

Rolling Bearing Calculation

Input data

Bearing Geometry

Type of rolling bearing		Four point ball bearing (radial)
Bearing inner diameter	d	1300.0 mm
Bearing outer diameter	D	1500.0 mm
Bearing width	B	100.000 mm
Number of rolling elements	Z	60
Roller diameter	Dw	60.000 mm
Pitch diameter	Dpw	1400.0 mm
Conformity inner race	fi	0.53
Conformity outer race	fe	0.53
Nominal contact angle	α	45.000 °
Definition of clearance		User input as operating clearance
Definition of bearing tolerance		Not considered
Nominal axial clearance	Pa	0.0100 mm
Clearance generation type		axial direction

Loading

Speed of inner ring	ni	0.0000 rpm	inner ring is stationary relative to load
Speed of outer ring	ne	10.000 rpm	outer ring rotates relative to load
Axial force	Fx	500.000 kN	
Radial force Y	Fy	0.0000 kN	
Radial force Z	Fz	100.000 kN	
Moment Y	My	150000 Nm	
Moment Z	Mz	0.0000 Nm	
Reliability	reliability	90.000 %	
Maximal permissible value for aISO	aISOMax	50	
Temperature of shaft	T_i	20.000 °C	
Temperature of housing	T_e	20.000 °C	

Material

Surface hardness inner race	HRC_i	54
Surface hardness outer race	HRC_e	54
Ultimate strength of core inner race	Rm_i	1000.0 MPa
Ultimate strength of core outer race	Rm_e	1000.0 MPa
Material for inner ring		Steel
Material for outer ring		Steel
Material for rolling element		Steel

Lubrication

Lubricant		ISO VG 220 mineral oil
Kinematic viscosity at 40°C	v40	220.000 mm ² /s
Kinematic viscosity at 100°C	v100	19.000 mm ² /s
Oil density	rhoOil	890.000 kg/m ³
Oil temperature	thOil	70.000 °C
Oil does not contain effective EP additives		

Operating kinematic viscosity	$v(\vartheta)$	51.794 mm ² /s
Operating oil density	$\rho(\vartheta)$	851.593 kg/m ³
Lubricant cleanness		Grease lubrication, Slight to typical contamination

Results

Centrifugal loads are not considered

Bearing inner geometry

Number of rolling elements	Z	60
Roller diameter	Dw	60.000 mm
Pitch diameter	Dpw	1400.0 mm
Conformity inner race	fi	0.53
Conformity outer race	fe	0.53
Nominal contact angle	α	45.000°
Distance between center of curvature inner and outer ring	δ_{CC}	2.5406 mm
Distance between center of curvature inner ring	δ_{CC_i}	2.5406 mm
Distance between center of curvature outer ring	δ_{CC_e}	2.5406 mm
Nominal diametral clearance	Pd	0.0100 mm
Nominal axial clearance	Pa	0.0100 mm
Diameter inner race	di	1338.9 mm
Diameter outer race	de	1461.1 mm
Radius inner race	ri	31.800 mm
Radius outer race	re	31.800 mm
Distance between rolling elements	δ_{RE}	13.270 mm
Shoulder diameter inner ring	dSi	1376.0 mm
Limit contact angle inner ring	α_{lim_i}	65.330°
Shoulder diameter outer ring	dSe	1424.0 mm
Limit contact angle outer ring	α_{lim_e}	65.330°
Extension contact ellipsis inner ring	dCimax	1369.4 mm
Extension contact ellipsis outer ring	dCemin	1430.6 mm
Ellipsis length ratio inner race	eLR_i	130.815 %
Ellipsis length ratio outer race	eLR_e	131.215 %
Circumferential ball advance	Δb_{circ}	1.5062 mm
Axial ball excursion	Δb_{ax}	0.1011 mm

Forces and displacement

Axial force	Fx	500.000 kN
Radial force Y	Fy	0.0000 kN
Radial force Z	Fz	100.000 kN
Displacement X	ux	97.592 μ m
Displacement Y	uy	-0.0000 μ m
Displacement Z	uz	-65.4682 μ m
Moment Y	My	150000 Nm
Moment Z	Mz	0.0000 Nm
Rotation around Y	ry	0.1445 mrad
Rotation around Z	rz	-0.0000 mrad
Frictional moment	Mloss	761.628 Nm
Power loss	Ploss	797.708 W
Maximal pressure inner race	pmax_i	1818.0 MPa
Maximal pressure outer race	pmax_e	1771.8 MPa
Maximal pressure	pmax	1818.0 MPa
Static safety factor	SF	9.62227

Static safety is reduced because of hardness

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Limit for axial force, inner ring	Fa_max_i	3523.8 kN
Limit for axial force, outer ring	Fa_max_e	3563.4 kN
Limit for axial force	Fa_max	3523.8 kN

Life

Load capacity factor	bm	1.3
Dynamic load capacity	Cr	762.661 kN
Static load capacity	C0r	3370.1 kN
Fatigue load limit	Cur	60.151 kN

Load capacities C and C0 are reduced because of hardness

Life modification factor for reliability	a1	1
Viscosity ratio	χ	0.291162
Contamination factor	eC	0.349479
Life modification factor	aISO	0.206981
Reference load	Pref	405137 N
Basic reference rating life	L10r	6.67098
Basic reference rating life	L10rh	11118.3 h
Modified reference rating life	Lnmr	1.38077
Modified reference rating life	Lnmrh	2301.3 h

