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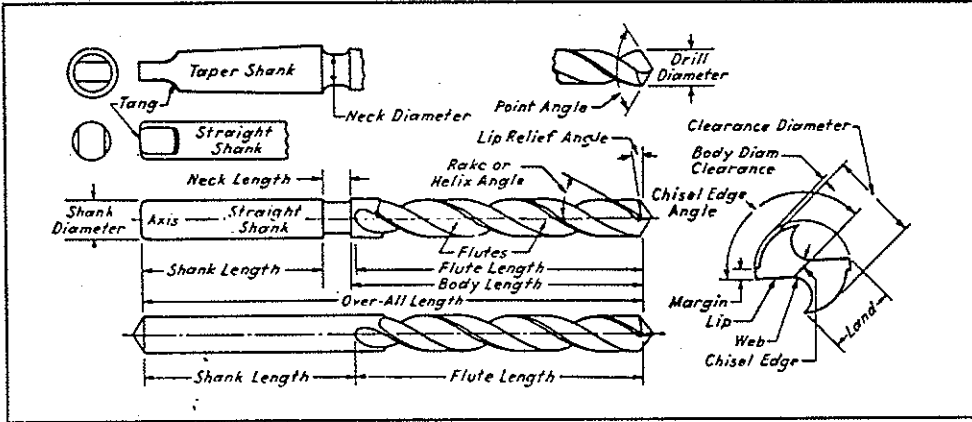
UNIVERSITAS
GADJAH MADA

**Rancangan Mesin Bor Kecil Dengan Spindel 4 Macam Kecepatan Putar Antara 450 Rpm - 1200 Rpm,
Penggerak Motor Listrik 1,5 HP**
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LAMPIRAN

ANSI Standard Twist Drill Nomenclature



ANSI Standard Straight Shank Twist Drills — From 0.261 to 0.9062 Inch, Incl.
 (ANSI B94.11-1967, R1972)

Drill Size	Drill Diam.	Jobbers Length		Taper Length		Screw Mach. Length	
		Overall	Flute	Overall	Flute	Overall	Flute
27/64	0.4219	5 3/8	3 15/16	7 1/4	4 5/8	3 3/8	2
7/16	0.4375	5 1/2	4 1/16	7 1/4	4 5/8	3 7/16	2 1/16
29/64	0.4531	5 5/8	4 3/16	7 1/2	4 3/4	3 9/16	2 1/8
15/32	0.4688	5 3/4	4 3/16	7 1/2	4 3/4	3 5/8	2 1/8
31/64	0.4844	5 7/8	4 3/8	7 3/4	4 3/4	3 11/16	2 3/16
1/2	0.5000	6	4 1/2	7 3/4	4 3/4	3 3/4	2 1/4
33/64	0.5156	6 1/8	4 13/16	8	4 3/4	3 7/8	2 3/8
17/32	0.5312	6 1/4	4 13/16	8	4 1/2	3 7/8	2 3/8
35/64	0.5469	6 3/8	4 13/16	8 1/4	4 7/8	4	2 3/8
9/16	0.5625	6 5/8	4 13/16	8 1/4	4 7/8	4	2 1/2
37/64	0.5781	6 5/8	4 13/16	8 3/4	4 7/8	4 1/8	2 5/8
19/32	0.5938	7 1/8	5 1/16	8 3/4	4 7/8	4 1/8	2 5/8
39/64	0.6094	7 1/8	5 1/16	8 3/4	4 7/8	4 1/4	2 3/4
5/8	0.625	7 1/8	5 1/16	8 3/4	4 7/8	4 1/4	2 3/4
41/64	0.6406	7 1/8	5 3/16	9	5 1/8	4 1/2	2 7/8
21/32	0.6562	7 1/8	5 3/16	9	5 1/8	4 1/2	2 7/8
43/64	0.6719	7 3/8	5 3/8	9 1/4	5 3/8	4 5/8	2 7/8
11/16	0.6875	7 3/8	5 3/8	9 1/4	5 3/8	4 5/8	2 7/8
45/64	0.7031	...	...	9 1/2	5 3/8	4 3/4	3
23/32	0.7188	...	...	9 1/2	5 3/8	4 3/4	3
47/64	0.7344	...	...	9 3/4	5 7/8	5	3 1/8
3/4	0.750	...	...	9 3/4	5 7/8	5	3 1/8
49/64	0.7656	...	...	9 7/8	6	5 1/8	3 1/4
25/32	0.7812	...	...	9 7/8	6	5 1/8	3 1/4
51/64	0.7969	...	...	10	6 1/8	5 1/4	3 3/8
13/16	0.8125	...	...	10	6 1/8	5 1/4	3 3/8
53/64	0.8281	...	...	10	6 1/8	5 3/8	3 3/8
27/32	0.8438	...	...	10	6 1/8	5 3/8	3 1/2
55/64	0.8594	...	...	10	6 1/8	5 1/2	3 1/2
7/8	0.875	...	...	10	6 1/8	5 1/2	3 1/2
57/64	0.8906	...	...	10	6 1/8	5 3/8	3 5/8
29/32	0.9062	...	...	10	6 1/8	5 3/8	3 5/8

¹Franklin D Jones : Machinery's Handbook, hal. 1659

Tabel Faktor Material Kerja (K_d)^I

Tabel Faktor Pemakanan (F_f)^{II}

Table Work Material Factor, K_d , for Drilling with a Sharp Drill

Work Material	Work Material Constant, K_d
AISI 1117 (Resulfurized free machining mild steel)	12.000
Steel, 200 Bhn	24.000
Steel, 300 Bhn	31.000
Steel, 400 Bhn	34.000
Cast Iron, 150 Bhn	14.000
Most Aluminum Alloys	7.000
Most Magnesium Alloys	4.000
Most Brasses	14.000
Leaded Brass	7.000
Austenitic Stainless Steel (Type 316)	24.000* for Torque 35.000* for Thrust
Titanium Alloy T16A 4V 40R _c	18.000* for Torque 29.000* for Thrust
René41 40R _c	40.000*† min.
Hastelloy-C	30.000* for Torque 37.000* for Thrust

* Values based upon a limited number of tests. † Will increase with rapid wear.

Table Feed Factors, F_f , for Drilling

Inch Units				SI Metric Units			
Feed, in./rev	F_f	Feed, in./rev	F_f	Feed, mm/rev	F_f	Feed, mm/rev	F_f
.0005	.0023	.012	.029	0.01	.025	0.30	.382
.001	.004	.013	.031	0.03	.060	0.35	.432
.002	.007	.015	.035	0.05	.091	0.40	.480
.003	.010	.018	.040	0.08	.133	0.45	.528
.004	.012	.020	.044	0.10	.158	0.50	.574
.005	.014	.022	.047	0.12	.183	0.55	.620
.006	.017	.025	.052	0.15	.219	0.65	.708
.007	.019	.030	.060	0.18	.254	0.75	.794
.008	.021	.035	.068	0.20	.276	0.90	.919
.009	.023	.040	.076	0.22	.298	1.00	1.000
.010	.025	.050	.091	0.25	.330	1.25	1.195

^IFranklin D Jones : *Machinery's Handbook*, hal. 1801

^{II}Ibid, hal. 1802

Tabel Faktor Diameter Drill (FT) untuk aksial dan (FM) untuk Torsiⁱ
Tabel Faktor Ujung Pisau untuk Torsi dan Aksialⁱⁱ

Table Drill Diameter Factors: F_T for Thrust; F_M for Torque

Inch Units						SI Metric Units					
Drill Diam.. in.	F_T	F_M	Drill Diam.. in.	F_T	F_M	Drill Diam.. mm	F_T	F_M	Drill Diam.. mm	F_T	F_M
.063	.110	.007	.875	.899	.786	1.60	1.46	2.33	22.00	11.86	260.8
.094	.151	.014	.938	.950	.891	2.40	2.02	4.84	24.00	12.71	305.1
.125	.189	.024	1.000	1.000	1.000	3.20	2.54	8.12	25.50	13.34	340.2
.156	.226	.035	1.063	1.050	1.116	4.00	3.03	12.12	27.00	13.97	377.1
.188	.263	.049	1.125	1.099	1.236	4.80	3.51	16.84	28.50	14.58	415.6
.219	.297	.065	1.250	1.195	1.494	5.60	3.97	22.22	32.00	16.00	512.0
.250	.330	.082	1.375	1.290	1.774	6.40	4.42	28.26	35.00	17.19	601.6
.281	.362	.102	1.500	1.383	2.075	7.20	4.85	34.93	38.00	18.36	697.6
.313	.395	.124	1.625	1.475	2.396	8.00	5.28	42.22	42.00	19.89	835.3
.344	.426	.146	1.750	1.565	2.738	8.80	5.96	50.13	45.00	21.02	945.8
.375	.456	.171	1.875	1.653	3.100	9.50	6.06	57.53	48.00	22.13	1062
.438	.517	.226	2.000	1.741	3.482	11.00	6.81	74.90	50.00	22.86	1143
.500	.574	.287	2.250	1.913	4.305	12.50	7.54	94.28	58.00	25.75	1493
.563	.632	.355	2.500	2.081	5.203	14.50	8.49	123.1	64.00	27.86	1783
.625	.687	.429	2.750	2.246	6.177	16.00	9.19	147.0	70.00	29.93	2095
.688	.741	.510	3.000	2.408	7.225	17.50	9.87	172.8	76.00	31.96	2429
.750	.794	.596	3.500	2.724	9.535	19.00	10.54	200.3	90.00	36.53	3293
.813	.847	.689	4.000	3.031	12.13	20.00	10.98	219.7	100.00	39.81	3981

