

Selection of DODGE ULTRA KLEEN Polymer and Stainless Steel Housed Ball Bearings

DODGE ULTRA KLEEN mounted ball bearings are primarily designed for radial loading. However, they have the capacity to carry thrust loads and combined radial/thrust loads. The maximum recommended load which can be applied is limited by various components in the system, such as bearing, housing, shaft attachments, speed and life requirements as listed in this catalog and the instruction manual that accompanies each bearing. DODGE ULTRA KLEEN ball bearings have been applied successfully when these limits have been exceeded under controlled operating conditions. Contact DODGE Engineering for applications which exceed these recommendations.

Select a bearing from the Selection Table that has a radial load rating at the operating speed equal to or greater than the calculated Equivalent Radial Load for a desired L_{10} life. This simple method is all that is required for the majority of general applications and provides for occasional average shock loads.

L_{10} Hours Life-the life which may be expected for at least 90% of a given group of bearings operating under identical conditions.

Heavy Service-For heavy shock loads, frequent shock loads or severe vibrations, add up to 50% (according to severity of conditions) to the Equivalent Radial Load to obtain a Modified Equivalent Radial Load. Consult Application Engineering for additional selection assistance.

A maximum thrust load value of C/10 is recommended as a guide for general applications and will give adequate L_{10} life. If the thrust load exceeds this limit, it is advisable to use auxiliary thrust carrying devices, such as a shaft shoulder, snap ring, or a thrust collar. Where substantial radial load pulls the housing away from the mounting base, both the hold-down bolts and housing must be of adequate strength. Auxiliary load carrying devices, such as shear bars, are advisable for side or end-loading of pillow blocks and radial loads for flange units.

To determine the L_{10} hours life for loads and RPMs not listed use the following equation:

$$L_{10} = \left(\frac{C}{P}\right)^3 \times \left(\frac{16{,}667}{n}\right)$$

Where:
L_{10}= Life, hours
C = Dynamic Capacity, lbs. or N
P = Equivalent Radial Load, lbs. or N
n = Revolutions per minute

When the load on a ball bearing is solely a radial load with no thrust (axial) load, the Equivalent Radial Load (P) is equal to the actual radial load. However, when a thrust (axial) load is applied, the radial and thrust loads applied must be converted into an Equivalent Radial Load. Use X (radial factor) and Y (thrust factor) from Table 1 to convert the actual applied thrust and radial loads to an Equivalent Radial Load which has the same effect on the life of a bearing as a radial load of this magnitude.

Shaft Tolerances

Normal Shaft Size (Inches)	Recommended Shaft Tolerances SC (Inches)
Up to 1-1/2”	+0.000 -.0005
Over 1-1/2 to 2”	+0.000 -.0010

$$P = XF_R + YF_A$$

Where:
P = Equivalent Radial Load, lbs.
F_R= Radial load, lbs.
F_A= Thrust load, lbs.
e = Thrust load to radial load factor (Table 1)
X = Radial load factor (Table 1)
Y = Thrust Factor (Table 1)
C_0= Basic static capacity (Selection Table)

To find X and Y, first calculate F_A/C_0 to determine e. Calculate F_A/F_R and compare to e to determine the X and Y factors to use from Table 1.

Substitute all known values into the Equivalent Radial Load equation. The Equivalent Radial Load (P) thus determined can be used in the L10 life formula or compared to the allowable Equivalent Radial Load rating desired in the expanded rating chart to select a bearing (Selection Table).

NOTE: Bearing analysis program “BEST” is available on www.ptwizard.com

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If calculated value of P is less than F_R, use $P=F_R$.

