

GENERAL	Tapped Holes and Threads	756
	Threads	757
	Keyways	758
	Shafts	759
	Shaft Power	760
	Tolerances	761
	General Capacity	762
	HPC Capacity	763
	Backlash	763
	Gear Tooth Sizes	764
	Materials Available	765
	Material Strengths	766
	Material Hardness Values	766
	Materials - Delrin	767
	Materials - Hostaform	821
	International Material Equivalents	768
	Prime Number Factor Table	769
General Unit Conversions	770	
BELTS	Timing Belt Formulae, Terms and Definitions	.771 & 772
	Timing Belt Calculations	773
	Belt Selection Graph	774
	Tooth Shear Strength	775-785
	HTD Symbol Descriptions	786
	Design Calculations	787
	Belt Selection Graph	788
	Drive Design - Additional Factors	789
	Calculation Formulae	790
	Calculation Tensioning/Min Adjustment x/y	791
	Rated Power	792-799
Minimum Timing Belt Pulley & Roller Diameters	800	
Belt Length Tolerances	801	
GEARING	Spur Gears / Helical Gears	
	Formulas	802 & 803
	Load Calculations	804
	Speed Factors	805
	Zone Factors	806
	Strength Factors	807
	Bevel Gears	
	Formulas	808
	Load Calculations	809
	Speed Factors	810
	Zone Factors	810
	Strength Factors	810
	Worms & Wheels	
	Formulas	808
	Load Calculations	811
	Speed Factors	812
	Bending and Surface Stress Factors	813
Efficiency of Worms	814	
CHAINS	Chains - General Information	815
	Chain Selection Process (1-6)	816-818
	Chain Selection Rating Graph	819
	Chain Connecting Links	
	Simplex, Duplex and Triplex	820

TECHNICAL INDEX

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All figures given are
as a guide only and
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For confirmation of
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755

TAPPED HOLES & THREADS

METRIC

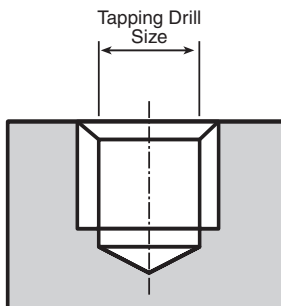
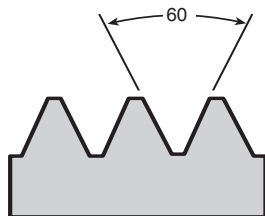
BORE or SHAFT Ø	KEYWAY	PIN HOLE Ø	GRUB SCREW
OVER UPTO			
4 - 6	-	1.50	M3
6 - 8	K2	2.00	M3
8 - 10	K3	3.00	M3
10 - 12	K4	4.00	M4
12 - 17	K5	5.00	M5
17 - 22	K6	6.00	M6
22 - 30	K8	8.00	M8
30 - 38	K10	10.00	M10
38 - 44	K12	10.00	M10
44 - 50	K14	10.00	M12
50 - 58	K16	10.00	M12

IMPERIAL







BORE or SHAFT Ø (inches)	KEYWAY (inches)	PIN HOLE Ø (inches)	GRUB SCREW
OVER UPTO			
0.156 - 0.312	-	0.062	M3
0.313 - 0.437	K3/32	0.062	M3
0.438 - 0.562	K1/8	0.125	M4
0.563 - 0.875	K3/16	0.187	M5
0.876 - 1.250	K1/4	0.250	M6
1.251 - 1.375	K5/16	0.250	M8
1.376 - 1.750	K3/8	0.375	M10
1.751 - 2.250	K1/2	0.500	M12

METRIC THREAD

TAPPING DRILL Ø (mm)	THREAD	PITCH (mm)	OUTSIDE Ø (mm)
1.60	M2	0.40	2.00
2.05	M2.5	0.45	2.50
2.50	M3	0.50	3.00
3.30	M4	0.70	4.00
4.20	M5	0.80	5.00
5.00	M6	1.00	6.00
6.00	M7	1.00	7.00
6.80	M8	1.25	8.00
8.50	M10	1.50	10.00
10.20	M12	1.75	12.00
12.00	M14	2.00	14.00
14.00	M16	2.00	16.00
15.50	M18	2.50	18.00
17.50	M20	2.50	20.00
19.50	M22	2.50	22.00
21.00	M24	3.00	24.00



