Setrvačníky

i Výpočet bez chyb.
ii Informace o projektu

? **Kapitola výpočtů**

1.0 Jednotky výpočtu, konverze jednotek

1.1 Jednotky výpočtu: SI Units (N, mm, kW...)

1.2 **Konverze jednotek**

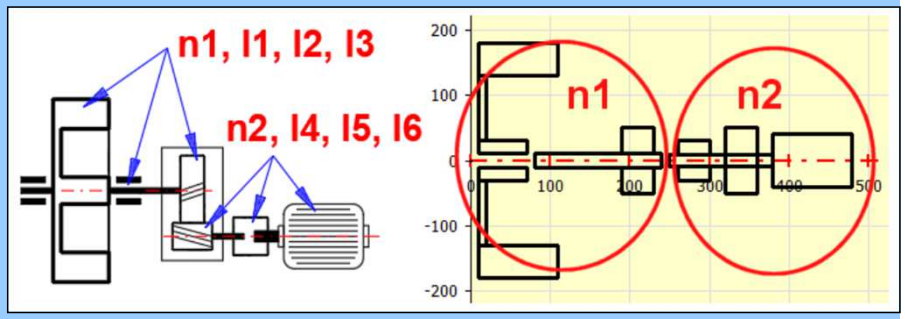
Délka	1	m	39.37007874	inch
Plocha	1	m²	1550.0031	inch²
Hustota	1	kg/m³	0.062427961	lb/ft³
Hmotnost	1	kg	2.204624	lb
Setrvačnost	1	kg·m²	23.73037	lb·ft²

Rychlost	1	m/s	3.280839895	ft/s
Zrychlení	1	m/s²	3.280839895	ft/s²
Otáčky	1	/s	6.283185307	rad/sec
Síla	1	N	0.224809	lbf
Moment	1	Nm	0.737561	lbf·ft
Výkon	1	kW	1.34102209	HP
Energie	1	J	0.737562149	ft·lbf
Tlak	1	MPa	0.145037	kpsi

2.0 Návrh momentu setrvačnosti, výpočet rozměrů setrvačníku, pevnostní kontrola, gyroskopický moment

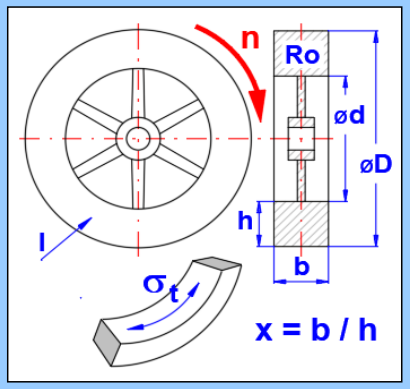
2.1 Orientační návrh momentu setrvačnosti setrvačníku

2.2	Typ stroje		01. Vznětový motor 4 dobý, 1 válec: [C = 63]	
2.3	Konstanta "C" pro návrh "I"	C	63.00	[~]
2.4	Jmenovitý výkon stroje	Pw	11	[kW]
2.5	Otáčky setrvačníku	n	4000.00	[/min]
2.6	Stupeň nerovnoměrnosti chodu	δ	0.0100	[~]
2.7	Moment setrvačnosti	I	0.2338875	[kg*m²]

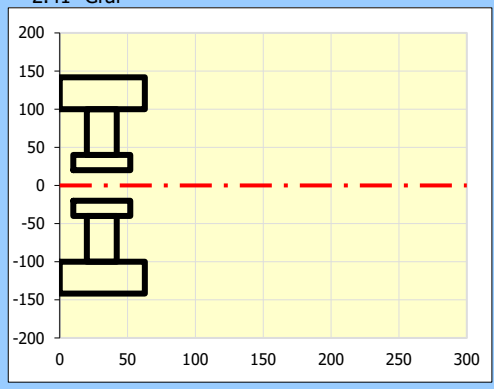


2.8 Předběžný návrh rozměrů setrvačníku

2.9	Požadovaný moment setrvačnosti	I	0.2338875	[kg*m²]
2.10	Hustota materiálu setrvačníku	Ro	7800	[kg/m³]
2.11	Poměr šířky k výšce věnce setrvačníku (b/h)	x	1.5	[~]
2.12	Vnitřní průměr	d	200.000	[mm]
2.13	Vnější průměr	D	283.617	[mm]
2.14	Šířka	b	62.712	[mm]
2.15	Výška	h	41.808	[mm]
2.16	Hmotnost	m	15.536	[kg]
2.17	Moment setrvačnosti	I	0.233887497	[kg*m²]



2.41 Graf



2.18 Maximální otáčky, maximální napětí

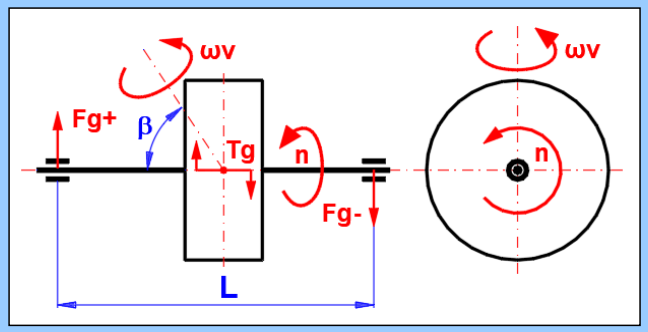
2.19	Maximální dovolené napětí	σtmax	100.000	[MPa]
2.20	Poisonova konstanta	ν	0.300	[~]
2.21	Otáčky setrvačníku	n	4000 < 7984	[/min]
2.22	Úhlová rychlost	ω	418.879	[rad/s]
2.23	Tangenciální napětí na vnitřním průměru	σt	25.100	[MPa]
2.24	Přesun hodnot do řádku tabulky číslo:		1	

2.25 Rozměry a výpočet setrvačníku (setrvačných hmot)

	Počet	a	D	d	b	Ro	ν	n	ω	rg	m	I	Ired	Ek	r	σt
ID	[-]	[mm]	[mm]	[mm]	[mm]	[kg/m³]	[~]	[/min]	[rad/s]	[mm]	[kg]	[kg*m²]	[kg*m²]	[J]	dx [mm]	[MPa]
1	1	0	283.6166	200	62.71246	7800	0.3	4000	418.879	122.698	15.53574	0.233887	0.233887	20518.91	200	25.10042
2	1	20	200	80	22	7800	0.3	4000	418.879	76.15773	4.528417	0.026265	0.026265	2304.208	80	11.67403
3	1	10	80	40	42	7800	0.3	4000	418.879	31.62278	1.235023	0.001235	0.001235	108.3483	40	1.902333