Table Chisel Edge Factors for Torque and Thrust

c/d	Approx. w/d	Torque Factor A	Thrust Factor B	Thrust Factor J	c/d	Approx. w/d	Torque Factor A	Thrust Factor B	Thrust Factor J
.03	.025	1.000	1.100	.001	.18	.155	1.085	1.355	.030
.05	.045	1.005	1.140	.003	.20	.175	1.105	1.380	.040
.08	.070	1.015	1.200	.006	.25	.220	1.155	1.445	.065
.10	.085	1.020	1.235	.010	.30	.260	1.235	1.500	.090
.13	.110	1.040	1.270	.017	.35	.300	1.310	1.575	.120
.15	.130	1.080	1.310	.022	.40	.350	1.395	1.620	.160

For drills of standard design, use $c/d = .18$.

For split point drills, use $c/d = .03$.

c/d = Length of Chisel Edge ÷ Drill Diameter.

w/d = Web Thickness at Drill Point ÷ Drill Diameter.

ⁱFranklin D Jones : *Machinery's Handbook*, hal. 1802

ⁱⁱIbid, hal. 1802

Tabel Faktor Pemakaian Alat (W)^ITabel Efisiensi Mesin Perkakas (E)^{II}

Table Tool Wear Factors, W

Type of Operation	W
For all operations with sharp cutting tools	1.00
Turning: Finish turning (lightcuts)	1.10
Normal rough and semi-finish turning	1.30
Extra-heavy duty rough turning	1.60-2.00
Milling: Slab milling	1.10
End milling	1.10
Light and medium face milling	1.10-1.25
Extra-heavy duty face milling	1.30-1.60
Drilling: Normal drilling	1.30
Drilling hard-to-machine materials and drilling with a very dull drill	1.50
Broaching: Normal broaching	1.05-1.10
Heavy duty surface broaching	1.20-1.30

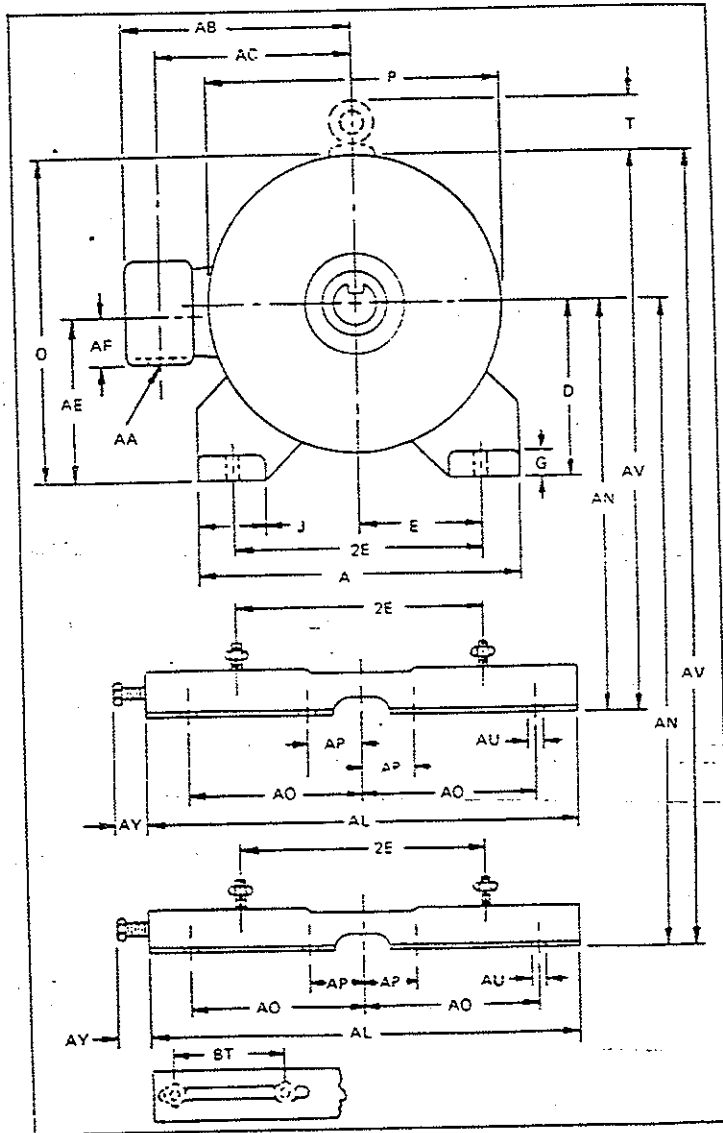
^I For planing and shaping, use values given for turning.

Table Machine Tool Efficiency Factors, E

Type of Drive	E	Type of Drive	E
Direct Belt Drive	.90	Geared Head Drive	.70-.80
Back Gear Drive	.75	Oil-Hydraulic Drive	.60-.90

^IFranklin D Jones : *Machinery's Handbook*, hal. 1795

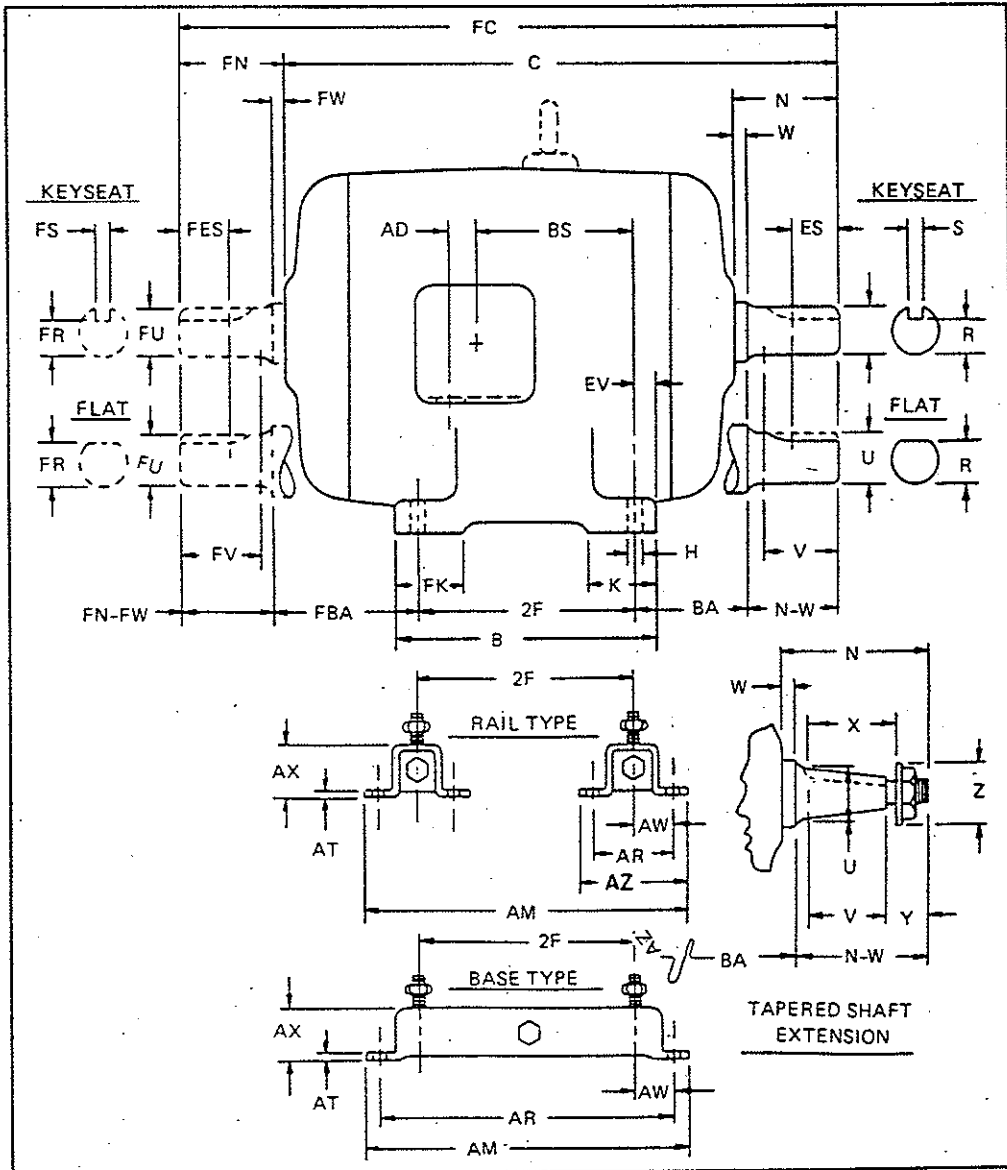
^{II}Ibid, hal. 1799



NEMA Standard dimensional designations for alternating-current and direct-current foot-mounted motors—drive end view.

