POWERPACK

X force

ABEG®

eXtreme series

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ABEG
Advanced Bearing Expert Group

ABEG® Xforce –
NO STRESS UNDER HEAVY LOADS

A long service life, high strength, guaranteed safety, dependable sealing technology, favourable price and short delivery times – the ABEG® Xforce series bundles all of these vital specifications for bearings used in heavy duty applications. These stringent criteria were satisfied by modifying the proven bearing technology with special seals for tough environmental conditions and special greasing with extreme pressure (EP) additives. Service life and comparison tests with selected types reveal that bearings with Xforce specifications triple the service lives compared to the premium reference class with conventional standard greasing.

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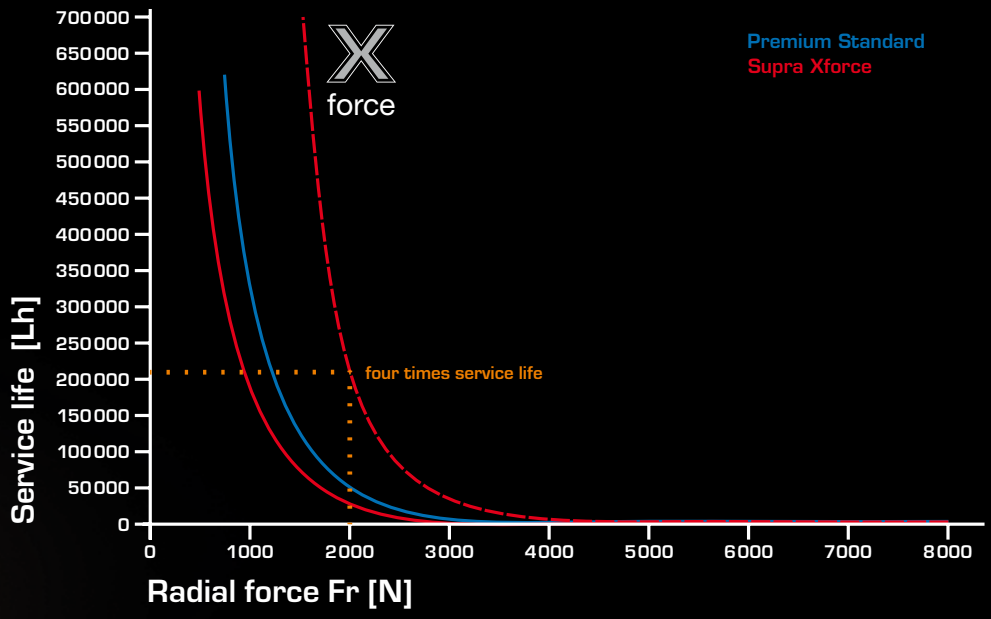
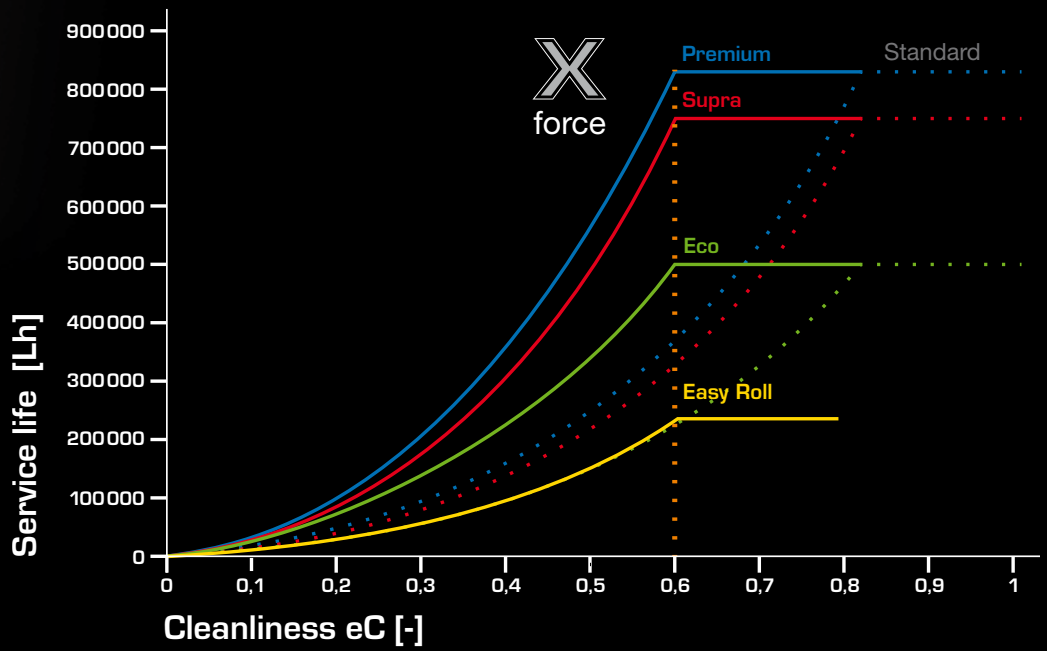
The Lubricant Makes the Difference