THREADS IMPERIAL

THREAD	Ø Hole for Tapping	Pitch mm	(TPI)	ØD mm	THREAD	Ø Hole for Tapping	Pitch mm	(TPI)	ØD mm
UNF 60° 					BSP 55° 				
2-64 UNF	1.90	0.40	64	2.18	1/8 BSP	8.75	0.91	28	9.73
3-56 UNF	2.15	0.45	56	2.51	1/4 BSP	11.80	1.34	19	13.16
4-48 UNF	2.40	0.53	48	2.84	3/8 BSP	15.25	1.34	19	16.66
6-40 UNF	2.95	0.64	40	3.51	1/2 BSP	19.05	1.81	14	20.96
8-36 UNF	3.55	0.71	36	4.17	5/8 BSP	21.03	1.81	14	22.91
10-32 UNF	4.10	0.79	32	4.83	3/4 BSP	24.50	1.81	14	26.44
12-28 UNF	4.65	0.91	28	5.49	7/8 BSP	28.25	1.81	14	30.20
1/4-28 UNF	5.50	0.91	28	6.35	1 BSP	30.75	2.31	11	33.25
5/16-24 UNF	6.90	1.06	24	7.94	1 1/4 BSP	39.50	2.31	11	41.91
3/8-24 UNF	8.50	1.06	24	9.53	1 1/2 BSP	45.24	2.31	11	47.80
7/16-20 UNF	9.90	1.27	20	11.11	1 3/4 BSP	51.00	2.31	11	53.75
1/2-20 UNF	11.50	1.27	20	12.70	2 BSP	57.00	2.31	11	59.61
9/16-18 UNF	12.90	1.41	18	14.29					
5/8-18 UNF	14.50	1.41	18	15.88	BSF 55° 				
3/4-16 UNF	17.46	1.59	16	19.05	3/16 BSF	4.00	0.79	32	4.76
7/8-14 UNF	20.42	1.81	14	22.23	1/4 BSF	5.30	0.98	26	6.35
1-12 UNF	23.25	2.12	12	25.40	5/16 BSF	6.80	1.15	22	7.94
					3/8 BSF	8.25	1.27	20	9.53
UNC 60° 					7/16 BSF	9.70	1.41	18	11.11
2-56 UNC	1.85	0.45	56	2.18	1/2 BSF	11.11	1.59	16	12.70
3-48 UNC	2.10	0.53	48	2.51	9/16 BSF	12.70	1.59	16	14.29
4-40 UNC	2.35	0.64	40	2.84	5/8 BSF	14.00	1.84	14	15.88
6-32 UNC	2.84	0.79	32	3.51	3/4 BSF	16.75	2.12	12	19.05
8-32 UNC	3.50	0.79	32	4.17	7/8 BSF	19.75	2.31	11	22.23
10-24 UNC	3.90	1.06	24	4.83	1 BSF	22.75	2.54	10	25.40
12-24 UNC	4.55	1.06	24	5.49					
1/4-20 UNC	5.10	1.27	20	6.35	BSW 55° 				
5/16-18 UNC	6.60	1.41	18	7.94	1/8 BSW	2.55	0.64	40	3.18
3/8-16 UNC	8.00	1.59	16	9.53	3/16 BSW	3.70	1.06	24	4.76
7/16-14 UNC	9.40	1.81	14	11.11	1/4 BSW	5.10	1.27	20	6.35
1/2-13 UNC	10.80	1.95	13	12.70	5/16 BSW	6.50	1.41	18	7.94
9/16-12 UNC	12.20	2.12	12	14.29	3/8 BSW	7.94	1.59	16	9.53
5/8-11 UNC	13.50	2.31	11	15.88	7/16 BSW	9.36	1.81	14	11.11
3/4-10 UNC	16.50	2.54	10	19.05	1/2 BSW	10.50	2.12	12	12.70
7/8-9 UNC	19.50	2.82	9	22.23	9/16 BSW	12.10	2.12	12	14.29
1-8 UNC	22.25	3.18	8	25.40	5/8 BSW	13.50	2.31	11	15.88
					3/4 BSW	16.27	2.54	10	19.05
BA 47.5° 					7/8 BSW	19.25	2.82	9	22.23
0-BA	5.10	1.00	25.38	6.00	1 BSW	22.00	3.18	8	25.40
1-BA	4.50	0.90	28.25	5.30					
2-BA	4.00	0.81	31.35	4.70					
3-BA	3.40	0.73	34.84	4.10					
4-BA	3.00	0.66	38.46	3.60					
5-BA	2.65	0.59	43.10	3.20					
6-BA	2.30	0.53	47.85	2.80					
7-BA	2.05	0.48	52.91	2.50					
8-BA	1.80	0.43	59.71	2.20					

GENERAL TECHNICAL SECTION

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757

KEYWAYS

METRIC

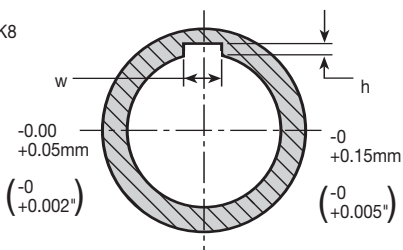
REF	w mm	h mm	P mm
K2	2	1.07	1.25
K3	3	1.50	1.85
K4	4	1.86	2.55
K5	5	2.35	3.05
K6	6	2.83	3.55
K8	8	3.34	4.10
K10	10	3.34	5.10
K12	12	3.35	5.10
K14	14	3.80	5.50
K16	16	4.30	6.00