Table 1

F_A/C_o	e	Radial/Thrust Factors			
		If F_A/F_R is equal to or less than e		If F_A/F_R is greater than e	
		$F_A/F_R \leq e$		$F_A/F_R > e$	
		X	Y	X	Y
0.014	0.19	1	0	0.56	2.30
0.021	0.21	1	0	0.56	2.15
0.028	0.22	1	0	0.56	1.99
0.042	0.24	1	0	0.56	1.85
0.056	0.26	1	0	0.56	1.71
0.070	0.27	1	0	0.56	1.63
0.084	0.28	1	0	0.56	1.55
0.110	0.30	1	0	0.56	1.45
0.170	0.34	1	0	0.56	1.31
0.280	0.38	1	0	0.56	1.15
0.420	0.42	1	0	0.56	1.04
0.560	0.44	1	0	0.56	1.00

Lubrication- DODGE Ball Bearings are lubricated at the factory and are ready to run. The bearings are initially lubricated with an aluminum complex based, H1 Food Grade grease and should be relubricated with the same or some equivalent. For high speeds, high loads, extreme temperatures and other abnormal operating conditions, special greases may be required. Contact DODGE Application Engineering for recommendations on these types of applications.

Misalignment - DODGE Ball Bearings are designed to allow a maximum of ±2° static misalignment. These bearings are not suitable for dynamic misalignment. To ensure good alignment, mounting surfaces must be checked for flatness and must lie in the same plane. When tightening base bolts, each bolt should be alternately tightening in incremental torque values until full torque is achieved to prevent the angular shifting of the pillow block that occurs when one bolt is tightened to its full torque. Shimming may be required to minimize misalignment.

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Recommended Torque													
Setscrews					D-LOK			Mounting Bolts					
Setscrew Size	Key Hex Across Flats	Recommended Torque			Cap Screw Size	Recom. Torque	EZ-KLEEN Recom. Torque	Metal Housings		EZ-KLEEN Housed Bearings			
		Standard Ball Bearing Insert		Corrosion Resistant Stainless Steel				Bolt Size	Recom. Dry Torque (Grade 2)	2-Bolt PB, 2 & 4 Bolt Fig. and Flg. Brackets		Tapped Base PB	
		Min	Max							Bolt Size	Torque ①	Bolt Size	Torque ②
(in.)	(in.)	(in-lbs.)	(in.-lbs.)	(in.-lbs.)	(in.)	(in.-lbs.)	(in.-lbs.)	(in.)	(in.-lbs.)	(in.)	(in.-lbs.)	(in.)	(in.-lbs.)
#10	3/32	28	33	25	#8-32	58	46	3/8-16	240	3/8-16	225	3/8-16	175
1/4	1/8	66	80	60	#10-32	90	72	7/16-14	384	7/16-14	350	7/16-14	350
5/16	5/32	126	156	117	1/4-28	180	144	1/2-13	600	1/2-13	500	1/2-13	400
3/8	3/16	228	275	206	5/16-24	400	320	5/8-11	1200	9/16-12	650		
7/16	7/32	342	428	321	3/8-24	750	600	3/4-10	1950	5/8-11	1000		
								7/8-9	2890				
(mm)	(mm)	(N-m)	(N-m)	(N-m)	(mm)	(N-m)	(N-m)	(mm)	(N-m)	(mm)	(N-m)	①Torque for Austenitic (18-8) Stainless ②Max. torque values published. Do not exceed	
M5	2.5	3.2	3.7	2.8	M4	585	4.68	M10	29	M8	15		
M6	3	6.2	7.7	5.8	M5	10.75	8.6	M12	50	M10	25		
M8	4	14.2	17.8	13.4	M6	20.5	16.4	M16	124	M12	50		
M10	5	26	31	23	M8	45	36	M20	238	M14	75		
M12	6	46	57	43				M22	322	M18	125		

Lubrication

High Speed Operation - In the higher speed ranges, too much grease will cause over-heating. The amount of grease that the bearing will take for a particular high speed application can only be determined by experience. If excess grease in the bearing causes overheating, it will be necessary to remove grease fitting to permit excess grease to escape. The bearing has been greased at the factory and is ready to run. When establishing a relubrication schedule, note that a small amount of grease at frequent intervals is preferable to a large amount at infrequent intervals.