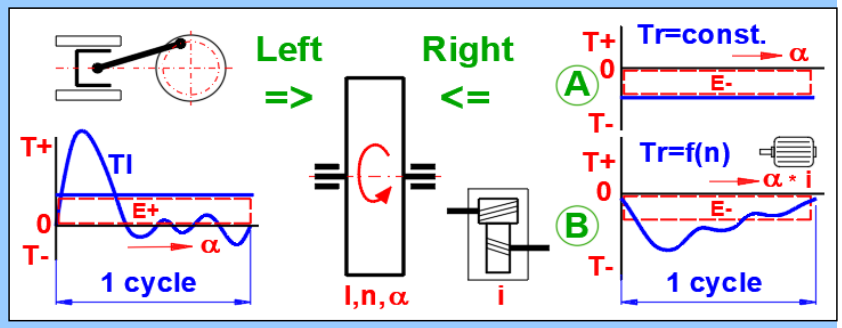
4	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
5	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
6	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
7	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
8	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
9	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
10	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
11	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
12	1	0	0	0	0	7800	0.3	1000	104.7198	---	0	0	0	0	0	---
										Σ	**21.2992**	**0.26139**	**0.26139**	**22931.5**		

2.26	**Roztočení setrvačníku**			
2.27	Moment setrvačnosti	I	0.26138734	[kg*m²]
2.28	Počáteční otáčky	n1	0	[/min]
2.29	Koncové otáčky	n2	4000	[/min]
2.30	Moment	T	20	[Nm]
2.31	Energie	E	22930.98859	[J]
2.32	Čas pro dosažení n2	t	5.474483559	[s]
2.33	**Gyroskopický moment**			
2.34	Moment setrvačnosti	I	0.26138734	[kg*m²]
2.35	Otáčky setrvačníku	n	4000	[/min]
2.36	Úhel osy otáčení setrvačníku	β	90	[°]
2.37	Úhlová rychlost otáčení setrvačníku	ωv	0.5	[rad/s]
2.38	Gyroskopický moment	Tg	54.74483654	[Nm]
2.39	Vzdálenost ložisek	L	200	[mm]
2.40	Síla od gyroskopického momentu	Fg	273.7241827	[N]

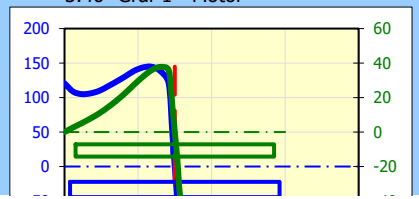


3.0 Analýza (výpočet) setrvačníku

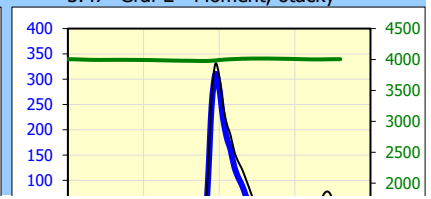
3.1	**Požadované parametry setrvačníku**			
3.2	Moment setrvačnosti	I	0.196962176	[kg*m²]
3.3	Stupeň nerovnoměrnosti chodu	δ	0.01	[~]
3.4	Požadované střední otáčky setrvačníku	nreq	4000	[/min]
3.5	Požadovaná střední úhlová rychlost	ωm	418.879020	[rad/s]
3.6	**Nastavení a spuštění analýzy**			
3.7	**A. Analýza - konstantní moment (pravá strana)**			
3.8	Výkon (příkon)	P	-10.92119521	[kW]
3.9	Spuštění analýzy			
3.10	**B. Analýza - elektromotor / generátor (pravá strana)**			
3.11	***Výběr motoru / generátoru***			
3.12	Typ motoru / generátoru		3000 / 2p ... 50Hz	
3.13	Doporučený jmenovitý výkon od / do	P	-13.1 / -53.9	[kW]
3.14	Jmenovitý výkon	P	-15	[kW]
3.15	Režim práce		Jako motor-generátor	
3.16	Synchronní otáčky	ns	3000	[/min]
3.17	Jmenovité otáčky	nr	2933 / 2933	[/min]
3.18	Jmenovitý moment	Tr	48.84077736	[Nm]
3.19	Koeficient rozběhového momentu	Tzcoeff	2.47 / 2.47	[~]