¹Franklin D Jones : *Machinery's Handbook*, hal. 2352

Tabel Dimensi Motor (lanjutan)¹



NEMA Standard dimensional designations for alternating-current and direct-current foot-mounted motors—side view.

NEMA Standard Dimensions for Alternating-current Foot-mounted Motors with Single Straight-shaft Extension

Frame No.	A Max	B Max	D*	E†	2F†	BA	H†	U	N-W	V Min	Keyscat	
											ES Min	S
42	...	...	2.62	1.75	1.69	2.06	0.28	0.3750	1.12	...	...	flat
48	...	...	3.00	2.12	2.75	2.50	0.34	0.5000	1.50	...	...	flat
48H	...	...	3.00	2.12	4.75	2.50	0.34	0.5000	1.50	...	...	flat
56	...	...	3.50	2.44	3.00	2.75	0.34	0.6250	1.88	...	1.41	0.188
56H	...	...	3.50	2.44	5.00	2.75	0.34	0.6250	1.88	...	1.41	0.188
143T	7.0	6.0	3.50	2.75	4.00	2.25	0.34	0.8750	2.25	2.00	1.41	0.188
145T	7.0	6.0	3.50	2.75	5.00	2.25	0.34	0.8750	2.25	2.00	1.41	0.188
182T	9.0	6.5	4.50	3.75	4.50	2.75	0.41	1.1250	2.75	2.50	1.78	0.250
184T	9.0	7.5	4.50	3.75	5.50	2.75	0.41	1.1250	2.75	2.50	1.78	0.250
213T	10.5	7.5	5.25	4.25	5.50	3.50	0.41	1.3750	3.38	3.12	2.41	0.312
215T	10.5	9.0	5.25	4.25	7.00	3.50	0.41	1.3750	3.38	3.12	2.41	0.312
254T	12.5	10.0	6.25	5.00	8.25	4.25	0.53	1.625	4.00	3.75	2.91	0.375
256T	12.5	12.5	6.25	5.00	10.00	4.25	0.53	1.625	4.00	3.75	2.91	0.375
284T	14.0	12.5	7.00	5.50	9.50	4.75	0.53	1.875	4.62	4.38	3.28	0.500
284TS	14.0	12.5	7.00	5.50	9.50	4.75	0.53	1.875	3.25	3.00	1.91	0.375
286T	14.0	14.0	7.00	5.50	11.00	4.75	0.53	1.875	4.62	4.38	3.28	0.500
286TS	14.0	14.0	7.00	5.50	11.00	4.75	0.53	1.625	3.25	3.00	1.91	0.375
324T	16.0	14.0	8.00	6.25	10.50	5.25	0.66	2.125	5.25	5.00	3.91	0.500
324TS	16.0	14.0	8.00	6.25	10.50	5.25	0.66	1.875	3.75	3.50	2.03	0.500
326T	16.0	15.5	8.00	6.25	12.00	5.25	0.66	2.125	5.25	5.00	3.91	0.500
326TS	16.0	15.5	8.00	6.25	12.00	5.25	0.66	1.875	3.75	3.50	2.03	0.500
364T	18.0	15.2	9.00	7.00	11.25	5.88	0.66	2.375	5.88	5.62	4.28	0.625
364TS	18.0	15.2	9.00	7.00	11.25	5.88	0.66	1.875	3.75	3.50	2.03	0.500
365T	18.0	16.2	9.00	7.00	12.25	5.88	0.66	2.375	5.88	5.62	4.28	0.625
365TS	18.0	16.2	9.00	7.00	12.25	5.88	0.66	1.875	3.75	3.50	2.03	0.500
404T	20.0	16.2	10.00	8.00	12.25	6.62	0.81	2.875	7.25	7.00	5.65	0.750
404TS	20.0	16.2	10.00	8.00	12.25	6.62	0.81	2.125	4.25	4.00	2.78	0.500
405T	20.0	17.8	10.00	8.00	13.75	6.62	0.81	2.875	7.25	7.00	5.65	0.750
405TS	20.0	17.8	10.00	8.00	13.75	6.62	0.81	2.125	4.25	4.00	2.78	0.500
444T	22.0	18.5	11.00	9.00	14.50	7.50	0.81	3.375	8.50	8.25	6.91	0.875
444TS	22.0	18.5	11.00	9.00	14.50	7.50	0.81	2.375	4.75	4.50	3.03	0.625
445T	22.0	20.5	11.00	9.00	16.50	7.50	0.81	3.375	8.50	8.25	6.91	0.875
445TS	22.0	20.5	11.00	9.00	16.50	7.50	0.81	2.375	4.75	4.50	3.03	0.625

All dimensions are in inches. See Fig. 1 for diagram showing letter symbols.

*Dimension D will never be greater than the above values for rigid-base motors. However, it may be less, so that shims are usually required for coupled or geared motors. When the exact dimension is required, shims up to 0.03 inch may be necessary on frame sizes whose D dimension is 8.00 inches or less; on larger frames, shims up to 0.06 inch may be necessary. No tolerances have been established for the D dimension of resilient mounted motors.

†Frame Nos. 42, 48, 48H, 56 and 56H have a tolerance for the 2F dimension of ±0.03 inch and for the H dimension (width of slot) +0.02, -0 inch. For frame Nos. 143T to 445T, inclusive, the tolerance for the 2E and 2F dimensions is ±0.03 inch and for the H dimension (diameter of hole) is +0.05, -0 inch.

The minimum size of the threaded or clearance hole, AA, for external conduit entrance (expressed in conduit size) to the terminal housing is for frame Nos. 143T through 184T, ¼ inch; for frame Nos. 213T and 215T, 1 inch; for frame Nos. 254T and 256T, 1 ¼ inches; for frame Nos. 284T through 286TS, 1 ½ inches; for frame Nos. 324T through 326TS, 2 inches; and for frame Nos. 364T through 445TS, 3 inches.

For larger frame sizes see NEMA Standards.

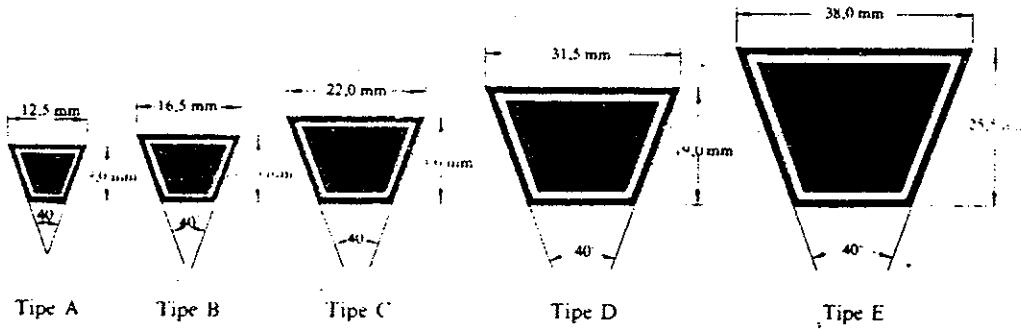
Tabel Daya dan Kecepatan Motor¹

Table NEMA Standard Frame Numbers for Polyphase, Squirrel-cage, Designs A and B, Horizontal and Vertical Motors, 60 Hertz, Class B Insulation System— 575 Volts and Less

Hp.	Totally Enclosed Fan-cooled Type*				Open Type**			
	Speed, rpm				Speed, rpm			
	3600	1800	1200	900	3600	1800	1200	900
½	...	...	...	143T	...	...	...	143T
¾	...	...	143T	145T	...	...	143T	145T
1	...	143T	145T	182T	...	143T	145T	182T
1½	143T	145T	182T	184T	143T	145T	182T	184T
2	145T	145T	184T	213T	145T	145T	184T	213T
3	182T	182T	213T	215T	145T	182T	213T	215T
5	184T	184T	215T	254T	182T	184T	215T	254T
7½	213T	213T	254T	256T	184T	213T	254T	256T
10	215T	215T	256T	284T	213T	215T	256T	284T
15	254T	254T	284T	286T	215T	254T	284T	286T
20	256T	256T	286T	324T	254T	256T	286T	324T
25	284TS	284T	324T	326T	256T	284T	324T	326T
30	286TS	286T	326T	364T	284TS	286T	326T	364T
40	324TS	324T	364T	365T	286TS	324T	364T	365T
50	326TS	326T	365T	404T	324TS	326T	365T	404T
60	364TS	364TS†	404T	405T	326TS	364TS†	404T	405T
75	365TS	365TS†	405T	444T	364TS	365TS†	405T	444T
100	405TS	405TS†	444T	445T	365TS	404TS†	444T	445T
125	444TS	444TS†	445T	...	404TS	405TS†	445T	...
150	445TS	445TS†	...	...	405TS	444TS†	...	...
200	...	...	...	...	444TS	445TS†	...	...

