



Units conversion, tables

1.0 Units conversion

Length	1	m	▼	=	3.280839895	feet	▼	=	3.280839895	feet	▼
Area	1	m ²	▼	=	1000000	mm ²	▼	=	10.76391042	feet ²	▼
Volume	1	cm ³	▼	=	0.061023744	inch ³	▼	=	0.000219969	Imp gal	▼
Flow rate	1	litre/s	▼	=	2.1189	ft ³ /min	▼	=	0.035315	ft ³ /s	▼
Mass	1	kg	▼	=	2.204624	lb	▼	=	35.273991	oz	▼
Density	1	kg/m ³	▼	=	0.000578038	oz/in ³	▼	=	0.062427818	lb/feet ³	▼
Inertia	1	kg*m ²	▼	=	0.737561	lbf*ft*s ²	▼	=	141.61197	ozf*in*s ²	▼
Force	1	N	▼	=	0.224809	lbf	▼	=	101.971621	p	▼
Moment	1	N*m	▼	=	8.850732	lbf*in	▼	=	11.80099742	ozf*ft	▼
Speed	1	m/s	▼	=	60	m/min	▼	=	3.280839895	ft/s	▼
Acceleration	1	m/s ²	▼	=	3.280839895	ft/s ²	▼	=	3600	m/min ²	▼
Power	1	kW	▼	=	1.34102	HP	▼	=	101.97	kg*m/s	▼
Energy	1	N*m	▼	=	0.000947813	BTU	▼	=	0.000277778	Wh	▼
Pressure	1	kPa	▼	=	0.145037	psi	▼	=	1000	Pa	▼
Time	0	hour	▼	=	0	minute	▼	=	0	second	▼
Temperature	20	°C	▼	=	68	°F	▼	=	293.15	°K	▼

Gearing dimension 3 3 ▼ Modul [mm] ▼ = 8.46667 Diametral Pitch ▼

2.0 Hardness table

HV	HRB	HRC	HB	HB	HB	S	Rm	ScSc
122	67		5.5	116	116	58	401	15
127	70		5.4	121	121	63	432	-
132	72.5		5.3	126	126	65	448	20
137	75		5.2	131	131	66	455	20.5
143	77		5.1	137	137	67	463	21
150	80		5	143	143	69	479	22
156	82		4.9	149	149	72	494	-
163	84.2		4.8	156	156	76	525	23
171	86		4.7	163	163	78	540	-
178	88.5		4.6	170	170	81	556	24
188	91	12	4.5	179	179	88	602	-
196	93		4.4	187	187	92	632	25
212	96	15	4.3	197	197	97	664	27
218	97		4.2	207	207	101	695	28
222	98	19	4.15	212	212	103	710	29
228	-	20	4.1	217	217	107	741	-
234	-	20.8	4.05	223	223	110	756	30
241	-	22	4	229	229	112	772	31
247	101	23	3.95	235	235	114	787	32
255	-	24.3	3.9	241	241	118	818	33

HV	HRB	HRC	HB	HB	HB	S	Rm	ScSc
261	104	25.2	3.85	248	248	123	849	34
269	105	26.6	3.8	255	255	125	865	35
275	-	27.5	3.75	262	262	130	895	36
284	106	29	3.7	269	269	132	911	37
292	-	29.8	3.65	277	277	136	942	38
300	-	30.9	3.6	285	285	141	973	40
308	109	32	3.55	293	293	143	988	41
318		33	3.5	302	302	147	1019	42
327		34	3.45	311	311	152	1050	43
337		35	3.4	321	321	159	1096	45
349		36.7	3.35	331	331	163	1127	46
359		37.7	3.3	341	341	168	1158	48
370		38.8	3.25	352	352	172	1189	49
381		39.9	3.2	363	363	179	1235	51
395		41.3	3.15	375	375	183	1266	52
408		42.4	3.1	388	388	190	1312	54
422		43.7	3.05	401	401	197	1359	56
437		44.8	3	415	415	206	1420	58
452		46	2.95	429	429	212	1467	60
470		47.5	2.9	444	444	219	1513	62
HV	HRB	HRC	HB	HB	HB	S	Rm	ScSc
497		49.5	2.85	461	461	226	1559	64
517		50.7	2.8	477	477	235	1621	66
532		51.9	2.75	495	495	241	1668	68
572		54.4	2.7	514		250	1729	71
609		56.1	2.65	534		262	1807	73
630		57.1	2.6	555		273	1884	75
670		58.9	2.55	578		284	1961	78
698		60	2.5	601		295	2039	81
710		60.5	2.45	627				-
725		61	2.44	630				82
740		61.7						84
760		62.5						86
780		63.3						87
800		64						88
820		64.8						90
840		65.5						92
860		66.3						93
880		67						95
900		67.7						96
HV	HRB	HRC	HB	HB	HB	S	Rm	ScSc