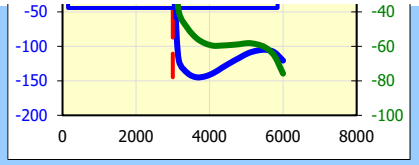
3.46 Graf 1 - Motor

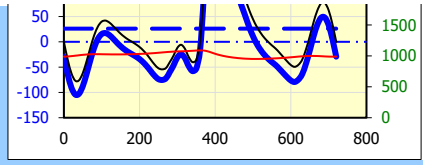


3.47 Graf 2 - Moment, otáčky

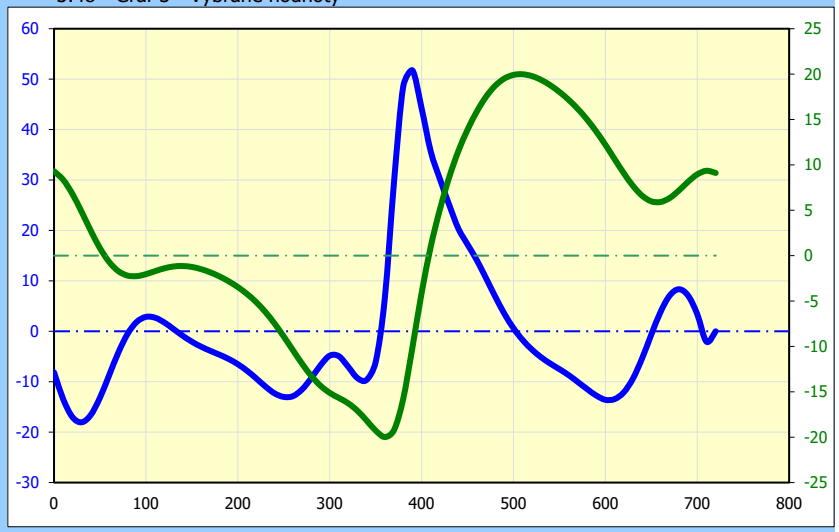


3.20	Rozběhový moment	Tz	120.6367201		[Nm]
3.21	Moment setrvačnosti motoru / Ie * i	Ie	0.068	0.039504	[kg*m²]
3.22	Převodový poměr setrvačník / motor	i	0.762	0.762	
3.23	Využitý výkon min/max	P	-14.22	-7.034	[kW]
3.24	***Nastavení parametrů iterace***				
3.25	Počet kroků iterace / citlivost		10	5	
3.26	Spuštění analýzy				
3.27	**Výsledky analýzy - B (elektromotor / generátor)**				
3.28	**Hodnoty z levé a pravé strany**		**Levá**	**Pravá**	
3.29	Střední točivý moment	Tm	26.07243	-26.18154	[Nm]
3.30	Energie dodaná setrvačníku	E+	528.8606	0	[J]
3.31	Energie odebraná setrvačníku	E-	-201.2247	-329.0069	[J]
3.32	Součet energie+- / odchylka v procentech	E	**-1.6366**	**-0.50%**	[J]
3.33	**Setrvačník**				
3.34	Střední otáčky setrvačníku	n	3995.874	3995.836	[/min]
3.35	Střední úhlová rychlost	ωm	418.446958		[rad/s]
3.36	Otáčky na začátku a konci cyklu	n1,n73	4005.171	4004.981	[/min]
3.37	Minimální / maximální otáčky	nmin/max	3975.895	4015.854	[/min]
3.38	Střední otáčky setrvačníku	nm	3995.874133		[/min]
3.39	Minimální / maximální úhlová rychlost	ωmin/max	416.3547	420.5392	[rad/s]
3.40	Střední úhlová rychlost	ωm	418.4469607		[rad/s]
3.41	Stupeň nerovnoměrnosti chodu	δ	0.01		[~]
3.42	Moment setrvačnosti	I	0.196962176		[kg*m²]
3.43	**Definice tabulky momentů (levá strana)**				
3.44	Počet platných řádků tabulky	nr	73	73	
3.45	**Tabulka zatížení a výsledků**				





3.48 Graf 3 - Vybrané hodnoty



H: +-dE [J] K: dn [/min]

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
	Úhel	**Levá**	**Vstup**	**Pravá**	**Motor**			**Setrvačník**						**3.49**	**C. Uživatelská analýza**		
	α	Tl	Ti=Tl+Tr	Tr=Te*i	ne	Te	Pwe	+-dE	E	n	dn	ω	dω	Pw			
ID	[°]	[Nm]	[Nm]	[Nm]	[/min]	[Nm]	[kW]	[J]	[J]	[/min]	[/min]	[rad/s]	[rad/s]	[kW]	30	30	1
1	0	0	-29.33033	-29.29332	3052.722	-38.43283	-12.28531	-8.130158	17324.16	4005.171	9.296446	419.4205	0.973522	12.30084	0.000134	-62.3291	-95.14428
2	10	-34.90361	-63.83442	-28.89528	3052.006	-37.9106	-12.11554	-13.4755	17316.03	4004.231	8.35653	419.3221	0.875094	26.76521	0.000134	-62.23829	-95.15765
3	20	-62.3149	-90.58347	-28.23533	3050.818	-37.04474	-11.83422	-16.99524	17302.55	4002.672	6.798161	419.1589	0.711902	37.96607	0.000134	-62.08774	-95.17981
4	30	-76.73453	-104.1676	-27.40264	3049.319	-35.95225	-11.47957	-18.04077	17285.56	4000.706	4.831888	418.953	0.505994	43.63811			
5	40	-76.01871	-102.5644	-26.51827	3047.728	-34.79197	-11.10329	-16.58076	17267.52	3998.618	2.743594	418.7343	0.287308	42.94407			
6	50	-61.70739	-87.43713	-25.70507	3046.264	-33.72504	-10.75763	-13.15952	17250.93	3996.697	0.823339	418.5332	0.08622	36.59264			
7	60	-38.27803	-63.35984	-25.05938	3045.102	-32.8779	-10.48341	-8.696835	17237.77	3995.173	-0.701351	418.3735	-0.073445	26.50613			
8	70	-11.64514	-36.29854	-24.63253	3044.334	-32.31787	-10.30224	-4.205623	17229.08	3994.165	-1.709304	418.268	-0.178998	15.1814			
9	80	12.55172	-11.89435	-24.42607	3043.962	-32.047	-10.21464	-0.523348	17224.87	3993.677	-2.196822	418.2169	-0.230051	4.97405			
10	90	30.31728	5.897216	-24.40038	3043.916	-32.01329	-10.20374	1.862702	17224.35	3993.617	-2.257493	418.2106	-0.236404	-2.466096			
11	100	39.95935	15.44778	-24.49182	3044.081	-32.13326	-10.24254	2.858682	17226.21	3993.833	-2.041557	418.2332	-0.213791	-6.460298			
12	110	41.96243	17.3103	-24.63216	3044.333	-32.31738	-10.30208	2.688162	17229.07	3994.164	-1.710183	418.2679	-0.17909	-7.23981			
13	120	38.27803	13.49377	-24.76411	3044.571	-32.4905	-10.35808	1.746537	17231.76	3994.476	-1.398601	418.3005	-0.146461	-5.644034			
14	130	31.39011	6.520066	-24.84983	3044.725	-32.60297	-10.39446	0.448184	17233.51	3994.678	-1.196175	418.3217	-0.125263	-2.727284			
15	140	23.50764	-1.384253	-24.87183	3044.764	-32.63183	-10.40379	-0.884221	17233.95	3994.73	-1.144231	418.3271	-0.119824	0.579028			