The voltage rating of 115 volts applies only to motors rated 15 hp and smaller.
 *1.00 Service Factor. **1.15 Service Factor.
 †When motors are to be used with V-belt or chain drives, the correct frame size is the frame size shown but with the suffix letter S omitted.

Tabel Ukuran Penampang Sabuk dan Diagram Pemilihan Sabuk¹



Ukuran penampang sabuk-V.

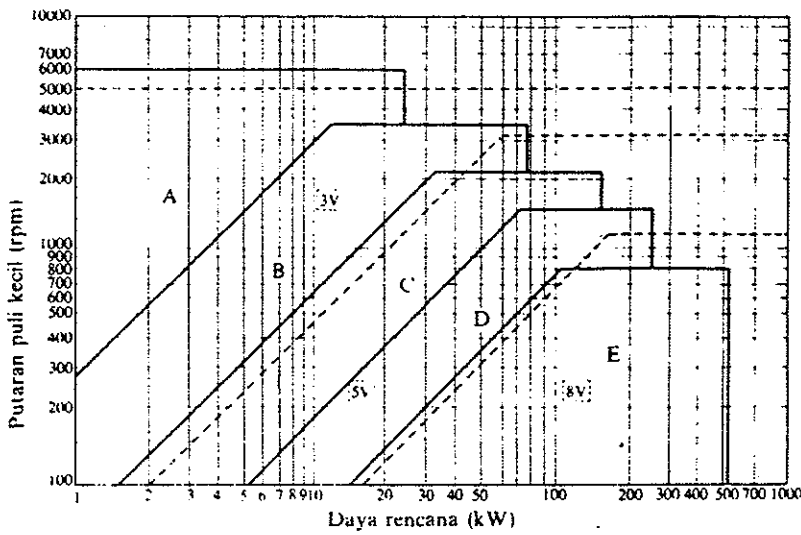


Diagram pemilihan sabuk-V.

¹Sularso : *Elemen Mesin*, hal. 164

Tabel Ukuran Puli-V^I

Tabel Diameter Minimum Puli Dianjurkan^{II}

Ukuran puli-V.

Penampang sabuk-V	Diameter nominal (diameter lingkaran jarak bagi d_p)	α (°)	H^*	L_o	K^{**}	K_c	c	f
A	71 - 100	34	11,95	9,2	4,5	8,0	15,0	10,0
	101 - 125	36	12,12					
	126 atau lebih	38	12,30					
B	125 - 160	34	15,86	12,5	5,5	9,5	19,0	12,5
	161 - 200	36	16,07					
	201 atau lebih	38	16,29					
C	200 - 250	34	21,18	16,9	7,0	12,0	25,5	17,0
	251 - 315	36	21,45					
	316 atau lebih	38	21,72					
D	355 - 450	36	30,77	24,6	9,5	15,5	37,0	24,0
	451 atau lebih	38	31,14					
E	500 - 630	36	36,95	28,7	12,7	19,3	44,5	29,0
	631 atau lebih	38	37,45					

Diameter minimum puli yang diizinkan dan dianjurkan (mm).

Penampang	A	B	C	D	E
Diameter min. yang diizinkan	65	115	175	300	450
Diameter min. yang dianjurkan	95	145	225	350	550

^ISularso : *Elemen Mesin*, hal.166

^{II}Ibid, hal. 169

Tabel Panjang Sabuk Standar¹

Panjang sabuk-V standar.

Nomor nominal		Nomor nominal		Nomor nominal		Nomor nominal	
(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)
10	254	45	1143	80	2032	115	2921
11	279	46	1168	81	2057	116	2946
12	305	47	1194	82	2083	117	2972
13	330	48	1219	83	2108	118	2997
14	356	49	1245	84	2134	119	3023
15	381	50	1270	85	2159	120	3048
16	406	51	1295	86	2184	121	3073
17	432	52	1321	87	2210	122	3099
18	457	53	1346	88	2235	123	3124
19	483	54	1372	89	2261	124	3150
20	508	55	1397	90	2286	125	3175
21	533	56	1422	91	2311	126	3200
22	559	57	1448	92	2337	127	3226
23	584	58	1473	93	2362	128	3251
24	610	59	1499	94	2388	129	3277
25	635	60	1524	95	2413	130	3302
26	660	61	1549	96	2438	131	3327
27	686	62	1575	97	2464	132	3353
28	711	63	1600	98	2489	133	3378
29	737	64	1626	99	2515	134	3404
30	762	65	1651	100	2540	135	3429
31	787	66	1676	101	2565	136	3454
32	813	67	1702	102	2591	137	3480
33	838	68	1727	103	2616	138	3505
34	864	69	1753	104	2642	139	3531
35	889	70	1778	105	2667	140	3556
36	914	71	1803	106	2692	141	3581
37	940	72	1829	107	2718	142	3607
39	965	73	1854	108	2743	143	3632
39	991	74	1880	109	2769	144	3658
40	1016	75	1905	110	2794	145	3683
41	1041	76	1930	111	2819	146	3708
42	1067	77	1956	112	2845	147	3734
43	1092	78	1981	113	2870	148	3759
44	1118	79	2007	114	2896	149	3785

¹Sularso : *Elemen Mesin*, hal. 168



Tabel Koefisien Gesek Material^I

Tabel Kekuatan Tarik Material Sabuk^{II}

Belt material	Pulley material						
	Cast iron, steel			Wood	Compressed paper	Leather face	Rubber face
	Dry	Wet	Greasy				
1. Leather oak tanned	0.25	0.2	0.15	0.3	0.33	0.38	0.40
2. Leather chrome tanned	0.35	0.32	0.22	0.4	0.45	0.48	0.50
3. Canvas-Stitched	0.20	0.15	0.12	0.23	0.25	0.27	0.30
4. Cotton Woven	0.22	0.15	0.12	0.25	0.28	0.27	0.30
5. Rubber	0.30	0.18	—	0.32	0.35	0.40	0.42
6. Balata	0.32	0.20	—	0.35	0.33	0.40	0.42

Kind of Belt	Strength, Pounds per Square Inch	Pounds per Foot, 1 Square Inch Section
Oak leather (single).....	4000- 5,500	0.45
Oak leather (double).....	2500- 5,000	0.45
Chrome leather (single).....	7500-12,000	0.45
Cotton (solid woven).....	6850- 8,800	
Cotton (folded and stitched).....	3850- 5,150	
Rubber.....	4300	0.54

^IRS Khurmi : *A Textbook Of Machine Design*, hal. 651

^{II}Louis J Bradford : *Machine Design*, hal. 199

Tabel Faktor Delah Momen dan Torsi^I

Tabel Faktor Keamanan Material Terhadap Beban^{II}

<i>Nature of load</i>	K_m	K_t
1. Stationary shafts		
(a) Gradually applied load	1.0	1.0
(b) Suddenly applied load	1.5 to 2.0	1.5 to 2.0
2. Rotating shafts		
(a) Gradually applied load	1.5	1.0
(b) Suddenly applied load with minor shock	1.5 to 2.0	1.5 to 2.0
(c) Suddenly applied load with major shock	2.0 to 3.0	1.5 to 3.0

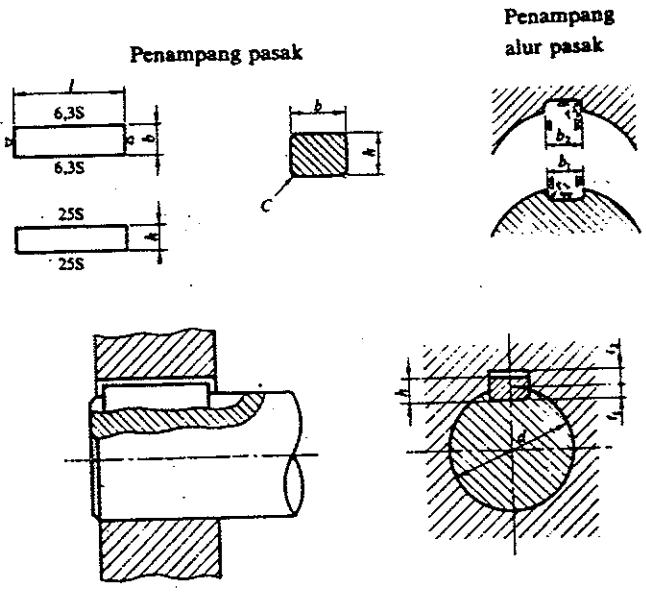
<i>Material</i>	<i>Steady load</i>	<i>Live load</i>	<i>Shock load</i>
Cast iron	5 to 6	8 to 12	16 to 20
Wrought iron	4	7	10 to 15
Steel	4	8	12 to 16
Soft materials and alloys	6	9	15
Leather	9	12	15
Timber	7	10 to 15	20

^IRS Khurmi : *A Textbook Of Machine Design*, hal. 431

^{II}Ibid, hal. 88

Tabel Ukuran Pasak dan Alur Pasak Standar

Ukuran pasak dan alur pasak.



