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Plain bearings — Hydrodynamic plain journal bearings under steady-state conditions —

Part 2: Functions for calculation of multi-lobed journal bearings

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 8, *Calculation methods for plain bearings and their applications*.

A list of all parts in the ISO/TS 31657 series can be found on the ISO website.

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Plain bearings — Hydrodynamic plain journal bearings under steady-state conditions —

Part 2: Functions for calculation of multi-lobed journal bearings

1 Scope

This document specifies the characteristic values for selected two-, three- and four-lobe bearings.

The functions plotted and listed in table form below are required for the operationally safe design of hydrodynamic multi-lobed journal bearings according to ISO/TS 31657-1. They are based on the presumptions and boundary conditions indicated there and only apply to stationary operating states. The symbols used are explained in ISO/TS 31657-1; calculation examples are also included there.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Functions for calculation of multi-lobed journal bearings

4.1 General

The characteristic values for two-, three- and four-lobe bearings with relative lubrication pocket widths of $b_P^* = 0{,}8$ are shown in table form below. The characteristic values were calculated for the geometrical parameters summarised in Figure 1 (angular spans of segment sliding surface, Ω, angular coordinates of lubricant pocket centrelines, $\varphi_{P,1}$, gap ratios, $h_{0,\max}^*$, bearing width ratios B^*) in the operating range $0{,}02 \leq h_{\min}^* \leq 1$. The profile factors, K_P, associated with the indicated gap ratios, $h_{0,\max}^*$, can be calculated for these bearing types as follows:

$$K_P = h_{0,\max}^* \qquad \text{for } Z = 2$$

$$K_P = 2 \cdot h_{0,\max}^* - 1 \qquad \text{for } Z = 3$$

$$K_P = \frac{h^*_{0,\max} - \frac{1}{\sqrt{2}}}{1 - \frac{1}{\sqrt{2}}} \quad \text{for } Z = 4$$

The following (dimensionless) characteristic values are indicated in Tables 1 to 43:

a) Static characteristic values

Sommerfeld number:

$$So = \frac{F \cdot \psi^2_{\text{eff}}}{B \cdot D \cdot \eta_{\text{eff}} \cdot \omega}$$

Relative eccentricity:

$$\varepsilon = \frac{e}{C_{R,\text{eff}}}$$

Attitude angle, β, in °.

Product of maximum lubricant film pressure parameter and Sommerfeld number:

$$p^*_{\max} \cdot So = \frac{p_{\max} \cdot \psi^2_{\text{eff}}}{\eta_{\text{eff}} \cdot \omega}$$

Minimum relative lubricant film thickness:

$$h^*_{\min} = \frac{h_{\min}}{C_{R,\text{eff}}}$$

Friction force parameter:

$$F^*_f = \frac{f}{\psi_{\text{eff}}} \cdot So$$

Lubricant flow rate parameter due to hydrodynamic pressure build-up:

$$Q^*_3 = \frac{Q_3}{Q_0}$$

Lubricant flow rate parameter due to supply pressure:

$$Q^*_p = \frac{Q_p}{P^*_{\text{en}} \cdot Q_0}$$

Lubricant flow rate parameter at the exit of the lubrication gap:

$$Q^*_2 = \frac{Q_2}{Q_0}$$

Non-dimensional difference between maximum lubricant temperature and lubricant temperature in the lubricant pockets:

$$\Delta T^*_{\max} = \frac{\rho \cdot c_p \cdot \psi_{\text{eff}}}{\bar{p} \cdot f} \cdot \Delta T_{\max}$$

b) Dynamic characteristic values

Non-dimensional lubricant film stiffness coefficients:

$$c^*_{i,k} = \frac{\psi^3_{\text{eff}}}{2 \cdot B \cdot \eta_{\text{eff}} \cdot \omega} \cdot c_{i,k} \qquad (i, k = 1, 2)$$

Non-dimensional lubricant film damping coefficients:

$$d^*_{i,k} = \frac{\psi^3_{\text{eff}}}{2 \cdot B \cdot \eta_{\text{eff}} \cdot \omega} \cdot \omega \cdot d_{i,k} \qquad (i, k = 1, 2)$$

For some selected four-lobe bearings (Ω = 70°, $\varphi_{P,1}$ = 315°), these characteristic values are shown graphically as a function of the Sommerfeld number *So*, the gap ratio $h^*_{0,\max}$ and the bearing width ratio B^* in Annex A, Figures A.1 to A.16.