16	150	16.09997	-8.748177	-24.82843	3044.686	-32.57489	-10.38537	-2.067386	17233.07	3994.627	-1.246711	418.3164	-0.130555	3.659236			
17	160	9.803822	-14.94232	-24.72696	3044.504	-32.44176	-10.34231	-3.050115	17231	3994.388	-1.486329	418.2913	-0.155648	6.249783			
18	170	4.586322	-20.00942	-24.57723	3044.234	-32.24532	-10.27878	-3.875861	17227.95	3994.034	-1.839874	418.2543	-0.192671	8.368411			
19	180	3.14E-15	-24.40467	-24.38696	3043.892	-31.99568	-10.19805	-4.646978	17224.08	3993.585	-2.289178	418.2072	-0.239722	10.20546			
20	190	-4.670173	-28.84577	-24.1588	3043.481	-31.69634	-10.10128	-5.490196	17219.43	3993.046	-2.82794	418.1508	-0.296141	12.06099			
21	200	-10.16228	-34.06724	-23.8892	3042.996	-31.34262	-9.986961	-6.524887	17213.94	3992.41	-3.464557	418.0842	-0.362808	14.24192			
22	210	-17.11917	-40.70246	-23.56874	3042.419	-30.92217	-9.851122	-7.813146	17207.41	3991.653	-4.221284	418.0049	-0.442052	17.01258			
23	220	-25.63151	-48.82959	-23.18492	3041.728	-30.41861	-9.688497	-9.339953	17199.6	3990.747	-5.127605	417.91	-0.536962	20.40487			
24	230	-35.46087	-58.19839	-22.72599	3040.902	-29.81649	-9.494139	-10.94791	17190.26	3989.663	-6.211306	417.7965	-0.650446	24.31329			
25	240	-45.05792	-67.25547	-22.18789	3039.934	-29.1105	-9.266386	-12.31052	17179.31	3988.392	-7.481952	417.6635	-0.783508	28.08808			
26	250	-52.22254	-73.81273	-21.58261	3038.845	-28.31637	-9.010371	-13.01414	17167	3986.963	-8.911228	417.5138	-0.933182	30.81556			
27	260	-54.37049	-75.31838	-20.94249	3037.692	-27.47654	-8.739821	-12.86312	17153.99	3985.451	-10.42275	417.3555	-1.091468	31.43222			
28	270	-51.76928	-72.08208	-20.30957	3036.553	-26.64615	-8.472508	-11.51081	17141.13	3983.957	-11.9173	417.199	-1.247977	30.07036			
29	280	-40.07783	-59.82208	-19.74299	3035.534	-25.90279	-8.233381	-9.273467	17129.61	3982.619	-13.2552	417.0589	-1.388082	24.94749			
30	290	-27.15798	-46.44402	-19.28639	3034.712	-25.30374	-8.04079	-6.740035	17120.34	3981.541	-14.33339	416.946	-1.500989	19.36322			
31	300	-11.83821	-30.79109	-18.95445	3034.114	-24.86824	-7.900846	-4.833058	17113.6	3980.757	-15.1172	416.8639	-1.58307	12.83475			
32	310	-5.877769	-24.59167	-18.71639	3033.686	-24.5559	-7.800513	-4.954187	17108.77	3980.195	-15.67935	416.805	-1.641937	10.24918			
33	320	-13.71023	-32.17913	-18.47233	3033.247	-24.23569	-7.697679	-7.002642	17103.81	3979.618	-16.25566	416.7447	-1.702289	13.40949			
34	330	-29.94264	-48.06524	-18.1273	3032.626	-23.78301	-7.552351	-9.240667	17096.81	3978.804	-17.07041	416.6594	-1.787609	20.02536			
35	340	-40.15942	-57.825	-17.67188	3031.806	-23.1855	-7.360621	-9.661104	17087.57	3977.728	-18.14581	416.5467	-1.900225	24.08504			
36	350	-35.69545	-52.88309	-17.19561	3030.949	-22.56063	-7.160222	-6.088529	17077.91	3976.604	-19.27045	416.429	-2.017997	22.02043			
37	360	-8.44E-14	-16.88631	-16.89539	3030.408	-22.16674	-7.033957	6.608148	17071.82	3975.895	-19.97937	416.3547	-2.092235	7.030178			
38	370	109.8232	92.61011	-17.22123	3030.995	-22.59424	-7.170999	29.63092	17078.43	3976.664	-19.20995	416.4353	-2.011661	-38.56328			
39	380	265.613	246.9352	-18.68151	3033.623	-24.51014	-7.785814	48.56289	17108.06	3980.112	-15.76171	416.7964	-1.650562	-102.9141			
40	390	330.6303	309.5545	-21.07209	3037.926	-27.64657	-8.794578	51.73223	17156.62	3985.757	-10.11674	417.3875	-1.059423	-129.1947			
41	400	306.8797	283.2532	-23.61495	3042.502	-30.98281	-9.870709	44.22083	17208.35	3991.762	-4.112155	418.0163	-0.430624	-118.3957			
42	410	249.284	223.4802	-25.78557	3046.409	-33.83066	-10.79184	35.62458	17252.58	3996.888	1.01343	418.5531	0.106126	-93.53143			
43	420	212.3032	184.7474	-27.53221	3049.553	-36.12225	-11.53473	30.13481	17288.2	4001.012	5.137858	418.985	0.538035	-77.40068			
44	430	189.6085	160.5722	-29.00829	3052.209	-38.05887	-12.16373	25.08203	17318.33	4004.498	8.623393	419.35	0.90304	-67.33097			
45	440	157.1145	126.8468	-30.2359	3054.419	-39.66949	-12.68767	20.34689	17343.42	4007.396	11.52219	419.6536	1.206601	-53.22779			
46	450	137.5773	106.3114	-31.23109	3056.21	-40.97518	-13.11296	17.22038	17363.76	4009.746	13.87219	419.8997	1.452692	-44.63682			
47	460	123.1299	91.01961	-32.07291	3057.725	-42.07965	-13.47309	14.12451	17380.98	4011.734	15.86002	420.1078	1.660857	-38.23523			
48	470	103.6379	70.8354	-32.76308	3058.967	-42.98514	-13.7686	10.56184	17395.11	4013.364	17.48974	420.2785	1.831521	-29.7684			
49	480	83.51433	50.19441	-33.27898	3059.896	-43.66201	-13.98965	6.922016	17405.67	4014.582	18.70795	420.4061	1.959092	-21.10048			
50	490	62.78496	29.12605	-33.617	3060.504	-44.10549	-14.13456	3.498904	17412.59	4015.38	19.50615	420.4896	2.042679	-12.2463			
51	500	44.79865	10.96844	-33.78784	3060.812	-44.32963	-14.20782	0.605556	17416.09	4015.784	19.90956	420.5319	2.084924	-4.612238			
52	510	29.83052	-4.029277	-33.81741	3060.865	-44.36842	-14.2205	-1.735974	17416.7	4015.854	19.97937	420.5392	2.092235	1.694344			
53	520	17.91122	-15.86352	-33.73265	3060.712	-44.25722	-14.18415	-3.61824	17414.96	4015.653	19.77923	420.5182	2.071276	6.670407			
54	530	7.999066	-25.59845	-33.55598	3060.394	-44.02543	-14.1084	-5.143835	17411.34	4015.236	19.36205	420.4745	2.027589	10.76271			
55	540	1.56E-14	-33.34555	-33.30478	3059.942	-43.69586	-14.00071	-6.401305	17406.2	4014.643	18.76889	420.4124	1.965474	14.01785			
56	550	-6.976081	-40.00801	-32.99213	3059.379	-43.28566	-13.86673	-7.511719	17399.8	4013.905	18.03061	420.3351	1.888161	16.81553			
57	560	-13.40613	-46.06996	-32.62517	3058.719	-42.80421	-13.70953	-8.697097	17392.29	4013.038	17.16409	420.2444	1.79742	19.35921			
58	570	-21.35389	-53.59144	-32.2002	3057.954	-42.24666	-13.52757	-10.05534	17383.59	4012.035	16.1606	420.1393	1.692334	22.51421			
59	580	-29.88971	-61.63426	-31.70874	3057.07	-41.60185	-13.31725	-11.44742	17373.53	4010.874	15.00007	420.0178	1.570804	25.88558			
60	590	-38.36039	-69.54353	-31.14905	3056.062	-40.86755	-13.07788	-12.73387	17362.09	4009.553	13.67847	419.8794	1.432406	29.19774			