Conventional grease is only good enough for standard performance; although solid lubricants produce better greasing results, they are very costly. However, EP (extreme pressure) additives on the other hand boost performance considerably in an economic way. Quadrupling the service lives is quickly and economically realisable.



Optimal Protection

Tough conditions require good seals. Bearings of the Xforce series are equipped with double-lip seals running in grooves. They ensure outstanding seal performance and reliably prevent penetration of medium-sized to large dirt particles.



Load Rating and Loads

In addition to practical service life tests on the performance test station, the increase in performance can also be demonstrated by the extended service life calculation pursuant to DIN ISO 281. The nominal service life calculation is unsuitable because it always calculates false and excessively high service life values under extreme conditions. A complete lubrication with standard grease (effectively separating the metallic surfaces between balls and the bearing raceway) cannot be successfully achieved at low rpm in particular. The reason for this is that the viscosity ratio is too low. Design engineers can work this out with the following calculation principles. However, below 10 min^{-1}, the calculation principles of the statistical service life calculations have to be used instead. In this case, please contact our Applications Engineering department.

Static Load Rating C_{stat}

The static load rating C_{stat} is a purely radial bearing loading (or purely axial in case of axial bearings), which causes a permanent deformation of 0.01% of the bearing diameter at the mostly stressed point of contact between balls and raceway, while bearings are static.

Dynamic Load Rating C_{dyn}

The dynamic load rating C_{dyn} states the bearing load arising from a nominal service life of one million revolutions pursuant to the ISO definition. It is determined by the fatigue behaviour of the bearing material. The service life of a bearing is defined as the time it takes for fatigue symptoms to appear. It depends on load, operating conditions and the statistical occurrence of damage. If local stress on parts of material impacted by balls continually exceeds acceptable stress, damage will occur, which leads to failure.

Dynamic Equivalent Load P

The dynamic equivalent load P is calculated from the radial load F_r and the axial load F_a of the bearing according to the following expression:

$$P = X * F_r + Y * F_a$$

X and Y are determined pursuant to DIN ISO 281 Supplementary Sheet 2.

Service Life Calculation

Nominal service life L_{10}

$$L_{10} = (C_{dyn} / P)^p \text{ (in } 10^6 \text{ revolutions)}$$

p = bearing exponent (in case of deep groove ball bearings: p = 3)

Nominal service life L_h

$$L_{10h} = (16.666 / n) * (C_{dyn} / P)^p \text{ (in hours h)}$$

n = number of revolutions (RPM)

Use our ABEG® Quickfinder *professional* software solution for carrying out software-supported calculations. This takes variable RPM into consideration, fluctuating loads and temperatures, as well as more than 350 different types of grease and oil. Please contact our distribution staff.