Lubrication Guide

Use a No. 2 Lithium complex base grease or equivalent*

Hours Run per Day	Suggested Lubrication Period in Weeks							
	1 to 250 RPM	251 to 500 RPM	501 to 750 RPM	751 to 1000 RPM	1001 to 1500 RPM	1501 to 2000 RPM	2001 to 2500 RPM	2501 to 3000 RPM
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	1	1
24	10	5	3	2	1	1	1	1

* For EZ-KLEEN series bearings, use an aluminum complex base grease.

Lubrication recommendations are intended for standard products applied in general operating conditions. For modified products, high temperature applications, and other anomalous applications contact product engineering at 864-284-5700.

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Table 2: Easy Selection for Polymer and Stainless Housed ULTRA KLEEN Mounted Ball Bearings - Inch and Metric

Ring Size	Shaft Size SC	Dynamic Capacity C, lbs.	Static Capacity C_0, lbs.	L_{10} Life - Hours	Allowable Equivalent Radial Load Rating (lbs.) at Various RPM*											
					50	150	250	500	750	1000	1250	1500	1600	1750	2000	2250
204	1/2	2464	1482	20000	629	436	368	292	255	232	215	203	198	192	184	177
	5/8			30000	550	381	322	255	223	203	188	177	173	168	161	155
	3/4			40000	500	346	292	232	203	184	171	161	157	153	146	140
	13/16			60000	436	303	255	203	177	161	149	140	137	133	128	123
	20mm			100000	368	255	215	171	149	136	126	118	116	113	108	103
205	7/8	2674	1769	20000	683	474	399	317	277	252	234	220	215	209	200	192
	15/16			30000	597	414	349	277	242	220	204	192	188	182	174	168
	1			40000	542	376	317	252	220	200	185	174	171	166	159	152
	25mm			60000	474	328	277	220	192	174	162	152	149	145	138	133
				100000	399	277	234	185	162	147	137	129	126	122	117	112
206	1-1/16	3713	2538	20000	948	658	555	440	385	349	324	305	299	290	277	267
	1-1/8			30000	829	574	485	385	336	305	283	267	261	253	242	233
	1-3/16			40000	753	522	440	349	305	277	257	242	237	230	220	212
	1-1/4			60000	658	456	385	305	267	242	225	212	207	201	192	185
	30mm			100000	555	385	324	257	225	204	190	179	175	170	162	156
207	1-1/4	4895	3461	20000	1250	867	731	580	507	461	428	402	394	382	366	352
	1-5/16			30000	1092	757	639	507	443	402	374	352	344	334	319	307
	1-3/8			40000	992	688	580	461	402	366	339	319	313	303	290	279
	1-7/16			60000	867	601	507	402	352	319	296	279	273	265	254	244
	35mm			100000	731	507	428	339	296	269	250	235	230	224	214	206
208	1-1/2	6232	4475	20000	1592	1104	931	739	645	586	544	512	501	487	465	448
	1-5/8			30000	1391	964	813	645	564	512	476	448	438	425	407	391
	40mm			40000	1263	876	739	586	512	465	432	407	398	386	369	355
				60000	1104	765	645	512	448	407	377	355	348	337	323	310
				100000	931	645	544	432	377	343	318	300	293	285	272	262
209	1-5/8	6707	4906	20000	1713	1188	1002	795	695	631	586	551	540	524	501	482
	1-11/16			30000	1497	1038	875	695	607	551	512	482	471	458	438	421
	1-3/4			40000	1360	943	795	631	551	501	465	438	428	416	398	382
	45mm			60000	1188	824	695	551	482	438	406	382	374	363	347	334
				100000	1002	695	586	465	406	369	343	322	316	306	293	282
210	1-15/16	6707	5213	20000	1713	1188	1002	795	695	631	586	551	540	524	501	482
	2			30000	1497	1038	875	695	607	551	512	482	471	458	438	421
	50mm			40000	1360	943	795	631	551	501	465	438	428	416	398	382
				60000	1188	824	695	551	482	438	406	382	374	363	347	334
				100000	1002	695	586	465	406	369	343	322	316	306	293	282

