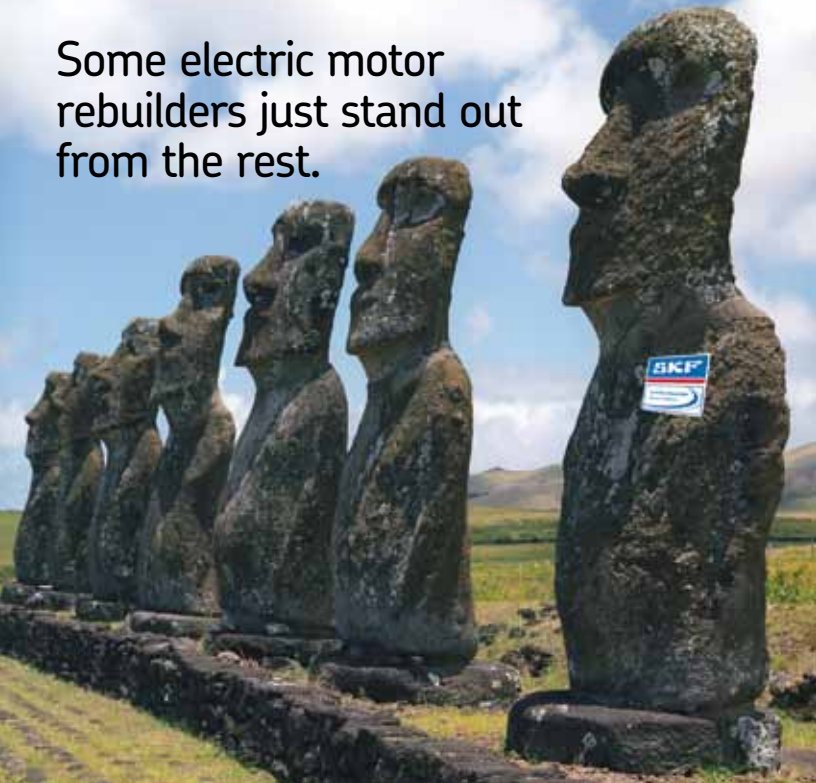


Viscosities based on 95 VI single-grade oils.
 ISO grades are specified at 40° C.
 AGMA grades are specified at 100° F.
 SAE 75W, 80W, 85W, and 5 and 10W
 specified at low temperature (below -17° F = 0° C).
 Equivalent viscosities for 100° F and 210° F are shown.
 SAE 90 to 250 and 20 to 50 specified at 210° F (100° C).

Comparison of various viscosity classification methods

NOTE: ISO mineral lubricants are recommended over SAE and AGMA lubricants for centrifugal pump applications.

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