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Calculations for the eXtreme Series

Extended service life calculations:

Under ideal operating conditions, calculating the nominal service life is adequate for dimensioning a conventional bearing. However, when bearings are used in high or low temperature applications for instance, it is necessary to use the extended service life calculation. This modifies the nominal service life of a bearing by using additional coefficients.

$$L_{nmh} = a_1 \times a_{ISO} \times L_{10h}$$

$$a_{ISO} = f\,(e_c \times C_u / P, \kappa)$$

L_{nmh} = Extended modified service life in hours
a_1 = Factor for failure probability (cf. Table 1)
a_{ISO} = Factor for operating conditions (cf. calculation)
L_{10h} = Nominal service life in hours

e_c = Contamination coefficient (cf. Table 2)
C_u = Fatigue load limit (cf. bearing type table)
κ = Viscosity ratio (cf. diagrams 1, 2 and 3)

Failure probability in %	10	5	4	3	2	1
Failure runtime	L_{10}	L_5	L_4	L_3	L_2	L_1
Factor a_1	1,00	0,62	0,53	0,44	0,33	0,21

Table 1

Degree of contamination		Coefficient e_c	
		$d_m \leq 100$ mm	$d_m \geq 100$ mm
Very clean	Sealed and greased bearings, circulating oil lubrication with ultrafine filtering of returning oil.	0,8 – 0,6	0,9 – 0,8
Normal cleanliness	Greased bearings with cover discs, oil bath or oil splash lubrication from the oil sump.	0,6 – 0,5	0,8 – 0,6
Typical contamination	Bearing contaminated with abrasion particles from other machine parts.	0,3 – 0,1	0,4 – 0,2