61	600	-45.81742	-76.37583	-30.52626	3054.941	-40.05044	-12.8117	-13.58649	17349.35	4008.082	12.20784	419.7254	1.278402	32.05451				
62	610	-49.42224	-79.31384	-29.86151	3053.745	-39.1783	-12.5278	-13.44209	17335.77	4006.512	10.63814	419.561	1.114024	33.27454				
63	620	-45.48953	-74.72114	-29.20358	3052.561	-38.31508	-12.24703	-12.10365	17322.32	4004.959	9.084525	419.3983	0.951329	31.33561				
64	630	-35.33928	-63.97642	-28.61093	3051.494	-37.53753	-11.9943	-9.37623	17310.22	4003.559	7.685086	419.2517	0.80478	26.82025				
65	640	-15.29081	-43.46727	-28.15169	3050.668	-36.93501	-11.79858	-5.336228	17300.84	4002.475	6.600658	419.1382	0.691219	18.21745				
66	650	10.23284	-17.68139	-27.89027	3050.197	-36.59203	-11.68721	-0.635853	17295.51	4001.857	5.983354	419.0735	0.626575	7.409259				
67	660	38.27803	10.39505	-27.85912	3050.141	-36.55115	-11.67394	3.842397	17294.87	4001.784	5.909791	419.0658	0.618872	-4.355891				
68	670	61.70739	33.63558	-28.04736	3050.48	-36.79813	-11.75413	7.089017	17298.71	4002.228	6.354304	419.1124	0.665421	-14.09605				
69	680	76.01871	47.59857	-28.39461	3051.105	-37.25372	-11.90209	8.334256	17305.8	4003.048	7.174277	419.1982	0.751288	-19.95177				
70	690	76.73453	47.90497	-28.80277	3051.839	-37.78922	-12.07609	7.072332	17314.14	4004.012	8.138069	419.2992	0.852217	-20.08504				
71	700	62.3149	33.13798	-29.14904	3052.463	-38.24353	-12.22376	3.37711	17321.21	4004.83	8.955748	419.3848	0.937844	-13.89654				
72	710	34.90361	5.560849	-29.31437	3052.76	-38.46044	-12.29429	-2.066507	17324.59	4005.22	9.346139	419.4257	0.978725	-2.332191				
73	720	1.02E-13	-29.24128	-29.2132	3052.578	-38.32771	-12.25114		17322.52	4004.981	9.107257	419.4007	0.95371	12.26291				
74																		
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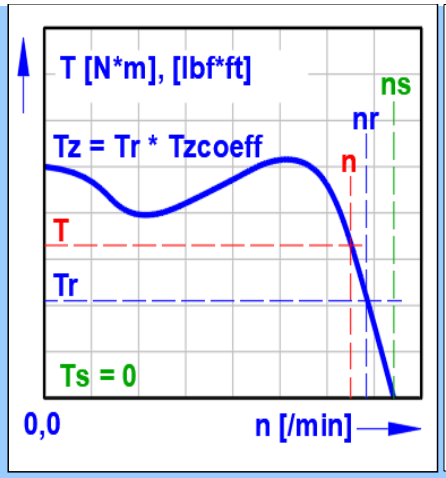
? **Kapitola doplňků**

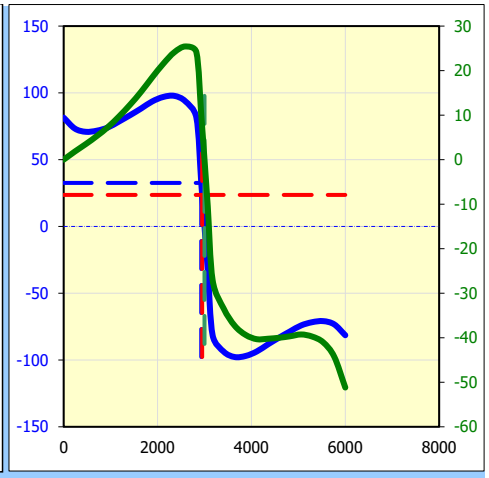
4.0 **Momentové křivky motorů, výkony, momenty setrvačnosti, hmotnost, účinnost**

4.1 **Parametry asynchronniho eletromotoru (generátoru)**

4.18 Graf momentu a výkonu

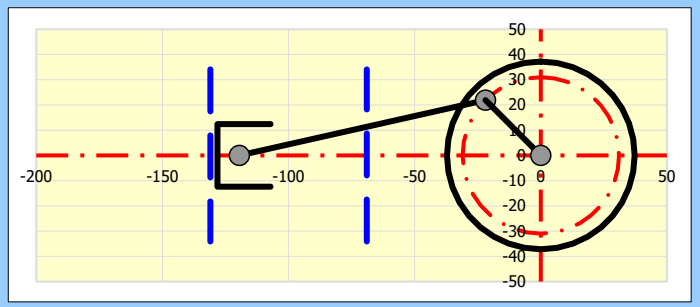
4.2	Typ motoru / generátoru		3000 / 2p ... 50Hz		
4.3	Jmenovitý výkon	Pr	10		[kW]
4.4	Režim práce		Jako motor-generátor		
4.5	Synchronní otáčky	ns	3000		[/min]
4.6	Jmenovité otáčky	nr	2931	2931	[/min]
4.7	Jmenovitý moment	Tr	32.58273627		[Nm]
4.8	Koeficient rozběhového momentu	Tzcoeff	2.5	2.5	[~]
4.9	Rozběhový moment	Tz	81.45684067		[Nm]
4.10	Hmotnost motoru (přibližně)	m	120		[kg]
4.11	Moment setrvačnosti (přibližně)	Ie	0.04529		[kg*m²]
4.12	Jmenovitá účinnost IE1/IE2	ηN	87.1	89	[%]
4.13	Jmenovitá účinnost IE3/IE4	ηN	90.9	92.3	[%]
4.14	**Výpočet momentu a výkonu pro zadané otáčky**				
4.15	Otáčky	n	2950		[/min]
4.16	Moment	T	23.61067845		[Nm]
4.17	Výkon	Pw	7.293350936		[kW]