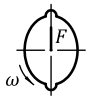
Z	Ω[°]	$\varphi_{P,1}$[°]	$h^*_{0,\max}$	B^*	Load case
2	150	180	3, 5	0,75	
		240	3, 5	0,75	
		270	1, 3, 5	0,5, 0,75, 1	
		300	3, 5	0,75	
3	100	240	3, 5	0,75	
		300	1, 3, 5	0,5, 0,75, 1	
4	70	270	3, 5	0,75	
		315	1, 2, 3, 4, 5	0,5, 0,75, 1	

Figure 1 — Geometrical parameters of selected multi-lobed journal bearings

4.2 Two-lobe bearings

Characteristic values for two-lobe bearings are listed in Tables 1 to 15.

Table 1 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 180°, $h^*_{0,max}$ = 3, B^* = 0,75

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,327	1,000	1,780	0,959	36,868	1,619	1,25	0,364	−0,107	0,174	0,019	0,541	0,168	0,168	0,093
0,014	0,203	15,82	0,364	0,935	1,790	0,971	37,474	1,604	1,35	0,373	−0,106	0,181	0,023	0,548	0,171	0,171	0,099
0,029	0,406	15,38	0,422	0,856	1,822	1,007	39,301	1,560	1,50	0,401	−0,105	0,201	0,035	0,576	0,182	0,182	0,116
0,048	0,607	14,65	0,510	0,768	1,878	1,065	42,339	1,488	1,71	0,455	−0,100	0,241	0,058	0,623	0,202	0,202	0,150
0,073	0,805	13,63	0,639	0,675	1,962	1,145	46,566	1,388	1,99	0,542	−0,089	0,306	0,099	0,699	0,235	0,235	0,206
0,108	1,001	12,36	0,834	0,579	2,083	1,243	52,000	1,265	2,35	0,684	−0,067	0,415	0,174	0,815	0,289	0,289	0,297
0,159	1,195	10,84	1,139	0,485	2,255	1,357	58,643	1,118	2,88	0,916	−0,020	0,599	0,314	0,994	0,376	0,377	0,450
0,241	1,387	9,11	1,645	0,392	2,504	1,482	66,479	0,953	3,64	1,323	0,084	0,932	0,597	1,285	0,525	0,525	0,721
0,384	1,577	7,17	2,569	0,303	2,884	1,616	75,476	0,769	4,80	2,120	0,326	1,599	1,240	1,810	0,801	0,801	1,249
0,677	1,768	5,05	4,546	0,217	3,522	1,755	85,736	0,567	6,73	4,010	1,012	3,194	3,029	2,907	1,371	1,371	2,459
1,478	1,959	2,79	10,341	0,133	4,839	1,898	97,153	0,350	10,97	10,662	3,665	8,585	10,316	6,159	2,978	2,978	6,332
3,840	2,100	1,14	29,250	0,071	7,487	2,003	106,265	0,177	20,77	40,455	15,265	29,531	46,571	17,323	7,373	7,374	20,278
18,558	2,200	0,18	183,912	0,022	16,491	2,079	113,058	0,049	65,04	514,115	142,002	242,523	642,042	124,068	32,520	32,518	154,507
45,130	2,220	0,06	569,417	0,010	26,225	2,095	114,450	0,023	142,08	2 504,109	425,818	779,476	3 114,672	443,694	115,503	115,503	554,368

Table 2 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 180°, $h^*_{0,max}$ = 5, B^* = 0,75