IMPERIAL

REF	w inches	h inches	P inches
K3/32	0.0937	0.062	0.070
K1/8	0.1250	0.065	0.075
K5/32	0.1562	0.075	0.090
K3/16	0.1875	0.094	0.110
K1/4	0.2500	0.120	0.145
K5/16	0.3125	0.145	0.180
K3/8	0.3750	0.178	0.216
K1/2	0.5000	0.229	0.286

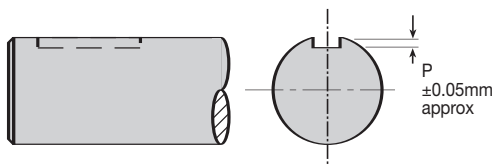
HOLE KEY

K2-K8



K10 - K16
width $-0.00 +0.10$
height $-0.00 +0.25$

SHAFT KEY

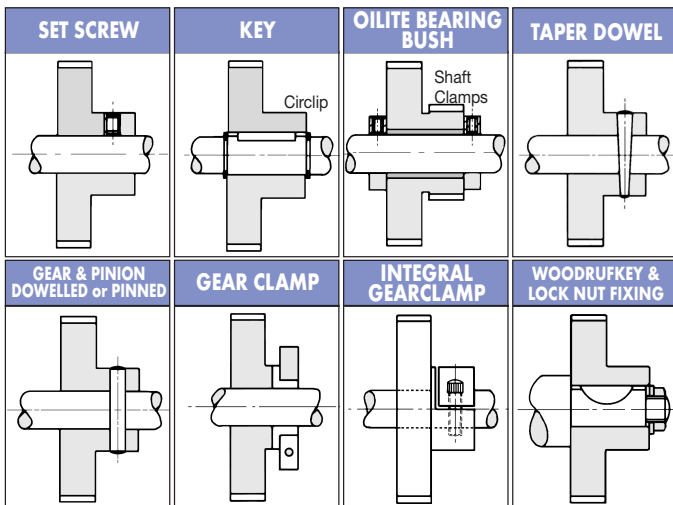


SHAFTS

FIXATIONS - SECURING OF GEARS TO SHAFTS

BORE or SHAFT DIAMETER	KEYWAY	PIN HOLE DIAMETER	SET SCREW SIZE
over $\varnothing 4$ - up to $\varnothing 6$	-	1.50	M3
$\varnothing 6$ - $\varnothing 8$	K2	2.00	M3
$\varnothing 8$ - $\varnothing 10$	K3	3.00	M3
$\varnothing 10$ - $\varnothing 12$	K4	4.00	M4
$\varnothing 12$ - $\varnothing 17$	K5	5.00	M5
$\varnothing 17$ - $\varnothing 22$	K6	6.00	M6
$\varnothing 22$ - $\varnothing 30$	K8	8.00	M8
$\varnothing 30$ - $\varnothing 38$	K10	10.00	M10
$\varnothing 38$ - $\varnothing 44$	K12	10.00	M10
$\varnothing 44$ - $\varnothing 50$	K14	10.00	M12
$\varnothing 50$ - $\varnothing 58$	K16	10.00	M12

SAMPLES OF ALTERNATIVE FIXINGS



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759

SHAFT POWER**SHAFT DIAMETERS**

APPROX TORQUE TRANSMITTED N/M

MATERIAL	SHAFT DIAMETER (mm)											
	Ø6	Ø10	Ø12	Ø15	Ø17	Ø20	Ø25	Ø30	Ø40	Ø50	Ø75	Ø100
N.m. MILD STEEL EN1A EN3 35000 N/m ²	1,50	6,60	11,50	23	34	55	105	180	440	840	2800	6600
N.m. EN8 EN32 EN58 45000 N/m ²	1,90	8,50	15	28	43	70	135	230	550	1000	3600	8500
N.m. EN16 EN19 EN24 EN36 60000 N/m ²	2,50	12,00	20	39	56	95	180	310	750	1500	4800	12000