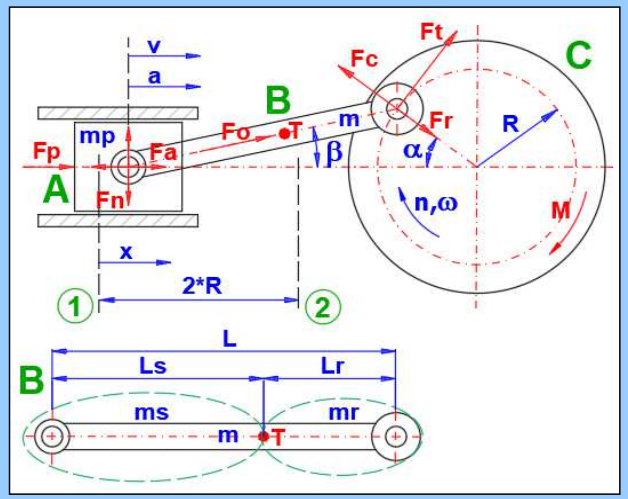




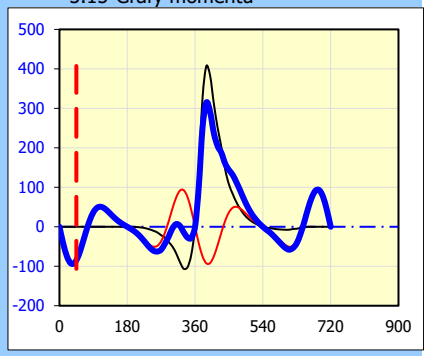
5.0 Klikový mechanismus

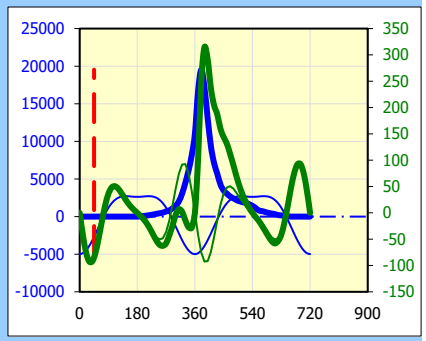
5.1	**Parametry klikoveho mechanismu**				
5.2	Hmotnost pusuvné části	mp	0.4		[kg]
5.3	Hmotnost ojnice (celková)	m	1		[kg]
5.4	Délka ojnice	L	100.00		[mm]
5.5	Poloha těžiště ojnice (T)	Ls	70.00	< 100	[mm]
5.6	Rozdělená hmotnost ojnice	ms,mr	0.3	0.7	[kg]
5.7	Poloměr kliky	R	31.00		[mm]
5.8	Otáčky kliky	n	4000		[/min]
5.9	Úhlová rychlost kliky	ω	418.8790205		[rad/s]
5.10	Klikový poměr (R / L)	λ	0.31		[~]
5.11	Odstředivá síla pro mr	Fc	3807.474053		[N]
5.12	Střední pístová rychlost	vs	8.266666667		[m/s]
5.13	Úhel natočení	α	45		[°]





5.15 Grafy momentů





5.16 Grafy vybraných hodnot

Modrá křivka (vlevo, silná)	1.	05. Fp [N]
Modrá křivka (vlevo, slabá)	2.	06. Fa [N]
Zelená křivka (vpravo, silná)	3.	20. ΣM [Nm]
Zelená křivka (vpravo, slabá)	4.	19. Ma [Nm]

5.14 Tabulka

	A	B	C	D	E	F	G	H	I	J	K	L	M	Grafy vybraných hodnot			
	α	Fp	x	v	a	Fa	Fn	Fo	Ft	Fr	Mp	Ma	M	1. Fp	2. Fa	3. ΣM	4. Ma
ID	[°]	[N]	[mm]	[m/s]	[m/s²]	[N]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[N]	[N]	[Nm]	[Nm]
1	0	0	0	0	7125.416	-4987.791	0	-4987.791	0	-4987.791	0	0	0	0	-4987.791	0	0