* Slight interference fit required when operating on the right of the heavy line or in the shaded area.
▲ Piloted flange only

NOTE: Bearing analysis program "BEST" is available on www.ptwizard.com



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Ring Size	Shaft Size SC	Dynamic Capacity C, lbs.	Static Capacity C_0, lbs.	L_{10} Life - Hours	Allowable Equivalent Radial Load Rating (lbs.) at Various RPM*											
					2500	2750	3000	3250	3500	3600	4000	4500	5000	5250	5500	6000
204	1/2	2464	1482	20000	171	166	161	157	153	151	146	140	136	133	131	128
	5/8			30000	149	145	140	137	133	132	128	123	118	117	115	111
	3/4			40000	136	131	128	124	121	120	116	111	108	106	104	101
	13/16			60000	118	115	111	109	106	105	101	97	94	93	91	88
	20mm			100000	100	97	94	92	89	88	85	82	79	78	77	75
205	7/8	2674	1769	20000	185	180	174	170	166	164	159	152	147	145	143	138
	15/16			30000	162	157	152	148	145	143	138	133	129	126	125	121
	1			40000	147	143	138	135	132	130	126	121	117	115	113	110
	25mm			60000	129	125	121	118	115	114	110	106	102	100	99	96
				100000	108	105	102	99	97	96	93	89	86	85	83	81
206	1-1/16	3713	2538	20000	257	249	242	236	230	228	220	212	204	201		
	1-1/8			30000	225	218	212	206	201	199	192	185	179	176		
	1-3/16			40000	204	198	192	187	183	181	175	168	162	160		
	1-1/4			60000	179	173	168	164	160	158	153	147	142	139		
	30mm			100000	151	146	142	138	135	133	129	124	119	118		
207	1-1/4	4895	3461	20000	339	329	319	311	303	301	290	279				
	1-5/16			30000	296	287	279	272	265	263	254	244				
	1-3/8			40000	269	261	254	247	241	239	230	221				
	1-7/16			60000	235	228	221	216	210	208	201	193				
	35mm			100000	198	192	187	182	177	176	170	163				
208	1-1/2	6232	4475	20000	432	419	407	396	386	383	369					
	1-5/8			30000	377	366	355	346	337	334	323					
	40mm			40000	343	332	323	314	307	304	293					
				60000	300	290	282	275	268	265	256					
				100000	253	245	238	232	226	224	216					
209	1-5/8	6707	4906	20000	465	450	438	426	416	412	398					
	1-11/16			30000	406	394	382	372	363	360	347					
	1-3/4			40000	369	358	347	338	330	327	316					
	45mm			60000	322	312	303	295	288	286	276					
				100000	272	263	256	249	243	241	233					
210	1-15/16	6707	5213	20000	465	450	438	426	416	412						
	2			30000	406	394	382	372	363	360						
	50mm			40000	369	358	347	338	330	327						
				60000	322	312	303	295	288	286						
				100000	272	263	256	249	243	241						

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Chemical Resistance Chart*

	Housing		Ball Bearing Insert	
	Polymer	Stainless	EZ-KLEEN	ULTRA-KLEEN
A				
Acetic Acid	B	B	A	B
Acetone	B	A	A	B
Ammonium Chloride		B	A	B
Ammonium Hydroxide	D	A		A
Aniline	A	A	B	A
B				
Beer		A	A	
Beet Sugar Liquids		A		
Benzene	B	B	B	B
Bleaching Lye	A			
Brake Fluid	A			
Butane	A	A	A	
Butanol	B	A	A	
Butyl Acetate	A	B	A	
C				
Calcium Chloride	A	B	A	C
Calcium Hydroxide		B	A	
Calcium Hypochlorite	A	D	B	C
Carbon Disulphide	A	B	B	
Carbon Tetrachloride	A	B	A	A
Chloroform	D	A	A	A
Chromic Acid	A	B	A	B
Citric Acid	A	A	A	A
Cresol	D	A		
D				
Detergents	A	A	A	A
Diesel Fuel	A	A	B	
E				
Ethanol	A	A		A
Ether (diethyl-)	A	A	B	A
Ethyl Acetate	B	B	B	
Ethylene Dichloride	D	B	B	
F				
Ferrous Chloride		D	B	
Formaldehyde		B	B	
Formic Acid	B	B	A	B
Freon 11	A	A	A	

