

AD-A069 440

TIMKEN CO CANTON OHIO

TAPERED ROLLER BEARING DEVELOPMENT FOR AIRCRAFT TURBINE ENGINES--ETC(U)

MAR 79 P S ORVOS, G J DRESSLER

F/G 13/9

F33615-76-C-2019

UNCLASSIFIED

AFAPL-TB-79-2007

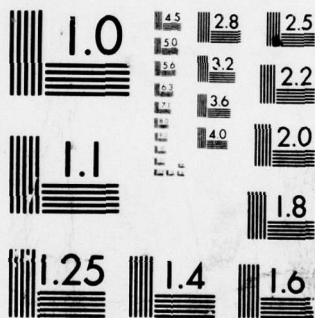
2 OF 2

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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

155	9257	5975	39.4	209	232	74.8	466	438	72
155	9257	5979	39.4	209	233	74.7	465	437	72
156	9181	6002	39.8	300	317	58.1	359	318	54
156	9181	5996	39.8	301	317	59.2	366	309	54
157	20782	1025	39.5	208	264	80.6	1127	1052	73
157	20828	1034	39.5	209	265	80.2	1124	1052	74
158	20843	1063	39.8	265	315	77.8	1091	942	65
158	20828	1069	40.0	282	322	73.5	1030	757	65
159	20782	3001	39.3	210	280	96.8	1354	1293	84
159	20813	3006	39.2	210	280	97.2	1361	1288	85
160	20828	3017	39.9	281	337	90.9	1274	1060	75
160	20858	3014	39.8	288	343	90.5	1271	1039	74
161	20797	6011	39.9	210	288	109.5	1533	1475	94
161	20843	6010	39.9	210	288	110.0	1544	1476	94
162	20828	6014	39.8	285	347	102.2	1432	1159	84
162	20858	6018	39.9	311	368	98.5	1383	1075	81
163	32429	3005	39.5	222	352	119.0	2597	2405	100
163	32475	3009	40.0	225	355	119.8	2619	2415	100
164	32460	3014	40.2	298	412	114.1	2492	2146	91
164	32475	3013	40.2	299	413	113.4	2478	2151	91
165	32429	6004	39.3	230	372	131.2	2864	2591	108
166	32444	4487	39.7	301	418	141.8	3097	2175	97
166	32444	4494	39.6	302	419	140.8	3075	2171	96

NOMINAL FLOW TO ROLLER BODIES

8 PTS/MIN

NOMINAL FLOW TO CONE RIB

12 PTS/MIN

NO.	SPEED RPM	LOAD LBF	FLOW PT/MIN	OIL TEMP. (F)		EXP TORQUE IN LBF	HEAT BTU/MIN		CAL TORQUE IN LBF
				IN	OUT		Q-BRG	Q-OIL	
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167	2269	981	40.5	206	205	19.0	29	-26	23
167	2269	1007	40.4	211	210	19.0	29	-17	22
168	2299	993	40.3	297	297	12.3	19	0	15
168	2314	978	40.3	299	300	11.0	17	3	15
169	2299	3001	40.6	212	214	29.1	45	42	29
169	2299	3032	40.5	209	211	28.5	44	38	29
170	2329	3001	40.2	301	303	19.4	30	35	19
170	2314	3075	40.1	303	304	20.2	31	17	19
171	2269	6011	40.2	208	212	44.3	68	88	34
171	2314	6002	40.3	209	214	40.3	63	78	35
172	2329	5950	40.4	299	303	28.2	44	66	23
172	2360	5967	40.5	299	302	27.7	44	70	23
173	9333	1011	39.9	215	231	47.5	299	303	50
173	9348	1013	40.6	213	229	47.4	298	315	50
174	9211	1070	40.5	303	316	45.4	282	243	37
174	9196	1051	40.6	298	311	47.3	293	260	38
175	9257	3068	40.3	211	231	59.1	368	376	63
175	9226	2989	40.3	214	234	56.2	349	376	62
176	9150	3023	41.0	304	318	51.6	318	289	47
176	9242	2996	40.3	298	314	52.7	328	302	47

177	9287	6015	40.1	207	232	67.3	421	477	73
177	9257	6011	40.5	207	231	65.2	406	467	74
178	9165	5949	40.2	301	318	57.1	352	328	54
178	9150	6001	40.2	301	318	56.4	348	327	54
179	20965	1010	40.6	211	265	74.4	1049	1051	76
179	21011	1016	40.5	211	267	75.3	1064	1062	76
180	20767	1043	40.5	306	348	66.1	924	805	63
180	20767	978	40.1	292	339	66.0	922	896	63
181	20752	2979	40.2	213	276	90.2	1260	1213	88
181	20813	2967	40.4	210	275	89.4	1253	1240	89
182	20858	3028	40.7	292	344	79.5	1116	995	77
182	20767	3033	40.5	307	355	79.1	1105	938	75
183	20691	6010	40.7	211	285	100.3	1397	1420	98
183	20797	6010	40.9	209	284	100.8	1411	1436	98
184	20858	5980	40.8	291	352	97.3	1366	1176	86
184	20813	5942	40.3	288	355	97.9	1371	1276	84
185	32323	3023	40.4	240	362	129.6	2819	2301	102
185	32460	3028	40.5	242	363	128.3	2802	2291	102
186	32505	3009	40.6	299	411	104.6	2288	2121	95
186	32505	3012	40.6	298	410	102.8	2249	2125	95
187	32414	4508	40.5	243	370	134.8	2940	2397	107
187	32414	4512	40.6	250	375	133.5	2912	2368	106
188	32490	4520	40.6	299	416	108.8	2379	2224	100
188	32490	4516	40.2	298	416	107.4	2349	2215	100