Life according ISO 281

Dynamic radial load factor	X	0.54
Dynamic axial load factor	Y	0.81
Dynamic equivalent load	P	459000 N
Basic life	L10	4.58729
Basic life	L10h	7645.5 h
Modified life	Ln	0.920696
Modified life	Ln	1534.5 h

Wear parameters

Frictional moment	Mloss	761.628 Nm
Power loss	Ploss	797.708 W
Power loss inner race	Ploss_i	411.651 W
Power loss outer race	Ploss_e	386.057 W
Wear parameter PVmax	PVmax	158.907 MPa·m/s
Wear parameter PVavg_max	PVavg_max	106.292 MPa·m/s
Wear parameter QV	QV	7977.1 W
Total thermal resistance	R	0.1386 K/W

Subsurface stresses

Maximal shear stress for inner race	τ_{max_i}	579.496 MPa
Depth for maximal shear stress inner race	$h(\tau_{max_i})$	0.6892 mm
Shear yield stress for core inner race	τ_{Yield_i}	425.000 MPa
Shear fatigue limit for core inner race	τ_{a_i}	255.000 MPa
Shear stress at core inner race	τ_i	255.000 MPa
Maximal shear stress for outer race	τ_{max_e}	565.437 MPa
Depth for maximal shear stress outer race	$h(\tau_{max_e})$	0.7090 mm
Shear yield stress for core outer race	τ_{Yield_e}	425.000 MPa
Shear fatigue limit for core outer race	τ_{a_e}	255.000 MPa
Shear stress at core outer race	τ_e	255.000 MPa
Required hardness depth inner race	hdmin_i	2.9052 mm
Required hardness depth outer race	hdmin_e	2.9055 mm

Damage Frequencies

Speed of inner ring	ni	0.00 1/s	(0rpm)
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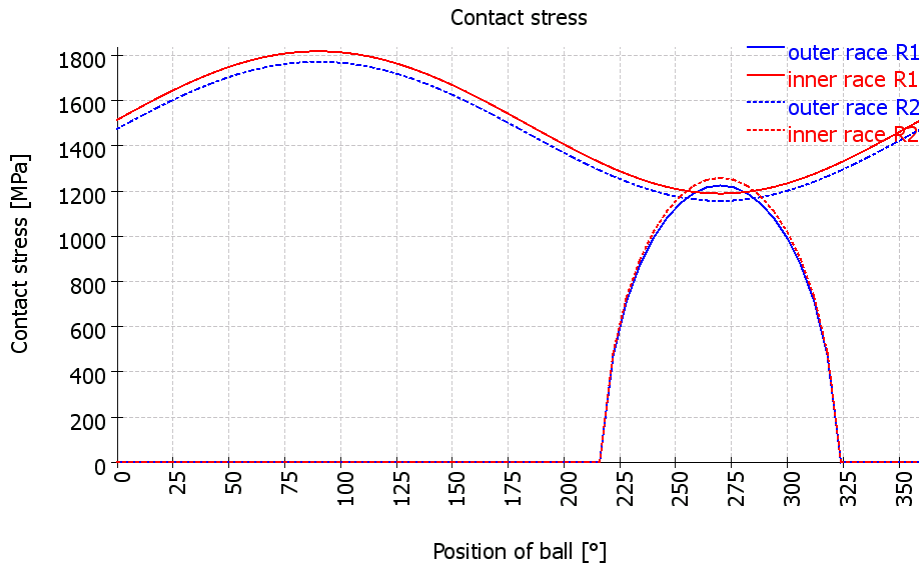
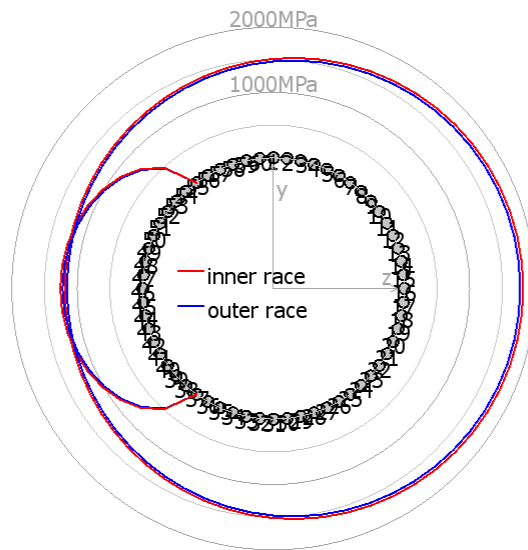
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Speed of outer ring	ne	0.17 1/s	(10rpm)
Rotation speed of cage	fc	0.09 1/s	(5rpm)
Damage frequency for inner race	fip	-5.15 1/s	(-309rpm)
Damage frequency for outer race	fep	4.85 1/s	(291rpm)
Damage frequency for rolling element	frp	3.89 1/s	(233rpm)