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,342	1,000	1,507	1,787	152,625	1,670	1,25	0,284	−0,038	0,110	0,022	0,315	0,081	0,081	0,039
0,011	0,301	7,29	0,370	0,951	1,518	1,801	154,870	1,650	1,33	0,292	−0,038	0,114	0,024	0,321	0,083	0,083	0,041
0,023	0,602	7,02	0,418	0,883	1,551	1,841	161,614	1,598	1,46	0,315	−0,036	0,125	0,031	0,339	0,089	0,089	0,048
0,038	0,902	6,57	0,493	0,800	1,610	1,905	172,838	1,510	1,64	0,359	−0,033	0,147	0,044	0,373	0,099	0,099	0,062
0,058	1,202	5,93	0,609	0,706	1,703	1,994	188,597	1,388	1,88	0,434	−0,026	0,185	0,069	0,427	0,116	0,116	0,085
0,088	1,500	5,14	0,793	0,604	1,841	2,104	208,778	1,235	2,25	0,564	−0,012	0,252	0,116	0,519	0,145	0,145	0,125
0,134	1,798	4,21	1,106	0,496	2,051	2,234	233,495	1,050	2,78	0,805	0,021	0,373	0,212	0,674	0,194	0,194	0,199
0,218	2,095	3,15	1,701	0,384	2,386	2,380	262,650	0,836	3,69	1,311	0,097	0,623	0,435	0,977	0,287	0,287	0,350
0,321	2,293	2,40	2,463	0,307	2,742	2,486	284,578	0,676	4,64	2,042	0,218	0,968	0,784	1,367	0,401	0,402	0,554
0,517	2,491	1,62	3,996	0,228	3,319	2,597	308,482	0,504	6,29	3,737	0,505	1,725	1,650	2,183	0,611	0,611	0,992
1,004	2,690	0,86	8,151	0,146	4,446	2,713	334,471	0,319	9,97	9,508	1,410	3,958	4,721	4,513	1,177	1,177	2,276
3,915	2,900	0,18	40,203	0,052	8,632	2,842	364,011	0,109	28,23	85,684	10,417	24,374	47,054	24,886	4,356	4,355	13,687
8,457	2,950	0,07	107,659	0,027	12,809	2,873	371,364	0,056	54,49	334,928	30,443	71,696	186,580	74,182	9,627	9,627	41,342
14,689	2,970	0,03	224,879	0,017	17,027	2,886	374,341	0,035	89,35	926,933	61,807	152,876	517,668	164,982	19,973	19,972	92,317

Table 3 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 240°, $h^*_{0,max}$ = 3, B^* = 0,75

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,327	1,000	1,780	0,959	36,868	1,619	1,25	0,135	−0,307	−0,025	0,249	0,351	−0,278	−0,278	0,283
0,024	0,300	65,76	0,343	0,948	1,800	0,986	38,272	1,585	1,30	0,144	−0,316	−0,024	0,259	0,360	−0,279	−0,279	0,296
0,053	0,600	64,93	0,388	0,863	1,862	1,065	42,498	1,483	1,39	0,176	−0,345	−0,021	0,296	0,394	−0,286	−0,285	0,339
0,096	0,900	63,58	0,501	0,756	1,983	1,191	49,575	1,320	1,55	0,239	−0,401	−0,010	0,380	0,458	−0,297	−0,297	0,435
0,195	1,255	61,44	0,833	0,612	2,255	1,387	61,648	1,055	2,00	0,395	−0,528	0,031	0,646	0,603	−0,316	−0,316	0,697
0,337	1,488	59,74	1,406	0,502	2,590	1,535	71,722	0,844	2,77	0,602	−0,683	0,128	1,168	0,780	−0,327	−0,326	1,148
0,647	1,698	58,00	2,889	0,331	3,159	1,675	82,206	0,632	4,44	0,968	−0,912	0,463	2,796	1,054	−0,296	−0,296	2,322
1,449	1,860	56,29	7,683	0,182	4,165	1,784	91,126	0,455	9,19	1,578	−1,003	1,986	9,830	1,400	0,010	0,010	6,279
4,655	1,931	53,56	34,941	0,068	6,408	1,816	94,911	0,372	29,85	3,188	2,998	14,895	75,236	1,592	2,566	2,567	30,672
11,520	1,879	50,12	119,413	0,030	9,298	1,747	90,997	0,431	76,95	7,878	21,587	63,226	403,924	1,955	9,260	9,259	113,638
26,368	1,811	46,94	379,970	0,014	13,580	1,670	86,161	0,509	179,60	19,622	83,789	224,646	1 939,293	3,095	25,234	25,233	393,073

Table 4 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 240°, $h^*_{0,max}$ = 5, B^* = 0,75