SHAFT ROTATION

KW = HP x 0,746

SHAFT ROTATION - H.P. TRANSMITTED FOR GIVEN R.P.M. AND Nm																
Nm	0,1	0,5	1	2	5	8	10	15	20	25	30	50	100	200	500	1000
RPM 5								0,01	0,014	0,017	0,002	0,035	0,07	0,15	0,35	0,70
10						0,011	0,014	0,02	0,028	0,038	0,041	0,07	0,15	0,28	0,70	1,40
20					0,014	0,023	0,028	0,04	0,056	0,07	0,085	0,14	0,28	0,55	1,40	2,80
50				0,014	0,038	0,055	0,007	0,10	0,14	0,17	0,21	0,35	0,70	1,40	3,50	7
100			0,014	0,028	0,07	0,115	0,14	0,21	0,28	0,35	0,41	0,70	1,45	2,80	7	14
200	0,014	0,028	0,055	0,14	0,23	0,28	0,42	0,57	0,70	0,85	1,50	2,90	5,60	14	28	
300	0,021	0,420	0,82	0,21	0,35	0,41	0,62	0,85	1,05	1,25	2,10	4,20	8,50	21	42	
400	0,028	0,055	0,11	0,28	0,45	0,55	0,85	1,10	1,40	1,70	2,80	5,60	11	28	56	
500	0,035	0,07	0,14	0,35	0,56	0,70	1,05	1,40	1,75	2,10	3,50	7,00	14	35	70	
750	0,010	0,051	0,10	0,21	0,52	0,85	1,05	1,60	2,10	2,70	3,10	5,20	10,40	21	52	107
1000	0,015	0,07	0,14	0,28	0,70	1,15	1,40	2,10	2,80	3,50	4,20	7,00	14	28	70	140
1500	0,022	0,10	0,21	0,40	1,00	1,70	2,10	3,10	4,20	5,10	6,20	10,50	21	41	100	210
2000	0,029	0,16	0,28	0,55	1,40	2,30	2,80	4,10	5,50	7	8,40	14	28	56	140	280
3000	0,044	0,24	0,42	0,82	2,10	3,50	4,20	6,20	8,50	10	12,50	21	43	85	210	420
4000	0,060	0,27	0,56	1,10	2,80	4,50	5,50	8,50	11	14	18	28	58	110	280	560
5000	0,072	0,35	0,70	1,40	3,50	5,60	7	10,50	14	17	21	35	70	140	350	700
8000	0,120	0,55	1,10	2,30	5,50	9,20	11	17	23	28	34	56	115	230	550	1150
10000	0,150	0,70	1,40	2,80	7,00	11,50	14	21	29	35	42	71	140	280	700	1400



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TOLERANCES

Gear tooth shape is an involute curve. Module BS4582 Pt 1 Fig 1 DIN867.
DP BS978 Pt 1 Fig 1 DIN 867.

METRIC IMPERIAL

BLANKS	mm	inches
GENERAL	±0.15	±0.006
BORES TO	H8 LIMITS	H8 LIMITS
GEAR ØD (nominal)	-0.15	-0.006
GEAR	mm	inches
PCD (nominal)	-0.15	-0.006
BACKLASH (nominal)	-0.11	-0.0043
TCE (0-60Ø)	0.04	0.0015
(TCE DELRIN)	0.05	0.0020
TCE (60-125Ø)	0.06	0.0023
(TCE DELRIN)	0.07	0.0028
TCE (125+Ø)	0.08	0.0032
RACKS	mm	inches
TCE	±0.10	±0.004
(300mm length)		

TCE = Total Composite Error

BORE AND SHAFT TOLERANCES

mm		BORE TOLERANCES		SHAFT TOLERANCES							
				CLEARANCE FIT		TRANSITION FIT		INTERFERENCE FIT			
Ø RANGE	H7	H8	f7	g6	k6	n6	p6	s6			
over upto	low high	low high	low high	low high	low high	low high	low high	low high	low high	low high	
0 3	0 +0.010	0 +0.014	-0.006 -0.016	-0.002 -0.008	+0.006 0	+0.010 +0.004	+0.012 +0.006	+0.020 +0.014			
3 6	0 +0.012	0 +0.018	-0.010 -0.022	-0.004 -0.012	+0.009 +0.001	+0.016 +0.008	+0.020 +0.012	+0.027 +0.019			
6 10	0 +0.015	0 +0.022	-0.013 -0.028	-0.005 -0.014	+0.010 +0.001	+0.019 +0.010	+0.024 +0.015	+0.032 +0.023			
10 18	0 +0.018	0 +0.027	-0.016 -0.034	-0.006 -0.017	+0.012 +0.001	+0.023 +0.012	+0.029 +0.018	+0.039 +0.028			
18 30	0 +0.021	0 +0.033	-0.020 -0.041	-0.007 -0.020	+0.015 +0.002	+0.028 +0.015	+0.035 +0.022	+0.048 +0.035			
30 50	0 +0.025	0 +0.039	-0.025 -0.050	-0.009 -0.025	+0.018 +0.002	+0.033 +0.017	+0.042 +0.026	+0.059 +0.043			
50 80	0 +0.030	0 +0.046	-0.030 -0.060	-0.010 -0.029	+0.021 +0.002	+0.039 +0.020	+0.051 +0.032	+0.072 +0.053			
80 120	0 +0.035	0 +0.054	-0.036 -0.071	-0.012 -0.034	+0.025 +0.003	+0.045 +0.023	+0.059 +0.037	+0.093 +0.071			

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761

GENERAL CAPACITY SIZE LIMITATIONS

Most of the cutting limitations are dependent on the required pitch.