Table 2

d_m: average bearing diameter

Operating Viscosity ν

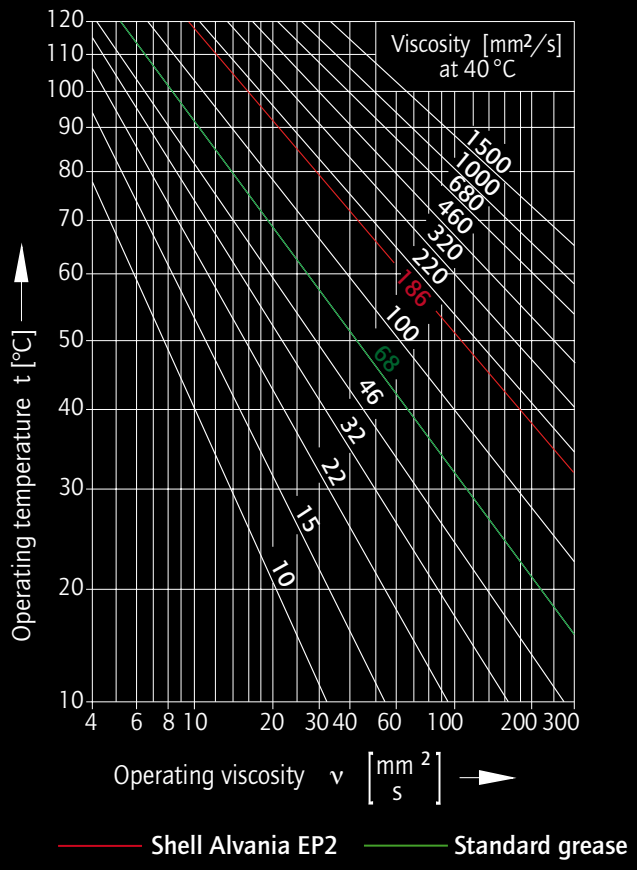

Diagram 1

Reference Viscosity ν_1

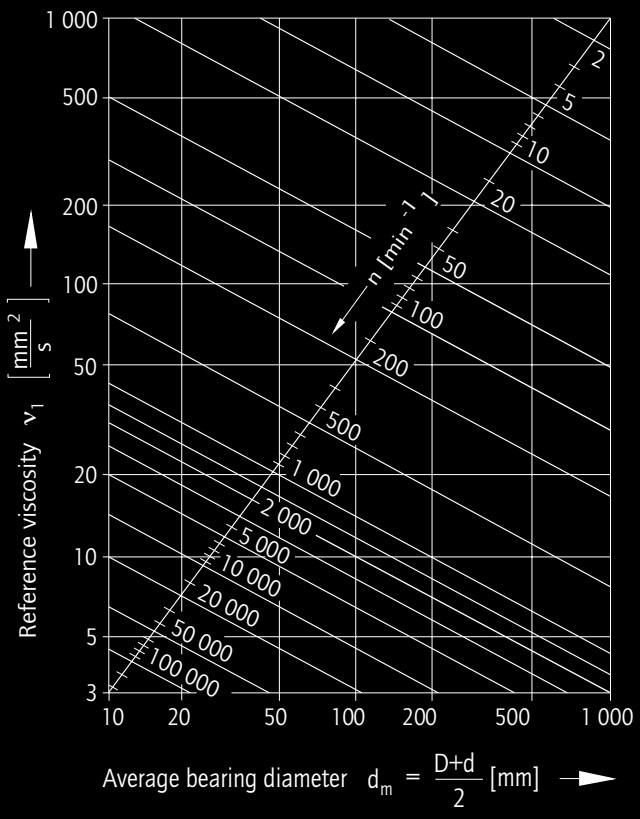

Diagram 2

Grease type	Thickener	Base oil	Viscosity [40 °C in mm/s]	Price
Shell Alvania EP2*	Lithium soap	Mineral oil	186	+
Klüberlub BE 41-542	Lithium complex soap	Mineral oil	540	0
Klüberlub BE 41-1501	Lithium complex soap	Mineral oil	1.500	–

*Standard

– less suitable

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Service Life Coefficient a_{iso}

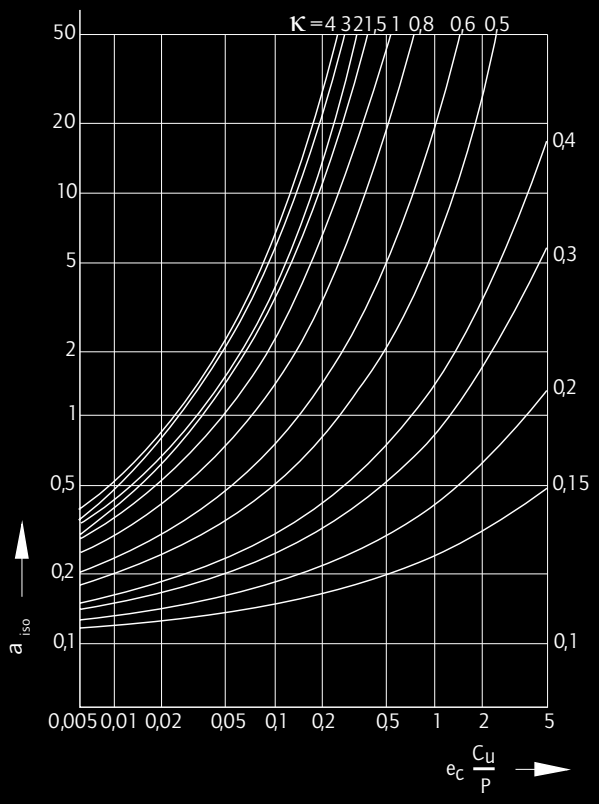

Diagram 3

Viscosity Ratio κ

The viscosity ratio κ indicates to what extent adequate lubrication is provided by the selected oil. If κ > 1, complete lubrication is achieved at the operating temperature, and the oil is suitable for the application. If κ < 1, it is recommended that an oil with EP additives is selected. If κ < 0,4, this can cause marginal lubrication and thus corrosion of the sliding surfaces. It is essential that oil with EP additives or solid grease is used in such cases.

$$\text{Viscosity ratio } \kappa = \frac{\nu}{\nu_1}$$

Temperature range [°C]	Water resistance	Corrosion protection	Pressure resistance	Noise behaviour	RMP	Additives
-25 °C to130 °C	++	++	+	O	O	EP
-20 °C to 140 °C	++	++	+++	-	-	EP
-10 °C to 150 °C	++	++	+++	-	-	EP/AW MOS_2/Graphit

Table 3

O suitable + very suitable ++ highly suitable +++ excellently suitable

EP = extreme pressure additive
AW = abrasion reducer
MOS_2 = molybdenum sulphide

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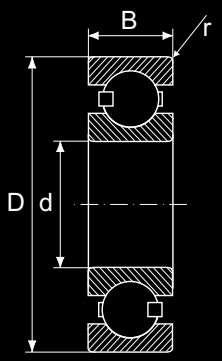
ABEG® Deep Groove Ball Bearings
60/62/63