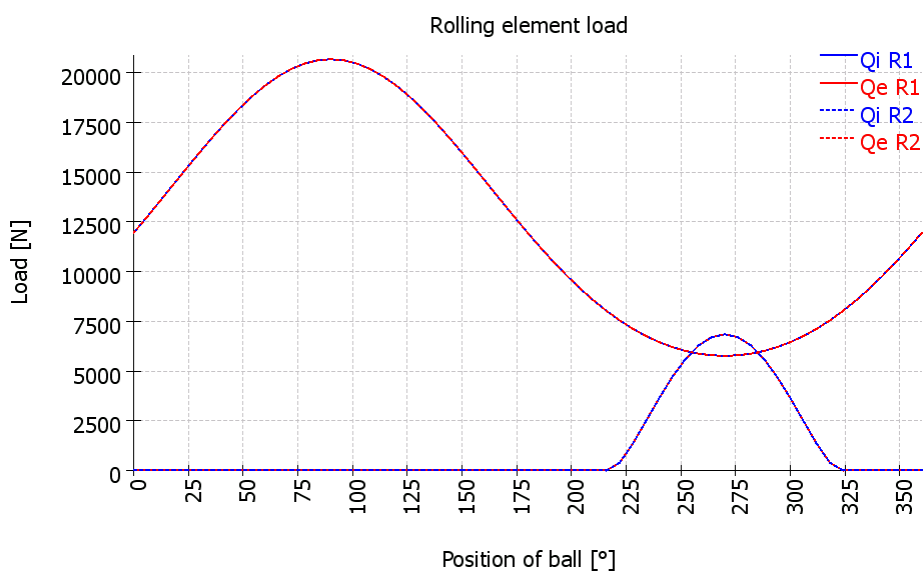
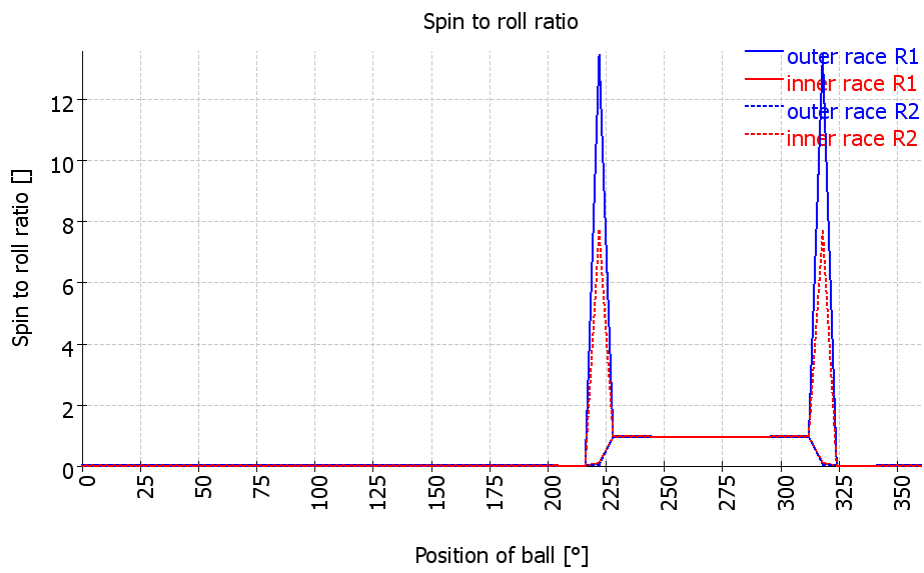
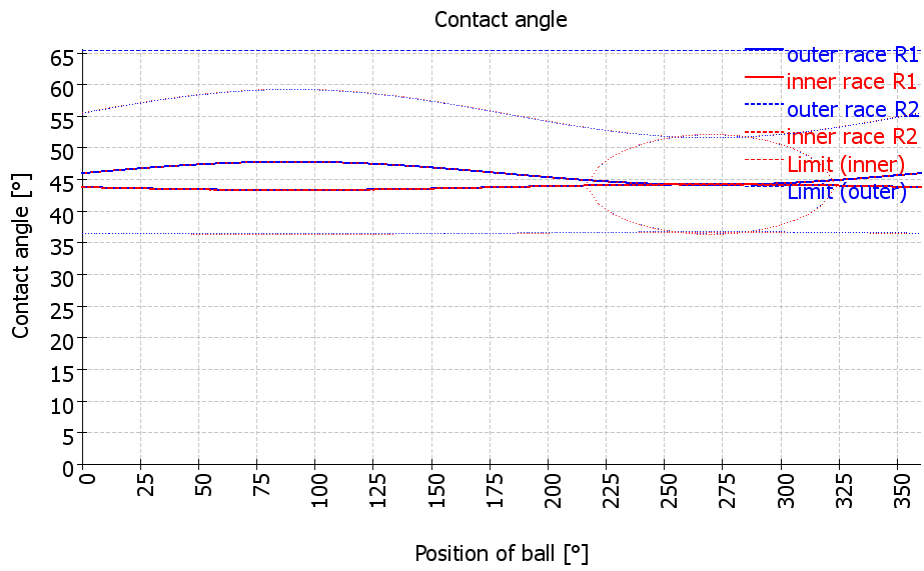
Bearing stiffness matrix

	ux [μm]	uy [μm]	uz [μm]	ry [mrad]	rz [mrad]
Fx [N]	10040.784	0.000	2169.967	-130622.101	0.000
Fy [N]	0.000	4238.117	0.000	-0.000	-2615097.527
Fz [N]	2169.977	0.000	5214.631	1918045.116	0.000
My [Nm]	-129.950	-0.000	1918.420	2698493.484	-0.000
Mz [Nm]	0.000	-2615.270	0.000	-0.000	2221642.185