GEARS

GEAR TYPE	RANGE	CAPACITY (mm)
SPUR GEARS HELICAL GEARS	120 - 1 DP 0.2 - 25 MOD	Ø5 - Ø1800 (0.200" - 72") Ø5 - Ø1000 (0.200" - 40")
SPROCKETS	1/4", 3/8", 1/2", 5/8", 3/4", 1", 1 1/4" CP 4,6,8 mm pitch	Ø14 - Ø400 (0.550" - 16")
INTERNAL GEARS	96 DP - 12 DP 1 - 7 mm pitch 0.2 - 2 MOD	Up to Ø200 internal (8") Max component Ø298 (12")
WORM WHEELS	0.2 - 4 MOD 1 - 7 mm pitch 96 - 6 DP	Ø15 - Ø250 (0.600" - 10")
WORMS	0.5 - 7 mm pitch 0.2 - 4 MOD 100 - 6DP	From Ø10 x 10 long up to Ø60 x 500 long depending on cutter and pitch
RACKS	96 - 4 DP (Up to 25 MOD 0.25 - 8 MOD on specials)	Up to 3000 long (120") in one piece
BEVELS	64 - 6 DP 0.4 - 6 MOD	Up to Ø120 (4.720")
TIMING PULLEYS	5 - 20mm AT 2.5 - 20mm T 3 - 14mm HTD	MXL XL L H Ø10 - Ø500 (0.400" - 20")
PINION GEARS	2mm - 13mm	Ø5 - Ø600 (0.200" - 24")

COMPONENTS

TYPE	ASSEMBLY	GEARBOX (mm)
BORING	- Jig boring 0.008mm of size at 25mm dia - Horizontal boring - light - Vertical boring	Max. area of 610 x 155 (24" x 6")
CUT OFF DRILLING		Up to Ø150 Up to Ø40
MILLING	- CNC - Co-ordinate milling and boring	Max. area of 610 x 155 (24" x 6")
SLOTTING	- Up to 152-4mm (6") stroke	
TURNING	- CNC - Precision turning and boring	Max. Ø600 x 1000 long
GRINDING	- Precision diameter grinding - Bore honing	Ø1 - Ø200 x 500 between centres Ø3 - Ø25



HPC CAPACITY AND BACKLASH

STANDARD PITCHES *Other pitches available on request.*

BEVELS	0.8 – 6 mod 48 – 5 DP	WORMS & WHEELS	0.4 – 4 mod 64 – 6 DP
SPROCKET	1/4": 3/8": 1/2": 5/8": 3/4": 1": 1 1/4" 4mm : 6mm : 8mm	RACKS	0.25 – 8 mod 96 – 4 DP
PULLEYS (PITCH)	0.08" : 0.2" : 0.375" : 0.5" T2.5 : T5 : T10 : T20 HTD3 : HTD5 : HTD8 : HTD14 AT5 : AT10 : AT20	PRESSURE ANGLES	
		Standard	20° P.A.
		Special	14 1/2 P.A.

BACKLASH CORRESPONDING TO PITCH

GEARS	BACKLASH (mm)	METRIC		IMPERIAL	
		Module	(mm) CP	DP	(Inches) CP
FINE PITCH	APPROX. BACKLASH = 0.07 – 0.12 @ STD CNTRS	0.25	1mm	100	1/20
				96	
				82	
				80	
				72	
	APPROX. BACKLASH = 0.1 – 0.15 @ STD CNTRS	0.5	2mm	64	1/10
				60	
				56	
				50	
				48	
MEDIUM PITCH	APPROX. BACKLASH = 0.13 – 0.2 @ STD CNTRS	0.9	1.5mm	46	1/8
				44	
				40	
				38	
				36	
	APPROX. BACKLASH = 0.15 – 0.3 @ STD CNTRS	2	3mm	34	1/4
				32	
				30	
				28	
				26	
HEAVY PITCH	APPROX. BACKLASH = 0.13 – 0.2 @ STD CNTRS	1	2mm	24	1/8
				22	
				20	
				19	
				18	
	APPROX. BACKLASH = 0.15 – 0.3 @ STD CNTRS	2.25	3.5mm	16	1/4
				15	
				14	
				13	
				12	
HEAVY PITCH	APPROX. BACKLASH = 0.15 – 0.3 @ STD CNTRS	2.5	4mm	11	1/4
				10	
				9	
				8	
				7	
				6	
				5	
				4.5	
4					

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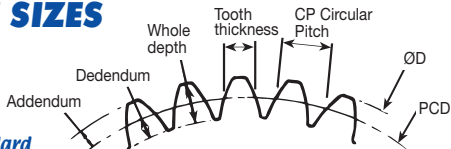
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763

GENERAL | TECHNICAL SECTION

GEAR TOOTH SIZES



Bold numbers are standard.
Dimensions in mm and inches.