Xforce series



Desig-nation	Model		Bore diameter	Outside diameter	Width	Chamfer	Limit speed		Mass	Load rating		Limit load
Type	ZZ	2RS DD	d (mm)	D (mm)	B (mm)	r (mm)	nG_{grease} (min^{-1})	nG_{oil} (min^{-1})	m (kg)	C_{stat} (N)	C_{dyn} (N)	C_u (N)
6007	X	X	35	62	14	1,00	12.000	14.000	0,15	10.300	16.800	431
6207	X	X	35	72	17	1,10	10.000	12.000	0,29	15.300	27.000	641
6307	X	X	35	80	21	1,50	8.800	10.000	0,46	19.100	35.100	800
6008	X	X	40	68	15	1,00	10.000	12.000	0,19	11.600	17.800	481
6208	X	X	40	80	18	1,10	8.800	10.000	0,37	19.000	32.500	754
6308	X	X	40	90	23	1,50	7.800	9.200	0,65	24.000	42.300	1.005
6009	X	X	45	75	16	1,00	9.200	11.000	0,24	15.100	22.100	632
6209	X	X	45	85	19	1,10	7.800	9.200	0,42	21.600	35.100	854
6309	X	X	45	100	25	1,50	7.000	8.200	0,84	32.000	55.300	1.340
6010	X	X	50	80	16	1,00	8.400	9.800	0,26	16.600	22.900	695
6210	X	X	50	90	20	1,10	7.100	8.300	0,47	23.200	37.100	971
6310	X	X	50	110	27	2,00	6.400	7.500	1,09	38.500	65.000	1.612
6011	X	X	55	90	18	1,10	7.700	9.000	0,37	21.200	29.600	888
6211	X	X	55	100	21	1,50	6.400	7.600	0,61	29.200	46.200	1.223
6311	X	X	55	120	29	2,00	5.800	6.800	1,35	45.000	74.100	1.885
6012	X	X	60	95	18	1,10	7.100	8.300	0,39	23.200	30.700	971
6212	X	X	60	110	22	1,50	6.000	7.300	0,80	36.000	55.300	1.508
6312	X	X	60	130	31	2,10	5.400	6.300	1,70	52.000	85.200	2.178
6013	X	X	65	100	18	1,10	6.700	8.000	0,44	25.000	31.900	1.047
6213	X	X	65	120	23	1,50	5.500	7.000	0,99	40.500	58.500	1.696
6313	X	X	65	140	33	2,10	5.000	6.000	2,10	60.000	97.500	2.513
6014	X	X	70	110	20	1,10	6.300	7.100	0,60	31.000	39.700	1.298
6214	X	X	70	125	24	1,50	5.100	6.100	1,10	45.000	63.700	1.885
6314	X	X	70	150	35	2,10	4.500	5.300	2,50	68.000	111.000	2.848
6015	X	X	75	115	20	1,10	5.800	7.000	0,64	33.500	41.600	1.403
6215	X	X	75	130	25	1,50	4.800	5.600	1,20	49.000	68.900	2.052
6315	X	X	75	160	37	2,10	4.300	5.000	3,00	76.500	119.000	3.204
6016	X	X	80	125	22	1,10	5.500	6.500	0,85	40.000	49.400	1.675
6216	X	X	80	140	26	2,00	4.500	5.300	1,40	55.000	72.800	2.220
6316	X	X	80	170	39	2,10	4.000	4.800	3,60	86.500	130.000	3.623