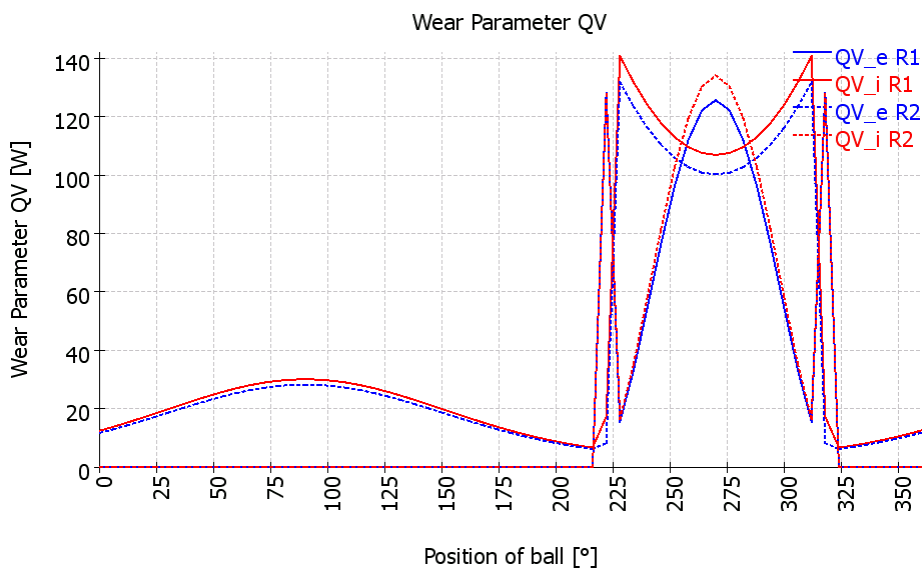
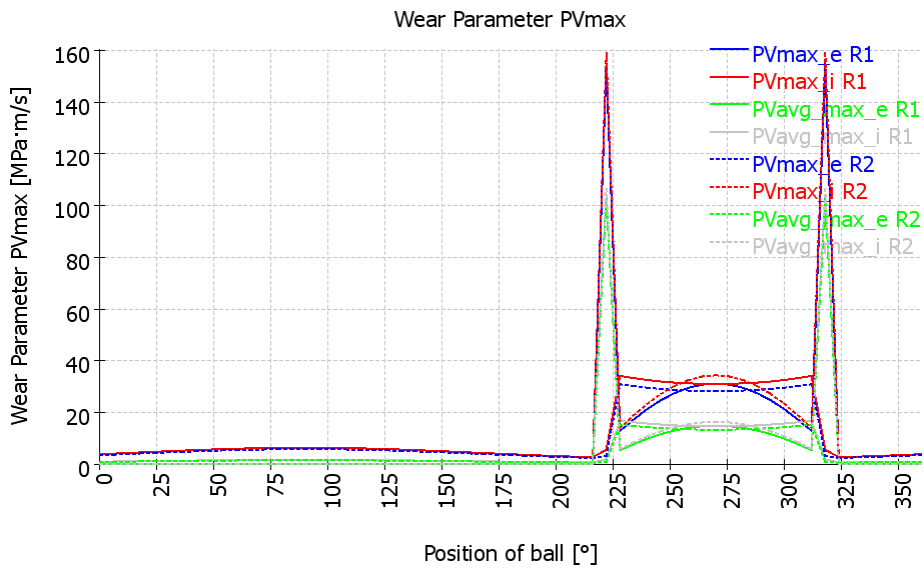
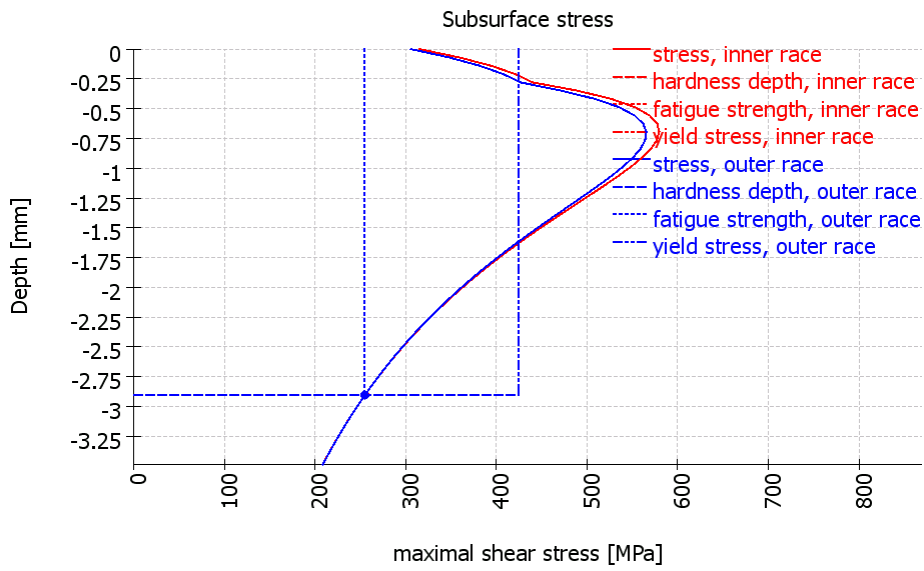
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Result table for bearing 1