MOD	DP	CIRCULAR PITCH	TOOTH THICKNESS	ADDENDUM (= MODULE)	DEDENDUM	WHOLE DEPTH
0.2 MOD	127.00	0.628	0.314	0.20	0.28	0.48
0.25 MOD	101.60	0.785	0.392	0.25	0.35	0.60
0.254	100 DP	0.0314"	0.0157"	0.010"	0.014"	0.0240"
0.265	96 DP	0.0327"	0.0163"	0.0104"	0.0145"	0.0250"
0.3 MOD	84.67	0.942	0.471	0.30	0.42	0.72
0.318	80 DP	0.0392"	0.0196"	0.0125"	0.0175"	0.0300"
0.353	72 DP	0.0436"	0.0218"	0.0138"	0.0194"	0.0333"
0.397	64 DP	0.0490"	0.0245"	0.0156"	0.02187"	0.0375"
0.4 MOD	63.50	1.256	0.628	0.40	0.56	0.96
0.5 MOD	50.80	1.570	0.785	0.50	0.70	1.20
0.529	48 DP	0.0654"	0.0327"	0.0208"	0.02916"	0.0500"
0.6 MOD	42.33	1.884	0.942	0.60	0.84	1.44
0.635	40 DP	0.0785"	0.0392"	0.025"	0.0350"	0.0600"
0.7 MOD	36.29	2.199	1.099	0.70	0.98	1.68
0.706	36 DP	0.0872"	0.0436"	0.0277"	0.0388"	0.0666"
0.75 MOD	33.87	2.356	1.178	0.75	1.05	1.80
0.794	32 DP	0.0981"	0.04906"	0.0312"	0.0437"	0.0750"
0.8 MOD	31.75	2.513	1.256	0.80	1.12	1.92
0.847	30 DP	0.1047"	0.05235"	0.0333"	0.0466"	0.08"
0.9 MOD	28.22	2.827	1.413	0.90	1.26	2.16
0.907	28 DP	0.1121"	0.05605"	0.0357"	0.0500"	0.0857"
1.00 MOD	25.40	3.141	1.570	1.00	1.400	2.40
1.05	24 DP	0.1308"	0.0654"	0.0416"	0.0583"	0.1000"
1.15	22 DP	0.1427"	0.07135"	0.0454"	0.0636"	0.1090"
1.25 MOD	20.32	3.926	1.963	1.25	1.562	2.81
1.27	20 DP	0.1570"	0.0785"	0.050"	0.0625"	0.1125"
1.411	18 DP	0.1745"	0.08725"	0.0555"	0.0694"	0.1250"
1.50 MOD	16.93	4.712	2.356	1.50	1.875	3.37
1.588	16 DP	0.1963"	0.09815"	0.0625"	0.0781"	0.1406"
1.693	15 DP	0.2094"	0.1047	0.0666"	0.0833"	0.1500"
1.75 MOD	14.51	5.497	2.7485	1.75	2.187	3.93
1.814	14 DP	0.2243"	0.11215"	0.0714"	0.0892"	0.1607"
2.0 MOD	12.70	6.283	3.141	2.00	2.50	4.50
2.117	12 DP	0.2617"	0.13085"	0.0833"	0.1041"	0.1875"
2.25 MOD	11.29	7.068	3.534	2.25	2.812	5.06
2.5 MOD	10.16	7.853	3.926	2.50	3.125	5.62
2.54	10 DP	0.3141"	0.15705"	0.100"	0.1250"	0.2250"
2.75 MOD	9.24	8.639	4.319	2.75	3.437	6.18
3 MOD	8.47	9.424	4.712	3.00	3.75	6.75
3.175	8 DP	0.3926"	0.1963"	0.125"	0.15625"	0.28125"
4 MOD	6.35	12.566	6.283	4.00	5.00	9.00
4.233	6 DP	0.5235	0.26175"	0.1666"	0.20833"	0.3750"
5 MOD	5.08	15.707	7.853	5.00	6.25	11.25
5.08	5 DP	0.6283"	0.31415"	0.200"	0.2500"	0.4500"
6 MOD	4.23	18.849	9.4245	6.00	7.50	13.50
6.35	4 DP	0.7853"	0.39265"	0.250"	0.3125"	0.5625"
8 MOD	3.175 DP	25.132	12.566	8.00	10.00	18.00

MATERIALS AVAILABLE

The materials below are supplied as standard. HPC Gears Ltd reserve the right to use higher grades of material.