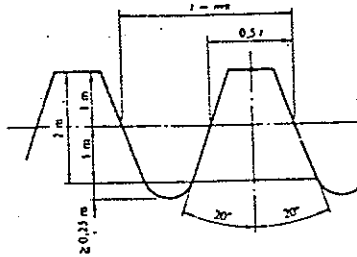
Ukuran-ukuran utama

(Satuan: mm)

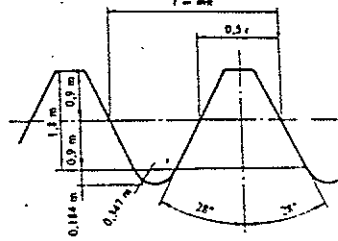
Ukuran nominal pasak $b \times h$	Ukuran standar $b, b_1,$ dan b_2	Ukuran standar h		C	r^*	Ukuran Standar t_1	Ukuran standar t_2			r_1 dan r_2	Referensi Diameter poros yang dapat dipakai d^{**}
		Pasak prismatis Pasak luncur	Pasak tirus				Pasak prismatis	Pasak luncur	Pasak tirus		
2 x 2	2	2		0,16-0,25	6-20	1,2	1,0		0,5	0,08-0,16	Lebih dari 6-8
3 x 3	3	3				6-36	1,8	1,4				0,9
4 x 4	4	4		0,25-0,40	8-45	2,5	1,8		1,2	0,16-0,25	10-12
5 x 5	5	5			10-56	3,0	2,3		1,7		12-17
6 x 6	6	6			14-70	3,5	2,8		2,2		17-22
(7 x 7)	7	7	7,2		16-80	4,0	3,0	3,5	3,0		20-25
8 x 7	8	7		0,40-0,60	18-90	4,0	3,3		2,4	0,25-0,40	22-30
10 x 8	10	8			22-110	5,0	3,3		2,4		30-38
12 x 8	12	8			28-140	5,0	3,3		2,4		38-44
14 x 9	14	9			36-160	5,5	3,8		2,9		44-50
(15 x 10)	15	10	10,2	0,60-0,80	40-180	5,0	5,0	5,5	5,0	0,40-0,60	50-55
16 x 10	16	10			45-180	6,0	4,3		3,4		50-58
18 x 11	18	11			50-200	7,0	4,4		3,4		58-65
20 x 12	20	12			56-220	7,5	4,9		3,9		65-75
22 x 14	22	14		63-250	9,0	5,4		4,4	75-85		
(24 x 16)	24	16	16,2	0,60-0,80	70-280	8,0	8,0	8,5	8,0	0,40-0,60	80-90
25 x 14	25	14			70-280	9,0	5,4		4,4		85-95
28 x 16	28	16			80-320	10,0	6,4		5,4		95-110
32 x 18	32	18			90-360	11,0	7,4		6,4		110-130

* l harus dipilih dari angka-angka berikut sesuai dengan daerah yang bersangkutan dalam tabel.
 6, 8, 10, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 70, 80, 90, 100, 110, 125, 140, 160, 180, 200, 220, 250, 280, 320, 360, 400.

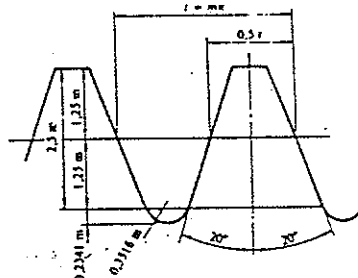
Tabel Profil Gigi Dasar¹



(a) Batang gigi dasar untuk gigi berkedalaman penuh.



(b) Batang gigi dasar untuk gigi gemuk dengan sudut tekanan besar.



(c) Batang gigi dasar untuk gigi berkedalaman lebih.

Ukuran roda gigi lurus standar berkedalaman penuh. (Satuan: mm)

Diameter lingkaran jarak bagi	$d_{o1} = 2r_{o1} = z_1 m, d_{o2} = 2r_{o2} = z_2 m$
Jarak sumbu poros	$a_0 = \frac{z_1 + z_2}{2} m$
Diameter lingkaran kepala	$d_{k1} = 2r_{k1} = (z_1 + 2) m, d_{k2} = 2r_{k2} = (z_2 + 2) m$
Diameter lingkaran dasar	$d_{d1} = z_1 m \cos \alpha_0, d_{d2} = z_2 m \cos \alpha_0$
Jarak bagi	$t_0 = \pi m$
Jarak bagi normal	$t_n = \pi m \cos \alpha_0$
Tinggi gigi (kedalaman pemotongan)	$h = 2m + c_1$

Keterangan: Jika kedalaman pemotongan akan diatur agar masing-masing gigi yang berpasangan memberikan setengah kelonggaran c_n dalam arah jarak bagi normal, maka dapat dipakai rumus berikut:

$$h' = h + c_n / 4 \sin \alpha_0 \text{ (dalam hal } \alpha_0 = 20^\circ \text{ maka } h' = h + 0,731 c_n \text{ dimana } c_n = c_0 \cos \alpha_0)$$

Tabel Tegangan Lentur Ijin (σ_a) pada bahan roda gigi¹

Tegangan lentur yang diizinkan σ_a pada bahan roda gigi.

Kelompok bahan	Lambang bahan	Kekuatan tarik σ_B (kg/mm ²)	Kekerasan (Brinell) H_B	Tegangan lentur yang diizinkan σ_a (kg/mm ²)
Besi cor	FC 15	15	140-160	7
	FC 20	20	160-180	9
	FC 25	25	180-240	11
	FC 30	30	190-240	13
Baja cor	SC 42	42	140	12
	SC 46	46	160	19
	SC 49	49	190	20
Baja karbon untuk konstruksi mesin	S 25 C	45	123-183	21
	S 35 C	52	149-207	26
	S 45 C	58	167-229	30
Baja paduan dengan pengerasan kulit	S 15 CK	50	400 (dicelup dingin dalam minyak)	30
	SNC 21 SNC 22	80 100	600 (dicelup dingin dalam air)	35-40 40-55
Baja khrom nikel	SNC 1	75	212-255	35-40
	SNC 2	85	248-302	40-60
	SNC 3	95	269-321	40-60
Perunggu Logam delta Perunggu fosfor (coran) Perunggu nikel (coran)		18 35-60	85 -	5 10-20
		19-30	70-100	5-7
		64-90	180-260	20-30
Damar phenol, dll.				3-5

Tabel Faktor Bentuk Gigi^I

Tabel Faktor Tegangan Kontak pada bahan roda gigi^{II}

Faktor bentuk gigi.

Jumlah gigi z	Y	Jumlah gigi z	Y
10	0,201	25	0,339
11	0,226	27	0,349
12	0,245	30	0,358
13	0,261	34	0,371
14	0,276	38	0,383
15	0,289	43	0,396
16	0,295	50	0,408
17	0,302	60	0,421
18	0,308	75	0,434
19	0,314	100	0,446
20	0,320	150	0,459
21	0,327	300	0,471
23	0,333	Batang gigi	0,484

Faktor tegangan kontak pada bahan roda gigi.