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Ball	ψ [°]	α_l [°]	α_e [°]	Q_{i_l} [N]	Q_{e_l} [N]	p_{i_l} [MPa]	p_{e_l} [MPa]	α_{i_r} [°]	α_{e_r} [°]	Q_{i_r} [N]	Q_{e_r} [N]	p_{i_r} [MPa]	p_{e_r} [MPa]	eLR _i	eLR _e
1	0.00	46.02	43.83	11948.4	0	1514.80	0.00	43.82	46.02	0	11948.4	0.00	1475.01	1.57	1.58
2	6.00	46.21	43.78	12737	0	1547.35	0.00	43.77	46.21	0	12737	0.00	1506.84	1.54	1.54
3	12.00	46.40	43.73	13544.7	0	1579.31	0.00	43.72	46.40	0	13544.7	0.00	1538.11	1.51	1.51
4	18.00	46.59	43.69	14361.6	0	1610.37	0.00	43.68	46.59	0	14361.6	0.00	1568.50	1.48	1.48
5	24.00	46.77	43.64	15176.8	0	1640.21	0.00	43.63	46.77	0	15176.8	0.00	1597.70	1.45	1.46
6	30.00	46.93	43.60	15978.5	0	1668.53	0.00	43.59	46.93	0	15978.5	0.00	1625.42	1.43	1.43
7	36.00	47.09	43.56	16754.6	0	1695.04	0.00	43.55	47.09	0	16754.6	0.00	1651.38	1.40	1.41
8	42.00	47.24	43.52	17492.4	0	1719.51	0.00	43.51	47.24	0	17492.4	0.00	1675.34	1.38	1.39
9	48.00	47.38	43.49	18179.6	0	1741.67	0.00	43.48	47.38	0	18179.6	0.00	1697.04	1.37	1.37
10	54.00	47.49	43.46	18803.8	0	1761.33	0.00	43.44	47.49	0	18803.8	0.00	1716.30	1.35	1.35
11	60.00	47.60	43.43	19353.8	0	1778.29	0.00	43.42	47.60	0	19353.8	0.00	1732.92	1.34	1.34
12	66.00	47.68	43.41	19819.2	0	1792.40	0.00	43.39	47.68	0	19819.2	0.00	1746.73	1.33	1.33
13	72.00	47.75	43.39	20191.1	0	1803.51	0.00	43.38	47.75	0	20191.1	0.00	1757.62	1.32	1.32
14	78.00	47.80	43.38	20462.2	0	1811.52	0.00	43.36	47.80	0	20462.2	0.00	1765.47	1.31	1.32
15	84.00	47.83	43.37	20627	0	1816.36	0.00	43.36	47.83	0	20627	0.00	1770.21	1.31	1.31
16	90.00	47.84	43.37	20682.3	0	1817.97	0.00	43.35	47.84	0	20682.3	0.00	1771.80	1.31	1.31
17	96.00	47.83	43.37	20627	0	1816.36	0.00	43.36	47.83	0	20627	0.00	1770.21	1.31	1.31
18	102.00	47.80	43.38	20462.2	0	1811.52	0.00	43.36	47.80	0	20462.2	0.00	1765.47	1.31	1.32
19	108.00	47.75	43.39	20191.1	0	1803.51	0.00	43.38	47.75	0	20191.1	0.00	1757.62	1.32	1.32
20	114.00	47.68	43.41	19819.2	0	1792.40	0.00	43.39	47.68	0	19819.2	0.00	1746.73	1.33	1.33
21	120.00	47.60	43.43	19353.8	0	1778.29	0.00	43.42	47.60	0	19353.8	0.00	1732.92	1.34	1.34
22	126.00	47.49	43.46	18803.8	0	1761.33	0.00	43.44	47.49	0	18803.8	0.00	1716.30	1.35	1.35
23	132.00	47.38	43.49	18179.6	0	1741.67	0.00	43.48	47.38	0	18179.6	0.00	1697.04	1.37	1.37
24	138.00	47.24	43.52	17492.4	0	1719.51	0.00	43.51	47.24	0	17492.4	0.00	1675.34	1.38	1.39
25	144.00	47.09	43.56	16754.6	0	1695.04	0.00	43.55	47.09	0	16754.6	0.00	1651.38	1.40	1.41
26	150.00	46.93	43.60	15978.5	0	1668.53	0.00	43.59	46.93	0	15978.5	0.00	1625.42	1.43	1.43
27	156.00	46.77	43.64	15176.8	0	1640.21	0.00	43.63	46.77	0	15176.8	0.00	1597.70	1.45	1.46
28	162.00	46.59	43.69	14361.6	0	1610.37	0.00	43.68	46.59	0	14361.6	0.00	1568.50	1.48	1.48
29	168.00	46.40	43.73	13544.7	0	1579.31	0.00	43.72	46.40	0	13544.7	0.00	1538.11	1.51	1.51
30	174.00	46.21	43.78	12737	0	1547.35	0.00	43.77	46.21	0	12737	0.00	1506.84	1.54	1.54
31	180.00	46.02	43.83	11948.4	0	1514.80	0.00	43.82	46.02	0	11948.4	0.00	1475.01	1.57	1.58
32	186.00	45.83	43.87	11187.6	0	1482.01	0.00	43.87	45.83	0	11187.6	0.00	1442.96	1.61	1.61
33	192.00	45.64	43.92	10462.2	0	1449.33	0.00	43.91	45.64	0	10462.2	0.00	1411.01	1.64	1.65
34	198.00	45.46	43.96	9778.57	0	1417.12	0.00	43.96	45.46	0	9778.57	0.00	1379.52	1.68	1.68
35	204.00	45.28	44.00	9141.71	0	1385.72	0.00	44.00	45.28	0	9141.71	0.00	1348.84	1.72	1.72
36	210.00	45.11	44.04	8555.54	0	1355.50	0.00	44.04	45.11	0	8555.54	0.00	1319.32	1.75	1.76
37	216.00	44.94	44.08	8022.92	0	1326.82	0.00	44.08	44.94	0	8022.92	0.00	1291.31	1.79	1.80
38	222.00	44.79	44.11	7545.76	387.888	1300.03	470.33	44.11	44.80	387.103	7545.73	483.13	1265.14	1.83	1.83
39	228.00	44.65	44.14	7125.15	1346.52	1275.45	712.16	44.15	44.66	1345.6	7125.09	731.85	1241.14	1.86	1.87
40	234.00	44.53	44.17	6761.6	2478.42	1253.42	872.77	44.17	44.54	2477.39	6761.47	896.98	1219.62	1.90	1.90
41	240.00	44.42	44.19	6455.1	3628.1	1234.21	990.99	44.20	44.43	3626.98	6454.88	1018.50	1200.87	1.92	1.93
42	246.00	44.34	44.21	6205.34	4692.15	1218.11	1079.70	44.22	44.35	4690.97	6205.02	1109.68	1185.15	1.95	1.96
43	252.00	44.27	44.23	6011.84	5594.28	1205.34	1144.89	44.23	44.28	5593.06	6011.43	1176.68	1172.68	1.97	1.98
44	258.00	44.21	44.24	5874.09	6277.97	1196.08	1189.75	44.25	44.23	6276.72	5873.6	1222.79	1163.63	1.95	1.96
45	264.00	44.18	44.25	5791.65	6703.78	1190.46	1216.06	44.25	44.20	6702.51	5791.1	1249.84	1158.15	1.92	1.93
46	270.00	44.17	44.25	5764.2	6848.3	1188.58	1224.74	44.25	44.19	6847.03	5763.64	1258.76	1156.31	1.91	1.92
47	276.00	44.18	44.25	5791.65	6703.78	1190.46	1216.06	44.25	44.20	6702.51	5791.1	1249.84	1158.15	1.92	1.93
48	282.00	44.21	44.24	5874.09	6277.97	1196.08	1189.75	44.25	44.23	6276.72	5873.6	1222.79	1163.63	1.95	1.96
49	288.00	44.27	44.23	6011.84	5594.28	1205.34	1144.89	44.23	44.28	5593.06	6011.43	1176.68	1172.68	1.97	1.98
50	294.00	44.34	44.21	6205.34	4692.15	1218.11	1079.70	44.22	44.35	4690.97	6205.02	1109.68	1185.15	1.95	1.96
51	300.00	44.42	44.19	6455.1	3628.1	1234.21	990.99	44.20	44.43	3626.98	6454.88	1018.50	1200.87	1.92	1.93
52	306.00	44.53	44.17	6761.6	2478.42	1253.42	872.77	44.17	44.54	2477.39	6761.47	896.98	1219.62	1.90	1.90
53	312.00	44.65	44.14	7125.15	1346.52	1275.45	712.16	44.15	44.66	1345.6	7125.09	731.85	1241.14	1.86	1.87
54	318.00	44.79	44.11	7545.76	387.888	1300.03	470.33	44.11	44.80	387.103	7545.73	483.13	1265.14	1.83	1.83
55	324.00	44.94	44.08	8022.92	0	1326.82	0.00	44.08	44.94	0	8022.92	0.00	1291.31	1.79	1.80