STANDARD MATERIALS

PRODUCT	STANDARD MATERIALS
GEARS WORM WHEELS WORMS SPROCKETS PULLEYS BEVELS RACKS	EN202, EN32A, EN24, EN36, EN58, DELRIN PHOSPHOR BRONZE, DELRIN EN202, DELRIN EN32B or EN 202, DELRIN, EN58 2011T3 ALUMINIUM, EN32, EN202 EN8, DELRIN EN8, EN32A, EN58, DELRIN

OTHER MATERIALS

EN8 EN19 EN24	(EN8) INDUCTION/FLAME HARDENED ONLY CAN BE THROUGH/INDUCTION/NITRIDE HARDENED 50-55 ROCKWELL 'C' OR FLAME HARDENED
EN202 EN32B EN36	CAN BE SKIN HARDENED OR CASE (CYANIDE) HARDENED
EN40B EN41	CAN BE NITRIDE HARDENED

BRITISH	GERMAN	FRENCH
PHOSPHOR BRONZE PB2 BS1400 1985	DIN1705 CUSN 12	AFNOR UE12
COPPER C101 HDHC BS2874		
ALUMINIUM BRONZE DTD 197A BS2874	DIN 17665 CuAl10Ni	ISO 428 CuAl10Fe5Ni5
BRASS CZ121 BS2874	CuZn39Pb3 DIN17660	CuZn40Pb3 NFA 51-105
PLASTIC DELRIN (Acetal 150) NYLON 66	DIN16979 DIN16985	
ALUMINIUM 2011T3 BS4300/5 HE15TF BS1474 HE30TF BS1474	DIN AlCuBiPb DIN AlCuSiMn DIN ALMgSiL	French Former NF A-U5PbBi French Former NF A-U4 SG French Former NF A-S G M 0.7
TUFNOL WHALE BS2572 Type 2 CARP BS2572 Type F1	DIN7735 HGW2082 DIN7735 HGW2083	

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765

GENERAL | TECHNICAL SECTION

MATERIAL STRENGTHS

Not heat treated

Note: 1N/mm² = 1 MPa

* Estimated values

Material	Condition	Tensile Strength lbf/in ²	Surface Stress S _c	Bending Stress S _b	Tensile Strength N/mm ²	Elongation After Fracture %	02% Proof Stress N/mm ²
Nylon 66		9500	500*	3900	62 - 82	20% 200%	—
Delrin (Polyacetal)		10000	500*	3900*	69	60%	—
Tufnol	WHALE	9800	560	4500	68	—	—
Cast Iron	GR17 (260)	35800	1400	9000	260	—	—
Brass	—	—	700*	7000*	—	—	—
Aluminium Alloy	HE15		500	13000	295	6% - 8%	230
Aluminium Bronze	AB2		900	9000	420 - 720	18% - 40%	140 - 660
Phosphor Bronze	PB2 Sand Cast	26800	700	7000	360-500	6.25%	170 - 280
(EN32A) 045M10		71680	1400	17000	430	18%	—
(EN32A) 045M10	Case Hardened	71680	9200	40000	—	—	—
(EN8) 080M40		78400	1400	19000	510-550	16% - 17%	—
(EN8) 080M40	Induction	78400	2800	17000	—	—	—
(EN24) 817M40		112000	3000	32000	850 - 1550	5% - 13%	635 - 1125
(EN24) 817M40	Induction/through	112000	5000	26500	—	—	—
(EN36) 655M13	Case Hardened	123200	11000	50000	—	—	—
(EN58AM) 303S21	—	78400	1800	20000	480 - 510	35% - 40%	180 - 20

Material	Melt Point	Max. Service Temperature	
		Long Term	Short Term
NYLON 66	255°C	100°C	170°C
DELIRIN	175°C	90°C	150°C
TUFNOL WHALE	—	120°C	130°C

MATERIAL HARDNESS VALUES

ROCKWELL C' SCALE 120°-150kg	ROCKWELL B' SCALE 1" BALL 100kg	FIRTH VICKERS 120kg	BRINELL 10mm Ø 3000kg	TONS PER -INS'	MATERIAL AND CONDITION THRU HDN VALUES DEPENDENT ON LIMITING RULING SECTIONS			
-20	67	114	114	26	EN1_3B			
-9	74	131	131	30	EN32			
1	83	156	156	36	EN8	EN56, 58		
10	90	187	187	41				
15	93	202	201	44	EN9_16	EN19, 33	EN8R, 34	EN351, 40
20	97	223	223	49	EN24, 36 AS ROLLED			
25	101	256	255	55	EN16T, 19T, 24T	EN36T, 24T	EN57	
30	105	287	285	62				
35	109	339	334	72				
40	112	389	375	82				
45	115	454	429	94	EN24, 25, 26, 30	THRO. HDN Z CONDITION		
50	120	540	495	108	EN8 IND HDN	EN16 THR'HD	EN19 THR'HD	EN26 THR'HD
55		633	555	121	EN24 IND HDN			
57		675	578	126	EN40B, 41 GASEOUS NITRIDE			
60		765	627	137	EN36 CASE/HD	EN32C/H, 33C/H	EN34C/H	EN31 THR'HD
63		867	652	144				
65		940	682	150	EN56, 58 PLASMA NITRIDE			
67		1060	725	160				
70		1150	780	171				