Bahan roda gigi (Kekerasan H_R)		k_H (kg/mm ²)	Bahan roda gigi (Kekerasan H_R)		k_H (kg/mm ²)
Pinyon	Roda gigi besar		Pinyon	Roda gigi besar	
Baja (150)	Baja (150)	0,027	Baja (400)	Baja (400)	0,311
" (200)	" (150)	0,039	" (500)	" (400)	0,329
" (250)	" (150)	0,053	" (600)	" (400)	0,348
" (200)	" (200)	0,053	" (500)	" (500)	0,389
" (250)	" (200)	0,069	" (600)	" (600)	0,569
" (300)	" (200)	0,086	" (150)	Besi cor	0,039
" (250)	" (250)	0,086	" (200)	"	0,079
" (300)	" (250)	0,107	" (250)	"	0,130
" (350)	" (250)	0,130	" (300)	"	0,139
" (300)	" (300)	0,130	" (150)	Perunggu fosfor	0,041
" (350)	" (300)	0,154	" (200)	"	0,082
" (400)	" (300)	0,168	" (250)	"	0,135
" (350)	" (350)	0,182	Besi cor	Besi cor	0,188
" (400)	" (350)	0,210	Besi cor nikel	Besi cor nikel	0,186
" (500)	" (350)	0,226	Besi cor nikel	Perunggu fosfor	0,155

Sudut tekanan $\alpha = 20^\circ$

^ISularso : *Elemen Mesin*, hal. 240

^{II}Ibid, hal. 243

Tabel Faktor Radial (XR) dan Faktor Aksial (YT)

Type of bearing	Specifications	$\frac{W_T}{W_R} < e$		$\frac{W_T}{W_R} > e$		e
		X _R	Y _T	X _R	Y _T	
Deep groove ball bearing	$\frac{W_T}{C_0} = 0.025$				2.0	0.22
	0.04				1.8	0.24
	0.07				1.6	0.27
	0.13	1	0	0.56	1.4	0.31
	0.25				1.2	0.37
	0.50				1.0	0.44
Angular contact ball bearings	Single row		0	0.35	0.57	1.14
	Two rows in tandem		0	0.35	0.57	1.14
	Two rows back to back	1	0.55	0.57	0.93	1.14
	Double row		0.73	0.62	1.17	0.86
Self-aligning bearings	Light series : for bores					
	10-20 mm	1	1.3	0.65	2.0	0.50
	25-35		1.7		2.6	0.37
	40-45		2.0		3.1	0.31
	50-65		2.3		3.5	0.28
	70-100		2.4		3.8	0.26
	105-110		2.3		3.5	0.28
	Medium series: for bores					
	12 mm		1.0	0.65	1.6	0.63
	15-20		1.2		1.9	0.52
25-50		1.5		2.3	0.43	
55-90		1.6		2.5	0.39	
Spherical roller bearings	For bores :					
	25-35 mm	1	2.1	0.67	3.1	0.32
	40-45		2.5		3.7	0.27
	50-100		2.9		4.4	0.23
	100-200		2.6		3.9	0.26
Taper roller bearings	For bores :					
	30-40 mm	1	0	0.4	1.60	0.37
	45-110				1.45	0.44
120-150	1.35				0.41	



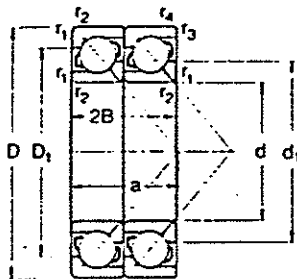
Tabel Masa Pakai Bantalan

S. No.	Application of bearing	Life of bearing, in hours
1.	Instruments and apparatus that are rarely used (a) Demonstration apparatus, mechanisms for operating sliding doors. (b) Aircraft engines	500 1,000—2,000
2.	Machines used for short periods or intermittently and whose breakdown would not have serious consequences e.g., hand tools, lifting tackle in workshops, and operated machines, agricultural machines, cranes in erecting shops domestic machines.	4,000—8,000
3.	Machines working intermittently, whose break down would have serious consequences, e.g., auxiliary machinery in power stations, conveyor plant for flow production, lifts, cranes for piece goods, machine tools used frequently.	8,000—12,000
4.	Machines working 8 hours per day and not always fully utilised, e.g., stationary electric motors, general purpose gear units.	12,000—20,000
5.	Machines working 8 hours per day and fully utilised, e.g., machines for the engineering industry, cranes for bulk goods, ventilating fans, counter shafts.	20,000—30,000
6.	Machines working 24 hours per day, e.g., separators, compressors, pumps, mine hoists, naval vessels.	40,000—60,000
7.	Machines required to work with high degree of reliability 24 hours per day, e.g., pulp and paper making machinery, public power plants, mine-pumps, water works.	100,000—200,000

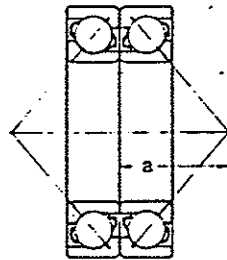


Tabel Single Row Ball Bearing dalam pasangan¹⁾

single row, in pairs
 d 17-80 mm



Tandem arrangement



Back-to-back arrangement



Face-to-face arrangement

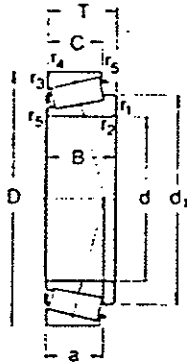
Principal dimensions Bearing pair		Basic load ratings Bearing pair dynamic C static C ₀	Limiting speeds Bearing pair Lubrication grease oil		Mass Bearing pair kg	Designation Single bearing ¹⁾		
d	D		r.min					
mm	N							
17	40	24	16 300	9 500	10 000	15 000	0,14	7203 BG
20	47	28	21 600	12 900	9 000	13 000	0,22	7204 BG
	52	30	28 100	17 000	8 500	12 000	0,30	7304 BG
25	52	30	24 200	15 300	8 000	11 000	0,26	7205 BG
	62	34	39 700	25 500	7 500	10 000	0,50	7305 BG
30	62	32	33 200	22 000	7 000	9 500	0,42	7206 BG
	72	38	50 700	34 000	6 300	8 500	0,74	7306 BG
35	72	34	44 200	30 000	6 000	8 000	0,60	7207 BG
	80	42	58 500	41 500	5 600	7 500	1,00	7307 BG
40	80	36	52 000	37 500	5 300	7 000	0,78	7208 BG
	90	46	72 800	51 000	5 000	6 700	1,34	7308 BG
45	85	38	58 500	42 500	5 000	6 700	0,88	7209 BG
	100	50	95 600	68 000	4 500	6 000	1,80	7309 BG
50	90	40	60 500	45 500	4 500	6 000	0,98	7210 BG
	110	54	111 000	81 500	4 000	5 300	2,30	7310 BG
55	100	42	76 100	57 000	4 300	5 600	1,30	7211 BG
	120	58	127 000	96 500	3 600	4 800	2,90	7311 BG
60	110	44	90 400	71 000	3 800	5 000	1,68	7212 BG
	130	62	146 000	112 000	3 400	4 500	2,70	7312 BG
65	120	46	104 000	83 000	3 400	4 500	2,10	7213 BG
	140	66	165 000	127 000	3 200	4 300	4,50	7313 BG
70	125	48	112 000	91 500	3 200	4 300	2,30	7214 BG
	150	70	186 000	146 000	2 800	3 800	5,50	7314 BG
75	130	50	117 000	98 000	3 200	4 300	2,60	7215 BG
	160	74	203 000	163 000	2 600	3 600	6,60	7315 BG
80	140	52	130 000	110 000	2 800	3 800	3,10	7216 BG
	170	78	221 000	183 000	2 400	3 400	7,80	7316 BG

¹⁾ When ordering, the number of single bearings required should be quoted, not the number of pairs



Tabel Taper Roller Bearing

single row
d 15-32 mm

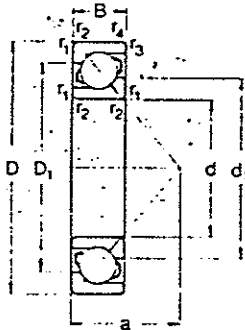


Principal dimensions			Basic load ratings		Limiting speeds		Mass	Designation	Dimension Series to ISO 355
d	D	T	C	C ₀	grease	oil			
mm			N		r/min		kg	-	-
15	42	14.25	21 200	12 700	9 000	13 000	0,095	30302	2FB
17	40	13.25	17 900	11 000	9 000	13 000	0,075	30203	2DB
	47	15.25	26 000	16 000	8 500	12 000	0,13	30303	2FB
	47	20.25	33 000	21 200	8 000	11 000	0,17	32303	2FD
20	42	15	22 900	15 600	8 500	12 000	0,097	32004 X	3CC
	47	15.25	26 000	16 600	8 000	11 000	0,12	30204	2DB
	52	16.25	31 900	20 000	8 000	11 000	0,17	30304	2FB
	52	22.25	41 300	28 000	7 500	10 000	0,23	32304	2FD
22	44	15	23 800	16 600	8 000	11 000	0,10	32022 X	3CC
	47	17	31 900	22 000	8 000	11 000	0,14	T2CC 022	2CC
25	47	15	25 500	18 300	8 000	11 000	0,11	32005 X	4CC
	52	16.25	29 200	19 300	7 500	10 000	0,15	30205	3CC
	52	19.25	34 100	25 000	7 000	9 500	0,19	32205 B	5CD
	52	22	44 000	32 500	6 700	9 000	0,23	33205	2DE
	62	18.25	41 800	26 500	6 700	9 000	0,26	30305	2FB
62	18.25	35 800	23 200	5 600	7 500	0,26	31305	7FB	
	25.25	56 100	39 000	6 000	8 000	0,36	32305	2FD	
	52	16	29 700	21 600	7 000	9 500	0,15	32028 X	4CC
58	20.25	39 600	28 500	6 300	8 500	0,25	32228 B	5DD	
30	55	17	33 600	24 500	6 700	9 000	0,17	32006 X	4CC
	62	17.25	38 000	25 500	6 300	8 500	0,23	30206	3DB
	62	21.25	47 300	33 500	6 300	8 500	0,28	32206	3DC
	62	21.25	45 700	33 500	6 000	8 000	0,30	32206 B	5DC
	62	25	60 500	45 500	5 600	7 500	0,37	33206	2DE
	72	20.75	52 800	34 500	5 600	7 500	0,39	30306	2FB
72	20.75	44 600	29 000	5 000	6 700	0,39	31306	7FB	
	28.75	72 100	52 000	5 300	7 000	0,55	32306	2FD	
32	58	17	34 700	26 000	6 300	8 500	0,19	32032 X	4CC