NOMINAL FLOW TO ROLLER BODIES

12 PTS/MIN

NOMINAL FLOW TO CONE RIB

8 PTS/MIN

NO.	SPEED RPM	LOAD LBF	FLOW PT/MIN	OIL TEMP. (F)		EXP TORQUE IN LBF	HEAT BTU/MIN		CAL TORQUE IN LBF
				IN	OUT		Q-BRG	Q-OIL	
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189	2299	1020	39.1	210	209	20.5	32	-27	22
189	2314	1026	39.0	211	211	21.2	33	-10	22
190	2406	1039	39.3	297	295	14.3	23	-34	15
190	2329	996	39.1	302	300	14.1	22	-29	14
191	2314	3005	39.4	211	212	29.9	47	32	29
191	2284	2998	39.4	211	212	29.9	46	30	28
192	2543	3016	41.1	302	302	20.6	35	7	20
192	2284	3041	39.4	300	301	20.5	32	14	19
193	2314	6009	39.4	210	213	39.9	62	57	34
193	2284	6009	39.3	211	214	38.9	60	61	34
194	2284	6003	39.4	302	302	28.2	43	2	23
194	2360	5997	39.5	302	303	26.8	43	31	23
195	9333	1016	39.4	208	225	51.8	326	317	49
195	9348	1021	39.3	209	225	51.9	326	313	49
196	9409	1003	39.3	300	311	40.0	254	215	36
196	9287	994	39.4	300	311	39.7	248	214	36
197	9363	2980	39.2	210	231	63.1	397	378	62
197	9333	2987	39.3	211	232	61.8	388	380	61
198	9379	3025	39.6	298	312	49.0	310	273	46
198	9409	3029	39.3	298	312	49.0	310	275	46

199	9287	5968	39.1	210	233	73.6	460	431	71
199	9382	5951	39.4	209	232	74.1	464	437	72
200	9287	5995	39.5	299	315	56.5	353	298	54
200	9348	5997	39.5	299	315	56.8	357	306	54
201	20813	977	39.4	204	261	79.4	1112	1057	72
201	20767	977	39.4	206	262	78.2	1093	1054	71
202	20752	1013	39.1	295	336	68.4	955	770	60
202	20767	996	39.0	296	338	67.7	946	779	60
203	20965	2988	39.1	209	277	95.2	1344	1252	84
203	20782	3013	39.2	208	277	94.7	1324	1264	84
204	20752	3054	39.3	300	351	84.8	1184	964	71
204	20752	3000	39.4	303	353	83.1	1160	942	71
205	20797	6037	39.6	211	286	109.0	1525	1398	94
205	20934	6012	39.4	208	284	109.1	1538	1416	94
206	20767	6040	39.2	291	350	92.9	1298	1100	82
206	20767	6027	39.2	307	361	90.0	1257	1012	80
207	32582	3031	37.9	232	360	117.5	2576	2266	95
207	32475	3032	39.2	238	363	119.6	2613	2278	95
208	32444	2961	38.9	294	407	101.7	2221	2056	88
208	32505	3007	39.4	300	412	103.3	2261	2059	88
209	32566	4529	39.3	242	372	126.9	2780	2381	101
209	32460	4543	39.2	243	373	128.4	2806	2378	100
210	32475	4531	39.6	301	420	109.5	2394	2199	94
210	32490	4526	39.5	300	420	108.6	2375	2207	93

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REFERENCES

1. Cornish, R. F., Orvos, P. S., and Dressler, G. J., Design, Development and Testing of High Speed Tapered Roller Bearings for Turbine Engines," Technical Report AFAPL-TR-75-26, AD #A026908, The Timken Company, July 1975.
2. Orvos, P. S., "Tapered Roller Bearing Development for Aircraft Turbine Engines," Technical Report AFAPL-TR-77-6, AD #A041317, The Timken Company, April 1977.
3. Orvos, P. S., and Dressler, G. J., "Tapered Roller Bearing Development for Aircraft Turbine Engines," Technical Report AFAPL-TR-77-83, AD #A054045, The Timken Company, December 1977.
4. "Mechanical Design Library Part IV," Structural Dynamics Research Corporation, Cincinnati, Ohio, 1976.
5. Parker, R. J., and Signer, H. R., "Lubrication of High Speed Large Bore Taper-Roller Bearings," Presented at ASLE-ASME Joint Lubrication Conference, Kansas City, Missouri, October 3-5, 1977.
6. Witte, D. C., "Operating Torque of Tapered Roller Bearings," Presented at ASME-ASLE International Lubrication Conference, New York City, October 9-12, 1972.
7. Leibensperger, R. L., "An Analysis of Flow of Oil Through a Tapered Roller Bearing," Transactions of ASME, Journal of Lubrication Technology, April 1972.