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Ball	ψ [°]	α_i [°]	α_e [°]	Q_i [N]	Q_e [N]	p_i [MPa]	p_e [MPa]	α_{i_r} [°]	α_{e_r} [°]	Q_{i_r} [N]	Q_{e_r} [N]	p_{i_r} [MPa]	p_{e_r} [MPa]	eLR _i	eLR _e
56	330.00	45.11	44.04	8555.54	0	1355.50	0.00	44.04	45.11	0	8555.54	0.00	1319.32	1.75	1.76
57	336.00	45.28	44.00	9141.71	0	1385.72	0.00	44.00	45.28	0	9141.71	0.00	1348.84	1.72	1.72
58	342.00	45.46	43.96	9778.57	0	1417.12	0.00	43.96	45.46	0	9778.57	0.00	1379.52	1.68	1.68
59	348.00	45.64	43.92	10462.2	0	1449.33	0.00	43.91	45.64	0	10462.2	0.00	1411.01	1.64	1.65
60	354.00	45.83	43.87	11187.6	0	1482.01	0.00	43.87	45.83	0	11187.6	0.00	1442.96	1.61	1.61

ψ : Position of ball
 α_i : Contact angle inner race
 α_e : Contact angle outer race
 Q_i : Force at inner race
 Q_e : Force at outer race
 p_i : Maximal pressure inner race
 p_e : Maximal pressure outer race
eLR_i : Ellipsis length ratio inner race
eLR_e : Ellipsis length ratio outer race