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,342	1,000	1,507	1,787	152,625	1,669	1,25	0,119	−0,206	−0,057	0,188	0,178	−0,160	−0,160	0,175
0,013	0,300	59,79	0,356	0,988	1,517	1,801	154,887	1,650	1,27	0,121	−0,209	−0,058	0,193	0,181	−0,162	−0,162	0,180
0,028	0,600	59,61	0,387	0,951	1,548	1,839	161,674	1,597	1,34	0,130	−0,220	−0,060	0,209	0,189	−0,167	−0,167	0,193
0,046	0,900	59,33	0,442	0,890	1,604	1,902	172,982	1,508	1,44	0,148	−0,240	−0,065	0,240	0,203	−0,176	−0,176	0,218
0,074	1,231	58,89	0,549	0,792	1,703	1,998	190,702	1,371	1,64	0,179	−0,279	−0,073	0,305	0,230	−0,194	−0,194	0,269
0,111	1,518	58,43	0,717	0,683	1,837	2,102	210,507	1,220	1,95	0,225	−0,335	−0,083	0,413	0,268	−0,218	−0,218	0,350
0,171	1,797	57,95	1,021	0,556	2,037	2,219	233,701	1,046	2,47	0,300	−0,428	−0,097	0,630	0,324	−0,255	−0,255	0,499
0,281	2,070	57,47	1,659	0,416	2,354	2,348	260,142	0,851	3,45	0,433	−0,601	−0,115	1,150	0,415	−0,318	−0,318	0,815
0,546	2,341	57,09	3,440	0,264	2,940	2,489	290,060	0,633	5,87	0,710	−1,003	−0,110	2,946	0,588	−0,441	−0,441	1,731
1,816	2,625	56,97	15,037	0,101	4,646	2,652	325,394	0,380	17,84	1,631	−2,658	0,683	21,407	1,044	−0,742	−0,742	8,014
3,419	2,702	57,02	34,428	0,058	6,004	2,699	335,693	0,306	34,13	2,381	−4,050	3,505	65,596	1,325	−0,735	−0,735	19,502
13,503	2,757	56,80	224,496	0,017	10,618	2,731	343,151	0,252	136,17	5,394	6,815	53,808	863,057	1,707	2,358	2,358	132,080

Table 5 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 270°, $h^*_{0,max}$ = 1, B^* = 0,5

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,000	1,000	2,614	0,000	3,008	1,000	2,00	0,000	−0,262	0,671	0,000	0,523	0,000	0,000	1,342
0,090	0,236	64,91	0,192	0,764	2,430	0,175	3,394	0,796	2,71	0,160	−0,171	0,469	0,163	0,372	0,174	0,174	0,923
0,163	0,361	56,42	0,373	0,639	2,471	0,245	3,784	0,706	3,34	0,292	−0,210	0,674	0,345	0,510	0,339	0,338	1,309
0,260	0,467	50,13	0,643	0,533	2,607	0,291	4,131	0,639	3,93	0,438	−0,204	0,976	0,690	0,599	0,501	0,501	1,868
0,401	0,562	44,64	1,081	0,438	2,833	0,323	4,403	0,588	4,66	0,650	−0,180	1,473	1,332	0,730	0,740	0,740	2,783
0,626	0,649	39,58	1,849	0,351	3,168	0,342	4,584	0,548	5,68	0,983	−0,107	2,338	2,622	0,926	1,120	1,120	4,383
1,011	0,729	34,71	3,317	0,271	3,649	0,351	4,663	0,520	7,20	1,570	0,093	4,007	5,477	1,241	1,791	1,793	7,460
1,783	0,805	29,68	6,656	0,195	4,392	0,350	4,633	0,502	9,89	2,748	0,706	7,804	13,213	1,799	3,154	3,155	14,473
3,709	0,877	24,15	16,512	0,123	5,714	0,335	4,477	0,497	15,89	5,805	3,052	19,273	41,921	3,039	6,768	6,767	35,742
11,175	0,943	17,40	66,166	0,057	8,914	0,303	4,174	0,511	36,26	18,352	19,280	80,457	252,403	6,810	21,690	21,697	148,293
30,369	0,974	12,58	238,937	0,026	13,981	0,273	3,946	0,534	85,56	53,612	93,221	315,937	1 384,251	14,455	64,581	64,585	574,742
59,033	0,985	9,96	568,507	0,015	19,196	0,255	3,837	0,550	155,16	109,469	267,165	805,560	4 501,754	23,051	130,675	130,663	1 433,334

Table 6 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 270°, $h^*_{0,max}$ = 3, B^* = 0,5