3.0 Roughness table

Ra (μm)	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025	0.012
Ra (μin)	2000	1000	500	250	125	63	32	16	8	4	2	1	0.5
Flame Cutting													
Snagging													
Sawing													
Planing, Shaping													
Drilling													
Chemical Milling													
Elect. Discharge Mach.													
Milling													
Broaching													
Reaming													
Electron Beam													
Laser													
Electro-Chemical Machining													
Boring, Turning													
Electrolytic Grinding													
Roller Burnishing													
Grinding													
Honing													
Electrostatic polishing													
Polishing													
Lapping													
Superfinishing													
Sand Casting													
Hot Rolling													
Forging													
Perm. Mold Casting													
Precision casting													
Extruding													
Cold Rolling, Drawing													
Die Casting													
Ra (μm)	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025	0.012
Ra (μin)	2000	1000	500	250	125	63	32	16	8	4	2	1	0.5
Rz (μm)	100	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025

4.0 Density and thermal expansion

ID	Materialnames	Density		Thermal expansion			
		[kg/m ³]	kg/m ³ ▼	[m/m/C*e-6]	C	[in/in/F*e-6]	F
1	Steel Carbon	7850	7850	11.7	20-100	6.500	68-212
2	Steel for electric sheets	7850	7850				
3	Tin bronze (8%Sn)	8800	8800	17.5	20-100	9.722	68-212
4	Aluminium bronze (9%Al)	7600	7600	15.6	20-100	8.667	68-212
5	Leaded bronze (25%Pb)	8800	8800	18.4	20-200	10.222	68-392
6	Dural	2800	2800	22.9	20-100	12.722	68-212
7	Aluminium (99.5%)	2700	2700	23.8	20-100	13.222	68-212
8	gray iron	7200	7200	8.5	20-100	4.722	68-212
9	Copper (99.5%)	8890	8890	17.7	25-300	9.833	77-572
10	Brass (70%Cu)	8550	8550	18.5	25-100	10.278	77-212
11	Pewter (Sn)	7280	7280	27	20	15.000	68
12	Magnesium (Mg)	1740	1740	26	20	14.444	68
13	Chrome (Cr)	7100	7100	8	20	4.444	68
14	Silver (Ag)	10500	10500	18.9	20	10.500	68
15	Titanium (Ti)	4530	4530	9	20	5.000	68
16	Wolfram (W)	19300	19300	4.3	20	2.389	68
17	Oak-tree	680	680				
18	Spruce	330	330				
19	Pine tree	500	500				
20	Larch	680	680				
21	cork	250	250				
22	Nylon	1150	1150	70-120	20-50	38.9-66.7	68-122
23	Polypropylene (PP)	910	910	180	20-50	100.000	68-122
24	polyvinyl chloride (PVC)	1400	1400	80-210	20-50	44.4-116.7	68-122
25	pottery	2400	2400	3	0-100	1.667	32-212
26	bakelite	1200	1200	21-36	0-100	44023.000	32-212
27	silica glass	2700	2700	3.1	0-500	1.722	32-932
28	Iridium (Ir)	22400	22400	6.6	20	3.667	68
29	Cobalt (Co)	8800	8800	12.6	20	7.000	68
30	Silicon (Si)	2330	2330	2.4	20	1.333	68
31	Nickel (Ni)	8900	8900	13	20	7.222	68
32	Slug (Pb)	11340	11340	29	20	16.111	68
33	Platinum (Pt)	21450	21450	9	20	5.000	68
34	Carbon- diamond	3514	3514	1.3	18	0.722	64.4
35	carbon- graphite	2220	2220	2	18	1.111	64.4
36	Uranus (U)	1870	1870		20		68
37	Calcium (Ca)	1540	1540	25	20	13.889	68
38	Zinc (Zn)	7130	7130	29	20	16.111	68
39	Zircon (Zr)	6530	6530		20		68
40	Gold (Au)	19290	19290	14.2	20	7.889	68