Ball	ω_{spin_i} [rad/s]	ω_{spin_e} [rad/s]	ω_{roll_i} [rad/s]	ω_{roll_e} [rad/s]	QV _i [W]	QV _e [W]	PVmax _i [MPa·m/s]	PVmax _e [MPa·m/s]	$\omega_{spin_i_r}$ [rad/s]	$\omega_{spin_e_r}$ [rad/s]	$\omega_{roll_i_r}$ [rad/s]	$\omega_{roll_e_r}$ [rad/s]	QV _{i_r} [W]	QV _{e_r} [W]	PVmax _{i_r} [MPa·m/s]	PVmax _{e_r} [MPa·m/s]
1	0.4	0.0	12.6	0.0	12.6	0.0	3.9	0.0	0.0	0.4	0.0	11.9	0.0	11.8	0.0	3.6
2	0.4	0.0	12.6	0.0	13.9	0.0	4.2	0.0	0.0	0.4	0.0	11.9	0.0	13.1	0.0	3.8
3	0.4	0.0	12.6	0.0	15.4	0.0	4.4	0.0	0.0	0.4	0.0	11.9	0.0	14.4	0.0	4.0
4	0.4	0.0	12.6	0.0	16.9	0.0	4.6	0.0	0.0	0.4	0.0	11.9	0.0	15.8	0.0	4.2
5	0.4	0.0	12.6	0.0	18.4	0.0	4.9	0.0	0.0	0.4	0.0	11.9	0.0	17.3	0.0	4.5
6	0.4	0.0	12.6	0.0	20.0	0.0	5.1	0.0	0.0	0.4	0.0	11.9	0.0	18.7	0.0	4.7
7	0.4	0.0	12.6	0.0	21.5	0.0	5.3	0.0	0.0	0.4	0.0	11.9	0.0	20.2	0.0	4.9
8	0.4	0.0	12.6	0.0	23.1	0.0	5.5	0.0	0.0	0.4	0.0	11.9	0.0	21.7	0.0	5.1
9	0.4	0.0	12.6	0.0	24.5	0.0	5.7	0.0	0.0	0.4	0.0	11.9	0.0	23.0	0.0	5.2
10	0.4	0.0	12.6	0.0	25.9	0.0	5.9	0.0	0.0	0.4	0.0	11.9	0.0	24.3	0.0	5.4
11	0.4	0.0	12.6	0.0	27.1	0.0	6.1	0.0	0.0	0.4	0.0	11.9	0.0	25.5	0.0	5.5
12	0.4	0.0	12.6	0.0	28.2	0.0	6.2	0.0	0.0	0.4	0.0	11.9	0.0	26.5	0.0	5.7
13	0.4	0.0	12.6	0.0	29.0	0.0	6.3	0.0	0.0	0.4	0.0	11.9	0.0	27.3	0.0	5.8
14	0.4	0.0	12.6	0.0	29.6	0.0	6.4	0.0	0.0	0.4	0.0	11.9	0.0	27.9	0.0	5.8
15	0.4	0.0	12.6	0.0	30.0	0.0	6.4	0.0	0.0	0.4	0.0	11.9	0.0	28.2	0.0	5.9
16	0.4	0.0	12.6	0.0	30.2	0.0	6.5	0.0	0.0	0.4	0.0	11.9	0.0	28.3	0.0	5.9
17	0.4	0.0	12.6	0.0	30.0	0.0	6.4	0.0	0.0	0.4	0.0	11.9	0.0	28.2	0.0	5.9
18	0.4	0.0	12.6	0.0	29.6	0.0	6.4	0.0	0.0	0.4	0.0	11.9	0.0	27.9	0.0	5.8
19	0.4	0.0	12.6	0.0	29.0	0.0	6.3	0.0	0.0	0.4	0.0	11.9	0.0	27.3	0.0	5.8
20	0.4	0.0	12.6	0.0	28.2	0.0	6.2	0.0	0.0	0.4	0.0	11.9	0.0	26.5	0.0	5.7
21	0.4	0.0	12.6	0.0	27.1	0.0	6.1	0.0	0.0	0.4	0.0	11.9	0.0	25.5	0.0	5.5
22	0.4	0.0	12.6	0.0	25.9	0.0	5.9	0.0	0.0	0.4	0.0	11.9	0.0	24.3	0.0	5.4
23	0.4	0.0	12.6	0.0	24.5	0.0	5.7	0.0	0.0	0.4	0.0	11.9	0.0	23.0	0.0	5.2
24	0.4	0.0	12.6	0.0	23.1	0.0	5.5	0.0	0.0	0.4	0.0	11.9	0.0	21.7	0.0	5.1
25	0.4	0.0	12.6	0.0	21.5	0.0	5.3	0.0	0.0	0.4	0.0	11.9	0.0	20.2	0.0	4.9
26	0.4	0.0	12.6	0.0	20.0	0.0	5.1	0.0	0.0	0.4	0.0	11.9	0.0	18.7	0.0	4.7
27	0.4	0.0	12.6	0.0	18.4	0.0	4.9	0.0	0.0	0.4	0.0	11.9	0.0	17.3	0.0	4.5
28	0.4	0.0	12.6	0.0	16.9	0.0	4.6	0.0	0.0	0.4	0.0	11.9	0.0	15.8	0.0	4.2
29	0.4	0.0	12.6	0.0	15.4	0.0	4.4	0.0	0.0	0.4	0.0	11.9	0.0	14.4	0.0	4.0
30	0.4	0.0	12.6	0.0	13.9	0.0	4.2	0.0	0.0	0.4	0.0	11.9	0.0	13.1	0.0	3.8
31	0.4	0.0	12.6	0.0	12.6	0.0	3.9	0.0	0.0	0.4	0.0	11.9	0.0	11.8	0.0	3.6
32	0.4	0.0	12.6	0.0	11.4	0.0	3.7	0.0	0.0	0.4	0.0	11.9	0.0	10.6	0.0	3.4
33	0.4	0.0	12.6	0.0	10.2	0.0	3.5	0.0	0.0	0.4	0.0	11.9	0.0	9.6	0.0	3.2
34	0.4	0.0	12.6	0.0	9.2	0.0	3.3	0.0	0.0	0.4	0.0	11.9	0.0	8.6	0.0	3.0
35	0.4	0.0	12.6	0.0	8.3	0.0	3.1	0.0	0.0	0.4	0.0	11.9	0.0	7.8	0.0	2.8
36	0.4	0.0	12.6	0.0	7.5	0.0	2.9	0.0	0.0	0.4	0.0	11.9	0.0	7.0	0.0	2.7
37	0.4	0.0	12.6	0.0	6.7	0.0	2.8	0.0	0.0	0.4	0.0	11.9	0.0	6.3	0.0	2.5