2	10	0	0.615848	2.943254	6941.093	-4858.765	-261.9317	-4865.82	-1358.872	-4739.466	0	-42.12504	-42.12504	0	-4858.765	-42.12504	-42.12504
3	20	0	2.431607	5.734964	6402.901	-4482.031	-477.9067	-4507.437	-2426.053	-4048.277	0	-75.20764	-75.20764	0	-4482.031	-75.20764	-75.20764
4	30	0	5.354462	8.235686	5553.611	-3887.528	-609.9382	-3935.085	-2987.44	-3061.729	0	-92.61065	-92.61065	0	-3887.528	-92.61065	-92.61065
5	40	0	9.237933	10.32889	4459.506	-3121.654	-634.7635	-3185.538	-2959.572	-1983.308	0	-91.74672	-91.74672	0	-3121.654	-91.74672	-91.74672
6	50	0	13.89327	11.92941	3203.482	-2242.437	-548.2019	-2308.474	-2402.401	-1021.464	0	-74.47444	-74.47444	0	-2242.437	-74.47444	-74.47444
7	60	0	19.10375	12.98862	1876.541	-1313.579	-366.0934	-1363.64	-1490.246	-339.7431	0	-46.19763	-46.19763	0	-1313.579	-46.19763	-46.19763
8	70	0	24.6403	13.49589	568.6537	-398.0576	-121.213	-416.1039	-453.3704	-22.24073	0	-14.05448	-14.05448	0	-398.0576	-14.05448	-14.05448
9	80	0	30.27702	13.47636	-639.9631	447.9742	143.6187	470.433	488.6655	-63.64689	0	15.14863	15.14863	0	447.9742	15.14863	15.14863
10	90	0	35.805	12.98525	-1686.167	1180.317	384.8577	1241.476	1180.317	-384.8577	0	36.58983	36.58983	0	1180.317	36.58983	36.58983
11	100	0	41.04321	12.09959	-2528.994	1770.296	567.5496	1859.048	1555.703	-866.3359	0	48.22681	48.22681	0	1770.296	48.22681	48.22681
12	110	0	45.84555	10.9084	-3152.012	2206.408	671.8761	2306.438	1633.687	-1385.993	0	50.64431	50.64431	0	2206.408	50.64431	50.64431
13	120	0	50.10375	9.502495	-3562.708	2493.896	695.0469	2588.939	1490.246	-1848.876	0	46.19763	46.19763	0	2493.896	46.19763	46.19763
14	130	0	53.74611	7.965142	-3789.081	2652.357	648.4138	2730.465	1222.084	-2201.616	0	37.88461	37.88461	0	2652.357	37.88461	37.88461
15	140	0	56.73269	6.364622	-3873.906	2711.734	551.4096	2767.229	915.2028	-2431.748	0	28.37129	28.37129	0	2711.734	28.37129	28.37129
16	150	0	59.04804	4.749564	-3867.444	2707.211	424.751	2740.329	626.8063	-2556.889	0	19.43099	19.43099	0	2707.211	19.43099	19.43099
17	160	0	60.69255	3.14747	-3819.543	2673.68	285.0872	2688.836	381.6838	-2609.943	0	11.8322	11.8322	0	2673.68	11.8322	11.8322
18	170	0	61.67393	1.566476	-3772.135	2640.495	142.3467	2644.329	178.5554	-2625.098	0	5.535216	5.535216	0	2640.495	5.535216	5.535216
19	180	0	62	1.1E-15	-3753.082	2627.157	9.98E-14	2627.157	1.22E-13	-2627.157	0	3.79E-15	3.79E-15	0	2627.157	3.79E-15	3.79E-15
20	190	40	61.67393	-1.566476	-3772.135	2640.495	-144.5031	2684.387	-181.2602	-2664.865	-0.083851	-5.535216	-5.619068	40	2640.495	-5.619068	-5.535216
21	200	81	60.69255	-3.14747	-3819.543	2673.68	-293.724	2770.295	-393.2471	-2689.012	-0.35846	-11.8322	-12.19066	81	2673.68	-12.19066	-11.8322
22	210	142	59.04804	-4.749564	-3867.444	2707.211	-447.0303	2884.066	-659.6838	-2691.004	-1.019204	-19.43099	-20.4502	142	2707.211	-20.4502	-19.43099
23	220	203	56.73269	-6.364622	-3873.906	2711.734	-592.688	2974.383	-983.7147	-2613.789	-2.12387	-28.37129	-30.49516	203	2711.734	-30.49516	-28.37129
24	230	285	53.74611	-7.965142	-3789.081	2652.357	-718.0869	3023.858	-1353.399	-2438.183	-4.070762	-37.88461	-41.95537	285	2652.357	-41.95537	-37.88461
25	240	366	50.10375	-9.502495	-3562.708	2493.896	-797.0509	2968.887	-1708.952	-2120.214	-6.779888	-46.19763	-52.97751	366	2493.896	-52.97751	-46.19763
26	250	447	45.84555	-10.9084	-3152.012	2206.408	-807.9927	2773.703	-1964.659	-1666.784	-10.26012	-50.64431	-60.90442	447	2206.408	-60.90442	-50.64431
27	260	529	41.04321	-12.09959	-2528.994	1770.296	-737.1448	2414.569	-2020.579	-1125.215	-14.41114	-48.22681	-62.63794	529	1770.296	-62.63794	-48.22681
28	270	692	35.805	-12.98525	-1686.167	1180.317	-610.4933	1969.333	-1872.317	-610.4933	-21.452	-36.58983	-58.04183	692	1180.317	-58.04183	-36.58983
29	280	814	30.27702	-13.47636	-639.9631	447.9742	-404.5837	1325.242	-1376.604	-179.2977	-27.52611	-15.14863	-42.67474	814	447.9742	-42.67474	-15.14863
30	290	1099	24.6403	-13.49589	568.6537	-398.0576	-213.4449	732.7203	-798.3431	39.16386	-38.80312	14.05448	-24.74864	1099	-398.0576	-24.74864	14.05448
31	300	1425	19.10375	-12.98862	1876.541	-1313.579	-31.05308	115.6678	-126.4069	28.81797	-50.11624	46.19763	-3.918614	1425	-1313.579	-3.918614	46.19763
32	310	2035	13.89327	-11.92941	3203.482	-2242.437	50.71157	-213.546	222.2348	-94.49078	-67.58516	74.47444	6.889278	2035	-2242.437	6.889278	74.47444
33	320	3053	9.237933	-10.32889	4459.506	-3121.654	13.96029	-70.05921	65.08957	-43.61869	-89.72895	91.74672	2.017777	3053	-3121.654	2.017777	91.74672
34	330	4478	5.354462	-8.235686	5553.611	-3887.528	-92.64284	597.6957	-453.759	465.0426	-106.6772	92.61065	-14.06653	4478	-3887.528	-14.06653	92.61065
35	340	6107	2.431607	-5.734964	6402.901	-4482.031	-173.2661	1634.181	-879.5705	1467.711	-102.4743	75.20764	-27.26668	6107	-4482.031	-27.26668	75.20764
36	350	8143	0.615848	-2.943254	6941.093	-4858.765	-177.0501	3289.004	-918.5165	3203.596	-70.59905	42.12504	-28.47401	8143	-4858.765	-28.47401	42.12504
37	360	10993	2.88E-31	-4.17E-15	7125.416	-4987.791	-4.56E-13	6005.209	-2.38E-12	6005.209	-1.35E-13	6.14E-14	-7.39E-14	10993	-4987.791	-7.39E-14	6.14E-14
38	370	16693	0.615848	2.943254	6941.093	-4858.765	637.973	11851.42	3309.733	11543.66	144.7268	-42.12504	102.6017	16693	-4858.765	102.6017	-42.12504
39	380	19543	2.431607	5.734964	6402.901	-4482.031	1605.91	15146.34	8152.266	13603.43	327.9279	-75.20764	252.7203	19543	-4482.031	252.7203	-75.20764
40	390	17100	5.354462	8.235686	5553.611	-3887.528	2072.986	13374.11	10153.36	10405.84	407.3648	-92.61065	314.7542	17100	-3887.528	314.7542	-92.61065
41	400	13028	9.237933	10.32889	4459.506	-3121.654	2014.376	10109.08	9391.989	6293.885	382.8984	-91.74672	291.1516	13028	-3121.654	291.1516	-91.74672
42	410	9364	13.89327	11.92941	3203.482	-2242.437	1740.987	7331.282	7629.578	3243.979	310.9914	-74.47444	236.5169	9364	-2242.437	236.5169	-74.47444
43	420	7125	19.10375	12.98862	1876.541	-1313.579	1619.639	6032.897	6593.019	1503.062	250.5812	-46.19763	204.3836	7125	-1313.579	204.3836	-46.19763
44	430	5700	24.6403	13.49589	568.6537	-398.0576	1614.501	5542.311	6038.683	296.2362	201.2537	-14.05448	187.1992	5700	-398.0576	187.1992	-14.05448
45	440	4275	30.27702	13.47636	-639.9631	447.9742	1514.166	4959.756	5151.981	-671.0266	144.5628	15.14863	159.7114	4275	447.9742	159.7114	15.14863
46	450	3460	35.805	12.98525	-1686.167	1180.317	1513.036	4880.76	4640.317	-1513.036	107.26	36.58983	143.8498	3460	1180.317	143.8498	36.58983