Tabel Single Row Ball Bearing

Angular contact ball bearings
 single row
 d 10-70 mm



Principal dimensions		Basic load ratings		Limiting speeds		Mass	Designation	
d	D	C	C ₀	Lubrication grease	oil			
mm		N		r/min		kg	-	
10	30	9	4 940	2 120	19 000	28 000	0.031	7200 B
12	32	10	7 020	3 050	17 000	24 000	0.045	7201 B
15	35	11	8 060	3 650	16 000	22 000	0.048	7202 B
	42	13	11 700	5 300	14 000	19 000	0.090	7302 B
17	40	12	9 950	4 750	14 000	19 000	0.070	7203 B
	47	14	14 800	7 200	12 000	17 000	0.12	7303 B
20	47	14	13 300	6 550	11 000	16 000	0.11	7204 B
	52	15	17 400	8 500	10 000	15 000	0.15	7304 B
25	52	15	14 800	7 650	9 500	14 000	0.13	7205 B
	62	17	24 200	12 700	8 500	12 000	0.25	7305 B
30	62	16	20 300	11 000	8 500	12 000	0.21	7206 B
	72	19	31 200	17 000	7 500	10 000	0.37	7306 B
35	72	17	27 000	15 000	7 500	10 000	0.30	7207 B
	80	21	36 400	20 400	7 000	9 500	0.51	7307 B
40	80	18	31 900	18 600	6 700	9 000	0.39	7208 B
	90	23	44 900	25 500	6 300	8 500	0.67	7308 B
45	85	19	35 800	21 200	6 300	8 500	0.44	7209 B
	100	25	58 500	34 500	5 600	7 500	0.90	7309 B
50	90	20	37 700	22 800	5 600	7 500	0.49	7210 B
	110	27	67 600	45 000	5 000	6 700	1.15	7310 B
55	100	21	46 200	28 500	5 300	7 000	0.65	7211 B
	120	29	79 300	48 000	4 500	6 000	1.45	7311 B
60	110	22	55 900	35 500	4 800	6 300	0.84	7212 B
	130	31	90 400	56 000	4 300	5 600	1.85	7312 B
65	120	23	63 700	41 500	4 300	5 600	1.05	7213 B
	140	33	101 000	64 000	4 000	5 300	2.25	7313 B
70	125	24	68 900	45 500	4 300	5 600	1.15	7214 B
	150	35	114 000	72 000	3 600	4 800	2.75	7314 B

Tabel Bahan Bantalan Luncur^ITabel Tekanan Maksimum Ijin dsb, dari bantalan radial^{II}

Sifat-sifat bahan bantalan luncur.

Bahan bantalan	Kekerasan H_B	Tekanan maksimum yang diperbolehkan (kg/mm^2)	Temperatur maks. yang diperbolehkan ($^{\circ}\text{C}$)
Besi cor	160-180	0,3-0,6	150
Perunggu	50-100	0,7-2,0	200
Kuningan	80-150	0,7-2,0	200
Perunggu fosfor	100-200	1,5-6,0	250
Logam putih berdasar Sn	20-30	0,6-1,0	150
Logam putih berdasar Pb	15-20	0,6-0,8	150
Paduan Cadmium	30-40	1,0-1,4	250
Kelmet	20-30	1,0-1,8	170
Paduan Aluminium	45-50	2,8	100-150
Perunggu timah hitam	40-80	2,0-3,2	220-250

Tekanan maksimum yang diizinkan, dll., dari bantalan radial.

Mesin	Bantalan	Perbandingan lebar/diameter standar l/d	Tekanan maks. yang diizinkan P_e (kg/mm^2)	Faktor tekanan-kecepatan maks. yang diizinkan $(pv)_s$ ($\text{kg/mm}^2 \text{ m/s}$)	Viskositas pada 38°C Z (cP)	Harga minimum yang diizinkan dari $\frac{ZN/p}{\left(\frac{\text{cP} \cdot \text{rpm}}{\text{kg/mm}^2}\right)}$
Otomobil Motor pesawat terbang	Bantalan utama	0,8-1,8	$0,6 + -1,2\Delta$	20	7-8	2×10^6
	Pena engkol	0,7-1,4	$1 \times + -3,5\Delta$	40		$1,4 \times 10^6$
	Pena torak	1,5-2,2	$1,5 \times + -4\Delta$	-		1×10^6
Pompa dan kompresor torak	Bantalan utama	1,0-2,0	$0,2 \times$	0,2-0,3	30-80	4×10^6
	Pena engkol	0,9-2,0	$0,4 \times$	0,3-0,4		$2,8 \times 10^6$
	Pena torak	1,5-2,0	$0,7 \times +$	-		$1,4 \times 10^6$
Mesin uap torak	Poros penggerak	1,6-1,8	0,4	$1 \times 1,5$	100	4×10^6
	Pena engkol	0,7-2,0	1,4	1,5-2	40	$0,7 \times 10^6$
	Pena torak	0,8-2,0	1,8	-	30	$0,7 \times 10^6$
Kendaraan rel	Poros	1,8-2,0	0,35	1-1,5	100	7×10^6
Turbin uap	Bantalan utama	1,0-2,0	$0,1 \times -0,2\Delta$	4	2-16	15×10^6
Generator, motor, pompa sentrifugal	Bantalan rotor	1,0-2,0	$0,1 \times -0,2\Delta$ $0,15 \times -0,15 \times$	0,2-0,3	25	25×10^6
Poros transmisi	Beban ringan	2,0-3,0	$0,02 \times$	0,1-0,2	25-60	14×10^6
	Mapan sendiri	2,5-4,0	$0,1 \times$			4×10^6
	Beban berat	2,0-3,0	$0,1 \times$			4×10^6
Mesin perkakas	Bantalan utama	1,0-4,0	0,05-0,2	0,05-0,1	40	$0,15 \times 10^6$
Pelubang (plong) Mesin gunting		1,0-2,0	$2,8 \times$		100	
		1,0-2,0	$5,5 \times$		100	
Mesin giling baja	Bantalan utama	1,1-1,5	2	5-8	50	$1,4 \times 10^6$
Roda gigi reduksi	Bantalan	2,0-4,0	0,05-0,2	0,5-1	30-50	5×10^6

Catatan: \times = pelumasan tetes atau cincin; $+$ = pelumasan percik; Δ = pelumasan pompa.