Where: (A) = No Effect - Excellent
(B) = Minor Effect - Good
(C) = Moderate Effect - Fair
(D) = Severe Effect - Not Recommended
Blank = No Data Available

NOTE: All references assume exposure temperature of 72°F.

* This chemical resistance chart is intended as a guideline. For exposure to high concentrations, prolonged contact, or higher operating temperatures, etc. reliance upon actual application experience is best. Aggressive relubrication intervals may also benefit bearing life. Contact application engineering at 864-284-5700 for assistance.

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Chemical Resistance Chart*

	Housing		Ball Bearing Insert	
	Polymer	Stainless	EZ-KLEEN	ULTRA-KLEEN
G				
Gasoline	A	A	A	A
Glycerol (Glycerin)	B	A	A	A
Glycol	B			
Grease	A	A	A	A
H				
Heptane	A	A	A	
Hexane	A	A	A	
Hydrochloric Acid (20%)	A	D	B	D
Hydrochloric Acid (100%)	D	D	C	D
Hydrofluoric Acid (20%)	D	D	B	D
Hydrofluoric Acid (100%)	D	D	C	D
Hydrogen Peroxide (10%)	A	C	A	
Hydrogen Peroxide (30%)	B	C	A	
I, K, L				
Iodine		D	B	D
Isopropanol (Isopropyl Alcohol)	B	A	A	
Kerosene	A	A	A	A
Lithium Chloride		A		
M				
Methanol	A	A	A	A
Methylene Chloride	D	B	B	
Methyl Ethyl Ketone	A	A	A	
Mineral Oil	A	A	A	A
Motor Oils	A	A	A	A
N				
Nitric Acid (10%)	A	A	A	A
Nitric Acid (20%)	D	A	A	A
Nitric Acid (50%)	D	A	A	A
O				
Oleic Acid	A	A	B	B
Olive Oil	A	A	A	A
P				
Perchloroethylene	A	B	B	
Phenol	B	B	A	
Phosphoric Acid (<40%)	A	B	A	A
Phosphoric Acid (>40%)	A	C	A	B
Potassium Chloride	A	B	A	B

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Chemical Resistance Chart*

	Housing		Ball Bearing Insert	
	Polymer	Stainless	EZ-KLEEN	ULTRA-KLEEN
P (Continued)				
Potassium Dichromate	A	B	B	B
Potassium Hydroxide	D	B	A	B
Potassium Permanganate	A	A	B	B
S				
Silicone	A	B	A	A
Soap Solution	A	A	A	A
Sodium Bicarbonate	A	A	A	A
Sodium Bisulfate		D	B	B
Sodium Bisulfite	A	B	B	B
Sodium Carbonate	A	A	A	B
Sodium Chloride	A	B	A	B
Sodium Hydroxide (20%)	D	A	A	A
Sodium Hydroxide (50%)	D	B	A	
Sodium Hydroxide (80%)	D	C	B	
Sodium Hypochlorite (<20%)	A	C	B	C
Sodium Hypochlorite (100%)	B	D	B	D
Sulfuric Acid (<10%)	A	D	A	C
Sulfuric Acid (10 - 75%)	A	D	B	D
Sulfuric Acid (>75%)	D	D	C	D
T				
Tetrahydofuran	B	A	A	
Toulene	A	A	A	
Trichlorethylene	B	B	A	
Triethylamine		A	A	
Turpentine	A	A	A	
V, W, X				
Vegetable Oils	A	A	A	A
Water	A	A	A	A
Xylene	A	B	A	

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