MESYS Shaft and Rolling bearing calculation

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Ball	$\omega_{spin_i_l}$ [rad/s]	$\omega_{spin_e_l}$ [rad/s]	$\omega_{roll_i_l}$ [rad/s]	$\omega_{roll_e_l}$ [rad/s]	QV _{i_l} [W]	QV _{e_l} [W]	PV _{max_i_l} [MPa·m/s]	PV _{max_e_l} [MPa·m/s]	$\omega_{spin_i_r}$ [rad/s]	$\omega_{spin_e_r}$ [rad/s]	$\omega_{roll_i_r}$ [rad/s]	$\omega_{roll_e_r}$ [rad/s]	QV _{i_r} [W]	QV _{e_r} [W]	PV _{max_i_r} [MPa·m/s]	PV _{max_e_r} [MPa·m/s]
38	1.4	11.8	12.6	0.9	17.4	128.1	5.7	154.7	12.6	0.7	1.6	11.8	127.7	8.3	158.9	3.3
39	12.1	11.6	12.6	11.7	140.6	15.6	34.2	13.0	12.3	11.4	12.4	11.8	16.5	131.7	14.1	31.0
40	12.2	11.6	12.6	11.7	131.7	33.3	33.4	17.4	12.3	11.5	12.5	11.8	35.4	123.4	18.9	30.3
41	12.2	11.5	12.6	11.8	124.0	54.6	32.6	21.4	12.3	11.5	12.5	11.8	58.2	116.2	23.4	29.6
42	12.2	11.5	12.6	11.8	117.7	76.4	32.0	24.8	12.2	11.5	12.5	11.8	81.5	110.3	27.3	29.1
43	12.2	11.5	12.5	11.8	112.9	96.3	31.6	27.6	12.2	11.5	12.5	11.8	102.7	105.8	30.4	28.8
44	12.2	11.5	12.5	11.8	109.5	112.0	31.3	29.6	12.2	11.5	12.5	11.8	119.6	102.7	32.6	28.6
45	12.2	11.5	12.5	11.8	107.5	122.1	31.2	30.8	12.2	11.5	12.5	11.8	130.3	100.8	34.0	28.4
46	12.2	11.5	12.5	11.8	106.9	125.6	31.1	31.3	12.2	11.5	12.5	11.8	134.0	100.2	34.4	28.4
47	12.2	11.5	12.5	11.8	107.5	122.1	31.2	30.8	12.2	11.5	12.5	11.8	130.3	100.8	34.0	28.4
48	12.2	11.5	12.5	11.8	109.5	112.0	31.3	29.6	12.2	11.5	12.5	11.8	119.6	102.7	32.6	28.6
49	12.2	11.5	12.5	11.8	112.9	96.3	31.6	27.6	12.2	11.5	12.5	11.8	102.7	105.8	30.4	28.8
50	12.2	11.5	12.6	11.8	117.7	76.4	32.0	24.8	12.2	11.5	12.5	11.8	81.5	110.3	27.3	29.1
51	12.2	11.5	12.6	11.8	124.0	54.6	32.6	21.4	12.3	11.5	12.5	11.8	58.2	116.2	23.4	29.6
52	12.2	11.6	12.6	11.7	131.7	33.3	33.4	17.4	12.3	11.5	12.5	11.8	35.4	123.4	18.9	30.3
53	12.1	11.6	12.6	11.7	140.6	15.6	34.2	13.0	12.3	11.4	12.4	11.8	16.5	131.7	14.1	31.0
54	1.4	11.8	12.6	0.9	17.4	128.1	5.7	154.7	12.6	0.7	1.6	11.8	127.7	8.3	158.9	3.3
55	0.4	0.0	12.6	0.0	6.7	0.0	2.8	0.0	0.0	0.4	0.0	11.9	0.0	6.3	0.0	2.5
56	0.4	0.0	12.6	0.0	7.5	0.0	2.9	0.0	0.0	0.4	0.0	11.9	0.0	7.0	0.0	2.7
57	0.4	0.0	12.6	0.0	8.3	0.0	3.1	0.0	0.0	0.4	0.0	11.9	0.0	7.8	0.0	2.8
58	0.4	0.0	12.6	0.0	9.2	0.0	3.3	0.0	0.0	0.4	0.0	11.9	0.0	8.6	0.0	3.0
59	0.4	0.0	12.6	0.0	10.2	0.0	3.5	0.0	0.0	0.4	0.0	11.9	0.0	9.6	0.0	3.2
60	0.4	0.0	12.6	0.0	11.4	0.0	3.7	0.0	0.0	0.4	0.0	11.9	0.0	10.6	0.0	3.4