47	460	3053	41.04321	12.09959	-2528.994	1770.296	1546.329	5065.108	4238.623	-2360.393	83.17052	48.22681	131.3973	3053	1770.296	131.3973	48.22681
48	470	2687	45.84555	10.9084	-3152.012	2206.408	1490.098	5115.255	3623.219	-3073.878	61.67547	50.64431	112.3198	2687	2206.408	112.3198	50.64431
49	480	2442	50.10375	9.502495	-3562.708	2493.896	1375.631	5124.005	2949.482	-3659.279	45.2363	46.19763	91.43393	2442	2493.896	91.43393	46.19763
50	490	2198	53.74611	7.965142	-3789.081	2652.357	1185.752	4993.193	2234.822	-4026.088	31.39486	37.88461	69.27947	2198	2652.357	69.27947	37.88461
51	500	2035	56.73269	6.364622	-3873.906	2711.734	965.2106	4843.874	1602.01	-4256.635	21.29101	28.37129	49.6623	2035	2711.734	49.6623	28.37129
52	510	1913	59.04804	4.749564	-3867.444	2707.211	724.8934	4676.732	1069.727	-4363.667	13.73055	19.43099	33.16154	1913	2707.211	33.16154	19.43099
53	520	1832	60.69255	3.14747	-3819.543	2673.68	480.4283	4531.221	643.2128	-4398.27	8.107398	11.8322	19.9396	1832	2673.68	19.9396	11.8322
54	530	1628	61.67393	1.566476	-3772.135	2640.495	230.1107	4274.693	288.6439	-4243.605	3.412744	5.535216	8.94796	1628	2640.495	8.94796	5.535216
55	540	1425	62	3.29E-15	-3753.082	2627.157	4.62E-13	4052.157	5.66E-13	-4052.157	6.17E-15	1.14E-14	1.75E-14	1425	2627.157	1.75E-14	1.14E-14
56	550	1140	61.67393	-1.566476	-3772.135	2640.495	-203.8031	3785.984	-255.6444	-3758.451	-2.389759	-5.535216	-7.924975	1140	2640.495	-7.924975	-5.535216
57	560	814	60.69255	-3.14747	-3819.543	2673.68	-371.8818	3507.45	-497.8872	-3404.538	-3.602305	-11.8322	-15.4345	814	2673.68	-15.4345	-11.8322
58	570	732	59.04804	-4.749564	-3867.444	2707.211	-539.599	3481.284	-796.2878	-3248.243	-5.253927	-19.43099	-24.68492	732	2707.211	-24.68492	-19.43099
59	580	610	56.73269	-6.364622	-3873.906	2711.734	-675.4482	3389.712	-1121.076	-2978.766	-6.382072	-28.37129	-34.75336	610	2711.734	-34.75336	-28.37129
60	590	488	53.74611	-7.965142	-3789.081	2652.357	-767.7137	3232.836	-1446.932	-2606.685	-6.970287	-37.88461	-44.8549	488	2652.357	-44.8549	-37.88461
61	600	407	50.10375	-9.502495	-3562.708	2493.896	-808.4776	3011.45	-1733.452	-2150.61	-7.539383	-46.19763	-53.73701	407	2493.896	-53.73701	-46.19763
62	610	325	45.84555	-10.9084	-3152.012	2206.408	-770.8423	2646.172	-1874.327	-1590.147	-7.459817	-50.64431	-58.10412	325	2206.408	-58.10412	-50.64431
63	620	203	41.04321	-12.09959	-2528.994	1770.296	-632.6306	2072.226	-1734.096	-965.6788	-5.530172	-48.22681	-53.75698	203	1770.296	-53.75698	-48.22681
64	630	162	35.805	-12.98525	-1686.167	1180.317	-437.6799	1411.871	-1342.317	-437.6799	-5.022	-36.58983	-41.61183	162	1180.317	-41.61183	-36.58983
65	640	81	30.27702	-13.47636	-639.9631	447.9742	-169.5869	555.4939	-577.023	-75.15513	-2.739084	-15.14863	-17.88771	81	447.9742	-17.88771	-15.14863
66	650	40	24.6403	-13.49589	568.6537	-398.0576	109.0326	-374.2904	407.8121	-20.0058	-1.412306	14.05448	12.64218	40	-398.0576	12.64218	14.05448
67	660	0	19.10375	-12.98862	1876.541	-1313.579	366.0934	-1363.64	1490.246	-339.7431	0	46.19763	46.19763	0	-1313.579	46.19763	46.19763
68	670	0	13.89327	-11.92941	3203.482	-2242.437	548.2019	-2308.474	2402.401	-1021.464	0	74.47444	74.47444	0	-2242.437	74.47444	74.47444
69	680	0	9.237933	-10.32889	4459.506	-3121.654	634.7635	-3185.538	2959.572	-1983.308	0	91.74672	91.74672	0	-3121.654	91.74672	91.74672
70	690	0	5.354462	-8.235686	5553.611	-3887.528	609.9382	-3935.085	2987.44	-3061.729	0	92.61065	92.61065	0	-3887.528	92.61065	92.61065
71	700	0	2.431607	-5.734964	6402.901	-4482.031	477.9067	-4507.437	2426.053	-4048.277	0	75.20764	75.20764	0	-4482.031	75.20764	75.20764
72	710	0	0.615848	-2.943254	6941.093	-4858.765	261.9317	-4865.82	1358.872	-4739.466	0	42.12504	42.12504	0	-4858.765	42.12504	42.12504
73	720	0	1.15E-30	-8.34E-15	7125.416	-4987.791	7.58E-13	-4987.791	3.96E-12	-4987.791	0	1.23E-13	1.23E-13	0	-4987.791	1.23E-13	1.23E-13