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,219	1,000	1,737	0,864	50,725	1,052	1,16	0,017	−0,121	0,059	0,244	0,062	−0,107	−0,107	0,330
0,029	0,300	81,39	0,264	0,934	1,758	0,884	52,595	1,030	1,30	0,020	−0,121	0,067	0,259	0,066	−0,102	−0,102	0,346
0,065	0,574	79,98	0,352	0,825	1,819	0,935	57,521	0,972	1,54	0,031	−0,121	0,093	0,310	0,075	−0,088	−0,087	0,394
0,138	0,861	76,57	0,600	0,646	1,967	1,014	65,671	0,879	2,09	0,059	−0,105	0,182	0,481	0,095	−0,040	−0,040	0,549
0,228	1,001	72,54	0,976	0,510	2,132	1,054	70,214	0,825	2,83	0,101	−0,068	0,328	0,784	0,113	0,030	0,030	0,797
0,343	1,066	67,95	1,538	0,404	2,320	1,064	71,688	0,804	3,75	0,160	−0,010	0,551	1,309	0,133	0,121	0,121	1,184
0,505	1,092	62,75	2,424	0,318	2,554	1,052	71,111	0,804	5,03	0,246	0,084	0,904	2,271	0,159	0,240	0,241	1,814
0,756	1,097	56,85	3,974	0,243	2,874	1,026	69,181	0,819	6,99	0,385	0,250	1,532	4,237	0,198	0,418	0,418	2,959
1,208	1,090	50,03	7,147	0,174	3,365	0,989	66,289	0,845	10,42	0,642	0,617	2,852	9,028	0,266	0,735	0,736	5,382
2,202	1,074	41,86	15,349	0,110	4,232	0,940	62,611	0,882	17,84	1,239	1,686	6,465	24,638	0,409	1,478	1,479	12,023
5,666	1,047	30,73	52,233	0,051	6,345	0,876	58,047	0,935	42,44	3,428	7,798	24,121	128,756	0,772	4,047	4,046	43,158
13,560	1,028	22,43	166,704	0,024	9,519	0,837	55,380	0,971	98,25	8,914	30,395	85,418	623,960	1,465	10,802	10,799	150,032
24,443	1,019	17,86	371,567	0,014	12,657	0,819	54,246	0,987	175,92	17,061	74,399	204,567	1 848,538	2,327	21,727	21,726	361,019

Table 7 — Characteristic values of a two-lobe bearing with Ω = 150°, $\varphi_{P,1}$ = 270°, $h^*_{0,max}$ = 5, B^* = 0,5

So	ε	β [°]	$p^*_{max} \cdot So$	h^*_{min}	F^*_f	Q^*_3	Q^*_P	Q^*_2	ΔT^*_{max}	c^*_{11}	c^*_{12}	c^*_{21}	c^*_{22}	d^*_{11}	d^*_{12}	d^*_{21}	d^*_{22}
0,000	0,000	90,00	0,247	1,000	1,450	1,650	213,796	1,082	1,13	0,017	−0,082	0,023	0,209	0,027	−0,055	−0,055	0,212
0,016	0,250	77,97	0,282	0,941	1,459	1,658	215,843	1,072	1,25	0,018	−0,082	0,025	0,215	0,027	−0,055	−0,055	0,217
0,033	0,470	77,67	0,329	0,874	1,481	1,675	221,018	1,052	1,39	0,019	−0,082	0,031	0,233	0,028	−0,053	−0,053	0,230
0,075	0,854	76,43	0,487	0,718	1,569	1,726	237,424	0,990	1,79	0,026	−0,081	0,057	0,315	0,032	−0,044	−0,044	0,289
0,133	1,118	74,44	0,768	0,567	1,701	1,775	253,621	0,928	2,43	0,039	−0,071	0,115	0,489	0,037	−0,024	−0,024	0,405
0,217	1,270	71,65	1,238	0,438	1,871	1,803	263,800	0,887	3,41	0,060	−0,047	0,222	0,826	0,045	0,011	0,011	0,609
0,338	1,335	68,02	2,019	0,333	2,085	1,806	266,737	0,873	4,79	0,096	0,005	0,409	1,485	0,054	0,063	0,064	0,953
0,524	1,341	63,43	3,385	0,246	2,370	1,790	263,798	0,879	7,04	0,157	0,102	0,755	2,844	0,069	0,147	0,148	1,591
0,846	1,306	57,59	6,119	0,172	2,790	1,758	256,513	0,901	10,80	0,270	0,320	1,476	6,156	0,094	0,293	0,293	2,916
1,534	1,240	49,80	13,089	0,107	3,517	1,714	246,007	0,936	18,85	0,524	0,962	3,420	17,016	0,139	0,603	0,603	6,416
3,824	1,144	38,09	43,390	0,049	5,237	1,659	232,808	0,981	46,29	1,454	4,265	12,856	86,361	0,272	1,777	1,777	23,268
8,906	1,081	28,45	136,265	0,023	7,783	1,627	225,087	1,009	105,72	3,721	15,807	45,042	407,129	0,523	4,864	4,863	81,056
16,009	1,051	22,64	305,473	0,014	10,294	1,613	221,714	1,022	184,85	6,936	40,897	106,192	1 241,172	0,729	8,678	8,678	184,187