41	Iron (Fe)	7860	7860	12.3	20	6.833	68
42	Nickel bronze	8800	8800	15.7	20-220	8.722	68-428
43	Electron Beam	1810	1810	26.8	20-100	14.889	68-212
44	Wrought Copper (99.85%Cu)	8900	8900	17.7	25-300	9.833	77-572
45	Wrought Copper (99.5%Cu)	8890	8890	17.5	25-300	9.722	77-572
46	Cast brass (Ms 60)	8300	8300	21	20-200	11.667	68-392
47	wrought brass (63% Cu)	8430	8430	19	25-100	10.556	77-212
48	Alloy steel	7850	7850	11.4	20-100	6.333	68-212
49				14.5	20-600	8.056	68-1112
50	Premium steel Cr, Ni	7800	7800	15	20-100	8.333	68-212
51				17.3	20-400	9.611	68-752
52	Premium steel Chrome	7700	7700	10.5	20-100	5.833	68-212
53				11.5	20-400	6.389	68-752
54	silumin	2650	2650	18.8	20-200	10.444	68-392
55	ABS (akrylonitril butadien styren)	1045	1045	0.5-1	20-50	0.28-0.6	68-122
56	asphalt	1200	1200				
57	asbestos	2450	2450				
58	Asbestos carton	1200	1200				
59	bakelite	1270	1270	21-36	0-100	44023.000	32-212
60	concrete	1600	1600	5.8-6.6	0-100	3.2-3.7	32-212
61	brick	1600	1600	3.6-5.8	0-100	37317.000	32-212
62	Oak wood (along the fibre)	650	650	7.6	0-100	4.222	32-212
63	Oak wood (plumb on fibre)	650	650	54.4	0-100	30.222	32-212
64	Whitewood (along the fibre)	620	620	3	0-100	1.667	32-212
65	Whitewood(plumb on fibre)	620	620	58	0-100	32.222	32-212
66	hard rubrer	1325	1325	17-28	0-100	9.4-15.6	32-212
67	Rude rubber	940	940	37	0-100	20.556	32-212
68	Cured paper	1250	1250				
69	pertinax	1300	1300	40	0-100	22.222	32-212
70	Furcate polyethylene	930	930	230	20-50	127.778	68-122
71	polyethylentereftalat PETP	1350	1350	70-80	20-50	38.9-44.4	68-122
72	polyfenylenoxid PPO/PS (Noryl)	1080	1080	60-70	20-50	38.9-33.3	68-122
73	polyfarmaldehyt POM	1420	1420	100-140	20-50	55-78	68-122
74	polycarbonate PC	1220	1220	60-70	20-50	38.9-33.3	68-122
75	polymethylmetalcrylate PMMA (Umaplex)	1180	1180	70	20-50	33.333	68-122
76	polystyrene PS (Krasten)	1050	1050	60-80	20-50	38.9-44.4	68-122
78	polytetrafluorethylen PTFE (Teflon)	2170	2170	120	20-50	66.667	68-122
79	Jens Glas	2600	2600	3.4-6.3	0-100	1.9-3.5	32-212
80				20,2-34	0-500	11.2-18.9	32-932
81	Black coal	905	905				
82	Wood coal	182.5	182.5				
83	Brown coal	715	715				

5.0 **Oil viscosity**

5.1 Units Celsius ▼
 5.2 Viscosity index VI VI - 50 ▼

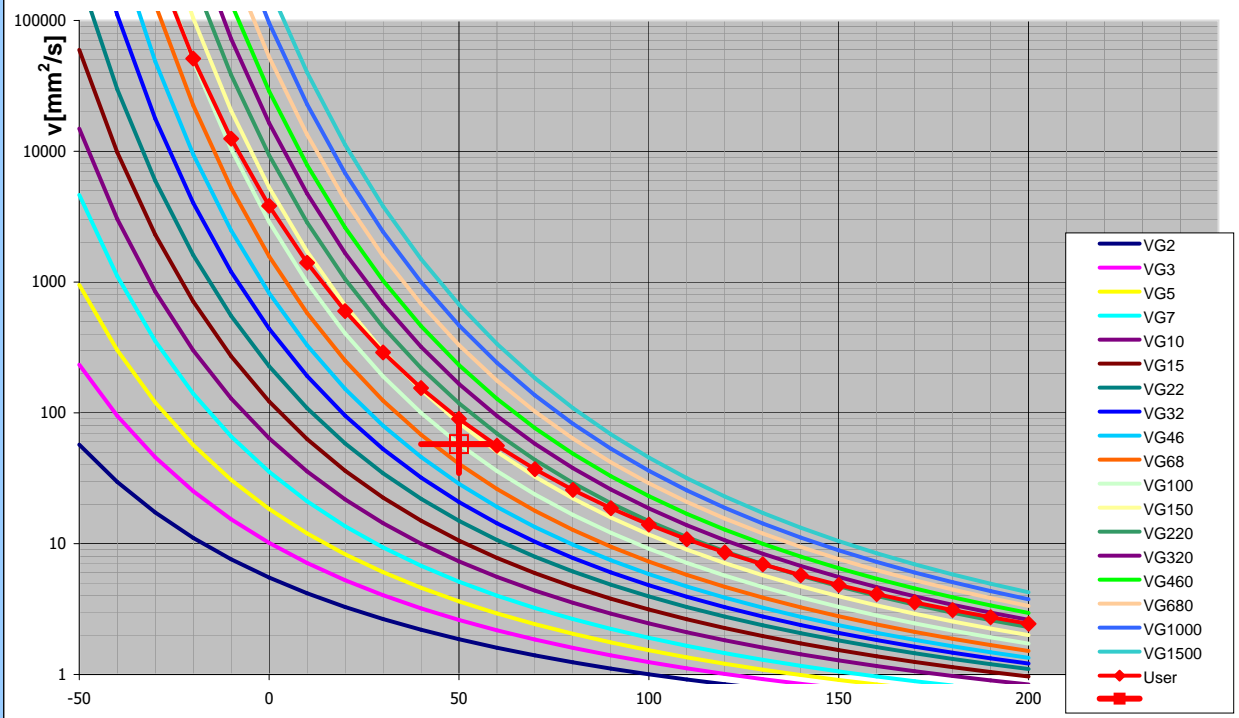
5.3 Exact viscosity for temperature:

5.4 Viscosity grade VG100 ▼
 5.5 Temperature T 50 [°C]
 5.6 Viscosity v 57.70 [cSt]
 5.7 Viscosity from/to 52.40 63.00

5.8 Viscosity calculation

5.9 Temperature	T1=	20	T1=	20	[°C]
5.10 Temperature	T2=	50	T2=	50	[°C]
5.11 Viscosity	v1=	600	v1=	600	[cSt]
5.12 Viscosity	v2=	90	v2=	90	[cSt]
5.13 Temperature	T3=	30			[°C]
5.14 Viscosity	v3=	289.72			[cSt]

User curve



5.15 ISO 3448 Viskosity grade

	Viskosity grade	VG10	VG15	VG22	VG32	VG46	VG68	VG100	VG150	VG220	VG320	VG460	VG680	VG1000
VI-0	20°C - from:	20.20	33.50	54.2	87.7	144.0	242.0	402.0	672.0	1080	1720	2700	4420	7170
	20°C - to:	25.90	43.00	69.8	115.0	189.0	315.0	520.0	862.0	1390	2210	3480	5680	9230
	37.8°C - from:	9.73	14.70	21.8	32.0	46.6	69.8	104.0	157.0	233	341	495	739	1100
	37.8°C - to:	12.00	18.10	26.8	39.4	57.4	85.8	127.0	194.0	286	419	608	908	1350
	50°C - from:	6.53	9.43	13.3	18.6	25.5	35.9	50.4	72.5	102	144	199	283	400
	50°C - to:	7.83	11.30	16.0	22.2	30.3	42.8	60.3	86.9	123	172	239	339	479
VI-50	20°C - from:	19.10	31.60	51.0	82.6	133.0	219.0	356.0	583.0	927	1460	2290	3700	5960
	20°C - to:	24.50	40.60	65.8	108.0	172.0	283.0	454.0	743.0	1180	1870	2930	4740	7640
	37.8°C - from:	9.68	14.70	21.7	31.9	46.3	69.2	103.0	155.0	230	337	488	728	1080
	37.8°C - to:	11.90	18.00	26.6	39.2	56.9	85.0	126.0	191.0	282	414	599	894	1330
	50°C - from:	6.65	9.62	13.6	19.0	26.1	37.1	52.4	75.9	108	151	210	300	425
	50°C - to:	7.99	11.50	16.3	22.6	31.3	44.4	63.0	91.2	129	182	254	360	509
VI-95	20°C - from:	18.10	29.80	48.0	76.9	120.0	193.0	303.0	486.0	761	1180	1810	2880	4550
	20°C - to:	23.10	38.30	61.7	98.7	153.0	244.0	383.0	614.0	964	1500	2300	3650	5780
	37.8°C - from:	9.64	14.60	21.6	31.7	45.9	68.4	101.0	153.0	226	331	478	712	1050
	37.8°C - to:	11.80	17.90	26.5	38.9	56.3	83.9	124.0	188.0	277	406	587	874	1290
	50°C - from:	6.78	9.80	13.9	19.4	27.0	33.7	55.3	80.6	115	163	228	326	466
	50°C - to:	8.14	11.80	16.6	23.3	32.5	46.6	66.6	97.1	138	196	274	393	560

5.16 Comparison table

ISO 3348 Industrial oils	AGMA 9005-D94 Gear oils	SAE J300 Engine oils	SAE J306 Gear oils
1500			250
1000	8A		
680	8		
460	7		140
320	6	60	
220	5	50	
150	4	40	85W
100	3	30	80W
68	2	20	
46	1		
32	0		15W
22		10W	
15		5W, 10W	
10			
7			
3			
2			