^ISularso : *Elemen Mesin*, hal. 109

^{II}Ibid, hal. 110



Tabel Besi Tuang Kelabu dan Pemakaiannya^I

Tabel Spesifikasi Besi Tuang Kelabu^{II}

Minimum physical properties of grey iron according to DIN 1691 (Nov. 1949)
Shrinkage approximately 1%; density $\gamma = 7.25 \text{ kg/dm}^3$; dynamic strength see p. 62

Designation	Wall thickness (test piece diam) mm	Tensile Strength σ_b kgf/mm ²	Bending Strength σ_{bb} kgf/mm ²	Deflec- tion ¹ f mm	Brinell hardness ² H_B kgf/mm ²	Young's modulus ³ E kgf/mm ²
GG—12	8...50 (30)	12 ³			120...180	7000... 4000
GG—14	4... 8 (13)	18	32	2	140...200	9500... 5500
	8...15 (20)	16	30	4		
	above 15...30 (30)	14	28	7		
	above 30...50 (45)	11	24	10		
GG—18	4... 8 (13)	22	38	2	160...220	10500... 8000
	8...15 (20)	20	36	4		
	above 15...30 (30)	18	34	7		
	above 30...50 (45)	15	30	10		
GG—22	4... 8 (13)	26	44	3	180...240	12000... 9500
	8...15 (20)	24	42	5		
	above 15...30 (30)	22	40	8		
	above 30...50 (45)	19	36	11		
GG—26	8...15 (20)	28	48	5	180...240	13000...11000
	above 15...30 (30)	26	46	8		
	above 30...50 (45)	23	42	11		
GG—30	above 15...30 (30)	30	48	8	180...220	
	above 30...50 (45)	25	45	11		

Grey castings. Summary and applications

Description	Application
Structural and commercial castings:	Columns, windows, ovens, pipes heating elements.
Machinery castings:	GG—12 No quality specifications, used for highly stressed parts like housings, base plates, stands.
	GG—14 GG—18 for parts subject to higher stresses or sliding friction: Housings, slide ways, steam engine cylinder, piston fittings, piston rings.
	GG—22 GG—26 for parts subject to heat (up to 420 °C) sliding friction and still higher stresses: cylinder, piston, piston rings.
	GG—30 for special purposes and very highly stressed parts.
Special CI, pearlitic CI	
Special magnetic properties, e.g., GG—12.9 (DIN 17006)	for electrical machines of higher magnetic induction.
Chill castings:	for wear resistant parts (difficult to machine), $H_B = 400—600 \text{ kgf/mm}^2$.
Through hardened chill castings	Seldom used due to its brittleness, e.g., sandblast nozzle.
Surface chilled castings	Cast in metal moulds (softer core) for wear-resistant plates and rings of edge mills, ball mills and stone crushers; for punches, drawing dies and runner wheels (Griffinguss).
Medium chilled castings	for rolls with fine, dense grains.

^IGustav N : *Machine Elements* Vol. I, hal. 91

^{II}Ibid.



Tabel Bahan Poros dan Spesifikasinya

Bahan poros yang umum digunakan.

Nama (2)	Kekuatan tarik σ_B N/mm ²	Kekerasan HV (dapat dikeraskan sampai)	Kekuatan (1)		Kekuatan (1)	
			tekuk berubah-ubah/ membesar N/mm ²	tekuk berubah-ubah/ membesar N/mm ²	torsi berubah-ubah/ membesar N/mm ²	torsi berubah-ubah/ membesar N/mm ²
			σ_{LW}	σ_{hSch}	τ_{tW}	τ_{tSch}
St 42-2	B 420---500	115 (450)	220	360	150	180
St 50-2	B 500---600	135 (530)	260	420	180	210
St 60-2	B 600---720	165 (720)	300	470	210	230
St 70-2	B 700---850	190	340	520	240	260
C 22, Ck 22	V 500---650	150	280	490	190	250
C 35, Ck 35	V 590---740	140 (530)	330	550	230	300
C 45, Ck 45	V 670---820	170 (720)	370	630	260	340
25CrMo4	V 800---950	186 (610)	430	730	300	450
34Cr1	V 900---1100	220 (670)	480	810	330	550
C 15, Ck 15	E 500---650 ³	140 (840)	260	420	180	210
16MnCr5	E 800---1100 ³	210 (840)	390	670	270	430

(1) Didasarkan pada Hähnen/Decker [3/10].

(2) B-baja konstruksi umumnya, V-baja ditemper, E-baja inset

(3) Nilai kekuatan dalam inti.



Tabel Spring Steel dan Pemakaiannya

Spring steels to DIN 17220..22 (April 1955) (Leaf and conical springs) and after Lüpfer 15/61.
Young's modulus $E \approx 21000 \text{ kgf/mm}^2$; shear modulus $G \approx 8300 \text{ kgf/mm}^2$

DIN	Symbol ¹	Composition in % (mean)				Ultimate strength σ_B (min) kgf/mm^2	δ , min %	H_B kgf/mm^2	Treatment	Application
		C	Si	Mn	others					
DIN 1669	50 M 7 H	0,5	to 0,4	1,7	—	120	7	340...400	H	Automobile leaf spring
	48 S 7 T	0,47	1,65	0,62	—	130	6	370...430	T	Railway leaf spring
	55 S 7 H	0,55	1,65	0,7	—	130	6	370...430	H	Automobile, Tramway and Light railway leaf springs (up to 10 mm thick)
	65 S 7 H	0,65	1,65	0,7	—	135	6	385...445	H	Light railway leaf springs (above 10 mm thick)
	50 CV 4 H	0,5	to 0,4	0,75	1,0Cr 0,1V	135	6	385...445	H	Leaf springs for higher requirements
Lüpfer		0,55	0,15	0,7	0,7	90...185	2	—	P	Tension helical springs
		0,7	0,15	0,7	—	140...210	2	—	—	Compression helical springs
		0,95	0,15	0,5	—	170...350	2	—	—	Heavy loaded helical springs in tension or compression
		0,65	0,15	0,7	—	140...180	6	—	—	Fatigue loaded comp. helical springs
		0,62	3,0	0,9	—	160...180	—	—	H	Gun springs
		0,5	0,3	0,8	1,1Cr 0,1V	130...155	5	—	—	Torsion bars and leaf springs for automobiles
		0,6	0,9	0,4	1,1Cr	130...160	—	—	—	Springs at higher temperatures
	0,65	0,15	0,3	—	100...130	5	—	—	Post formed leaf springs	
	0,85	0,15	0,3	—	150...180	4	—	H	Gramophone springs	
	1,0	0,15	0,3	—	200...230	3	—	—	Watch springs	

¹ H = oil hardened and tempered; T = water hardened and tempered; P = patented drawn spring wire – the higher σ_B values are for thinner wires.

² For cone springs H_B up to 520 is allowed.

PERPUSTAKAAN

Tabel Massa Jenis Bahan

Tabel Bahan dan Konstanta Fisiknya^{II}

Material	Density (kg/cm ³)	Material	Density (kg/cm ³)
Cast iron	0-00722	Zinc	0-00721
Wrought iron	0-00778	Lead	0-0114
Steel	0-0079	Tin	0-00740
Brass	0-00805	Aluminium	0-00027
Copper	0-00888		

KONSTANTA FISIK DAN BAHAN

Bahan	Elastisitas Modulus, E		Modulus Kekakuan, G		Angka Pembangan Poisson	Berat Satuan, w		
	Mpsi	GPa	Mpsi	GPa		lb/in ³	lb/ft ³	kN/m ³
Aluminum (all alloys)	10.3	71.0	3.80	26.2	0.334	0.098	169	26.6
Beryllium copper	18.0	124.0	7.0	48.3	0.285	0.297	513	80.6
Brass	15.4	106.0	5.82	40.1	0.324	0.309	534	83.8
Carbon steel	30.0	207.0	11.5	79.3	0.292	0.282	487	76.5
Cast iron, gray	14.5	100.0	6.0	41.4	0.211	0.260	450	70.6
Copper	17.2	119.0	6.49	44.7	0.326	0.322	556	87.3
Douglas fir	1.6	11.0	0.6	4.1	0.33	0.016	28	4.3
Glass	6.7	46.2	2.7	18.6	0.245	0.094	162	25.4
Inconel	31.0	214.0	11.0	75.8	0.290	0.307	530	83.3
Lead	5.3	36.5	1.9	13.1	0.425	0.411	710	111.5
Magnesium	6.5	44.8	2.4	16.5	0.350	0.065	112	17.6
Molybdenum	48.0	331.0	17.0	117.0	0.307	0.368	636	100.0
Monel metal	26.0	179.0	9.5	65.5	0.320	0.319	551	86.6
Nickel silver	18.5	127.0	7.0	48.3	0.322	0.316	546	85.8
Nickel steel	30.0	207.0	11.5	79.3	0.291	0.280	484	76.0
Phosphor bronze	16.1	111.0	6.0	41.4	0.349	0.295	510	80.1
Stainless steel (18-8)	27.6	190.0	10.6	73.1	0.305	0.280	484	76.0

^IRS Khurmi : *A Textbook Of Machine Design*, hal. 10

^{II}JE Shigley : *Perencanaan Teknik Mesin*, hal. 464



Tabel Pemilihan Konsisten Gemuk Menurut Cara Pemakaian¹

TABEL Pemilihan Konsisten Gemuk Menurut Cara Pemakaian

	Kelas-NLGI ^a	Keterangan
Pemakaian dengan tangan	1 – 3	Pada gemuk serbaguna NLGI 2–3
Instalasi pelumasan sentral	1 – 2	(Mampu angkut)
Pemakaian semprot	00 – 0	(Mampu semprot)
Pelumas cebur/celup	000 – 0	(Mampu alir)

a Dalam DIN 51818 gemuk dibagi menurut konsistennya (penetrasi Walk) dalam kelas NLGI – National Lubricating Grease Institute.

¹Gustav N : *Elemen Mesin* jilid II, hal.236