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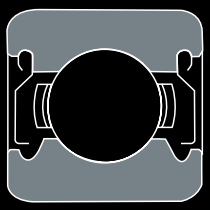
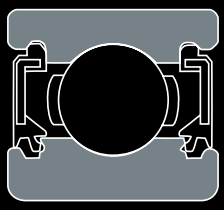
Desig-nation	Model		Bore diameter	Outside diameter	Width	Chamfer	Limit speed		Mass	Load rating		Limit load
Type	ZZ	2RS DD	d (mm)	D (mm)	B (mm)	r (mm)	nG_{grease} (min^{-1})	nG_{oil} (min^{-1})	m (kg)	C_{stat} (N)	C_{dyn} (N)	C_u (N)
6017	X	X	85	130	22	1,10	5.300	6.300	0,89	43.000	52.000	1.801
6217	X	X	85	150	28	2,00	4.300	5.000	1,79	64.000	87.100	2.681
6317	X	X	85	180	41	3,00	3.800	4.500	4,23	97.000	133.000	4.063
6018	X	X	90	140	24	1,50	5.000	6.000	1,02	50.000	60.500	2.052
6218	X	X	90	160	30	2,00	4.000	4.800	2,15	73.500	101.000	2.995
6318	X	X	90	190	43	3,00	3.600	4.300	4,91	108.000	151.000	4.482
6019	X	X	95	145	24	1,50	4.700	5.500	1,08	54.000	63.700	2.262
6219	X	X	95	170	32	2,10	3.800	4.500	2,62	82.000	114.000	3.435
6319	X	X	95	200	45	3,00	3.300	3.900	5,67	119.000	159.000	4.985
6020	X	X	100	150	24	1,50	4.500	5.500	1,15	54.000	63.700	2.262
6220	X	X	100	180	34	2,10	3.600	4.300	3,14	93.000	127.000	3.896
6022	X	X	110	170	28	2,00	4.000	4.700	1,96	73.500	85.200	3.058
6222	X	X	110	200	38	2,10	3.200	3.800	4,36	118.000	151.000	4.901

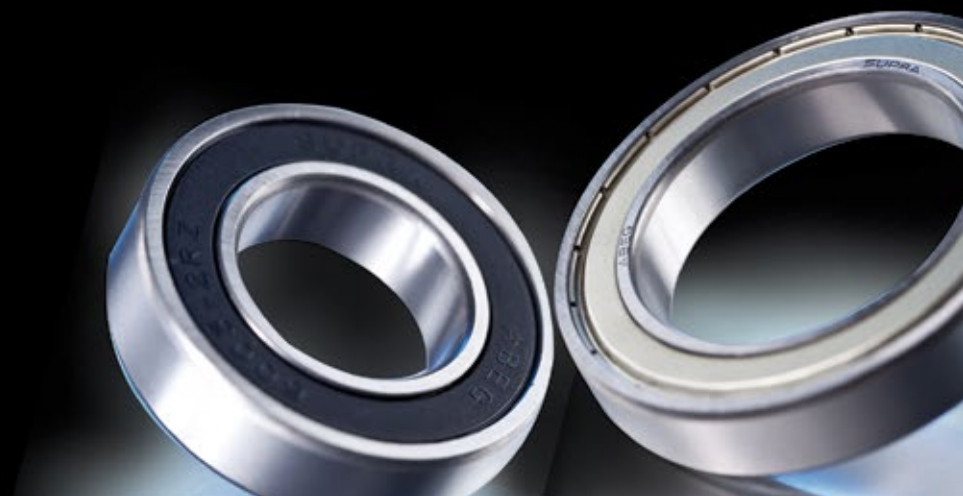
Please inquire directly about bearings with a bore diameter of 85 mm and above because these are not held in stock.



ZZ



2RS DD



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ABEG eXtreme series

HIGH PERFORMANCE AS STANDARD

Extreme Situations Demand Extreme Measures: ABEG® eXtreme.

With the ABEG® eXtreme series, the market now has especially long-lasting high performance bearings for very specific operating conditions. This was achieved by optimising tried-and-tested ABEG® bearing technology and equipping the series with a special combination of greasing and sealing elements.

To create alternatives to costly standard premium products or customised solutions with long delivery times, the development process also specifically focused on achieving the best possible acquisition and delivery conditions. The ABEG® eXtreme product line therefore provides ideal solutions which had never been available in the past: bearings that are not only efficient with long service lives, but also economical and available at short notice.

Other Products of the ABEG® eXtreme Series:

X speed — maximum RPM for high speed applications

X temp — higher service lives with extreme heat or cold conditions

X clean — special models for clean room applications and wash-down applications

Whenever the Going Gets Very Tough: The ABEG® eXtreme Series.

www.findling.com/extreme/downloads/

Technical modifications and errors excepted 11/2012

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