766



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MATERIALS DELRIN POLYACETAL 150

MECHANICAL PROPERTIES	ASTM TEST METHOD	VALUES	MECHANICAL PROPERTIES	ASTM TEST METHOD	VALUES		
Density	D792	1.42 g/cm ³	Coefficient of dynamic friction against Steel no lubricant water lubricated oil lubricated	D1894 -61T	0.10 - 0.30 0.10 - 0.20 0.05 - 0.10		
Tensile strength @ yield	D628	101 N/mm ² - N/mm ² 69 N/mm ² 48 N/mm ² 36 N/mm ² 26 N/mm ²				against Brass against Aluminium against Polyacetal	0.15 0.15 0.35
Elongation @ break	D638	.38 % - % 75 % 230 % 70°C 100°C 122°C	THERMAL PROPERTIES				
			Melting point	D2133	175 °C		
			Deflection temperature under flexural load	D648			
			1.8 N/mm ²		138 °C		
			0.5 N/mm ²		172 °C		
			Thermal conductivity		0.37 W/mK		
			Specific heat		1.47 kJ/kgK		
Tensile E Modulus	D638	3100 N/mm ²	Coefficient of linear thermal expansion				
Shear Strength	D732	66 N/mm ²	-40°C - 30 °C				
Flexural Modulus	D790	3650 N/mm ² 2620 N/mm ² 1550 N/mm ² 895 N/mm ² 620 N/mm ²	30°C - 60 °C		10.4 1x10 ⁻⁶ °C ⁻¹		
			60°C - 105 °C		12.2 1x10 ⁻⁶ °C ⁻¹		
			105°C - 150 °C		13.7 1x10 ⁻⁶ °C ⁻¹		
					14.9 1x10 ⁻⁶ °C ⁻¹		
Flexural fatigue endurance limit	D671	32 N/mm ²	Flamability		UL 94 HB		
Compressive stress 1% deformation 10% deformation	D695	36 N/mm ² 124 N/mm ²	Maximum continuous use temperature				
			in air		90 °C		
			in water		65 °C		
Izod impact strength unnotched notched	D256	no break J/m 96 J/m 123 J/m	Maximum intermittent use temperature				
			in air		150 °C		
			in water		80 °C		
Tensile impact strength	D1822	350 kJ/m ²	Minimum continuous use temperature		-40 °C		
			ELECTRICAL PROPERTIES				
			Volume resistivity		D257	10 ¹⁵	ohm cm
Deformation under load (14N/mm ² @ 50°C)	D621	0.5 %	Surface resistivity		D257	10 ¹³	ohm
			Dielectric strength short time (2.3mm sheet)		D149	20	kV/mm
Hardness, Rockell	D785	M94 R120	Dielectric constant 10-2HZ - 106HZ		D150	3.7	
			Dissipation factor (1mm sheet)		D150		
Water absorption 24 hours immersion equilibrium 50% R.H. equilibrium, continuous immersion	D570	0.25 % 0.22 % 0.90 %	100HZ		0.005		
			1kHz				
			10kHz 1MHZ				

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767

GENERAL TECHNICAL SECTION

INTERNATIONAL MATERIAL EQUIVALENTS

CS- Carbon Steels. CCMFS- Carbon and Carbon Manganese free cutting steels. AS-Alloy steels.

SHRS- Stainless and heat resistant steels.

En. No.	B.S. 970 : 1983	WERK-STOFF	AFNOR (France)	DIN (Germany)	KURZ-NAME	USA AISI/SAE	STEELS TYPE
1A	220M07	1.0711		9 S 20		1113	CCMFS
32C	080M15	1.1141	XC18	C 15		1016	CS
3B	070M20	1.0402	XC25	C 22		1020	CS
5C	080A32	1.1180	XC38	Cm 35		1035	CS
	070M26		50C30			1026	CS
6	080M30	1.1178		Ck 30		1030	CS
8	080M40	1.1186	60C40	Ck 40		1040	CS
8 A & B	080A35/37	1.1180	55C35	Cm 35		1035/1038	CS
8C	080A40	1.1186	XC42H1	Ck 40		1040	CS
8M	212M36	1.0726	35MF6	35 S 20		1140	CCMFS
	080M46	1.1191	XC48	Ck 45		1045	CS
9	070M55	1.0535	XC38	C 55		1055	CS
18B	530A32	1.7033	32C4	34 Cr 4		5130	AS
19	708M40	1.7225	42CD4	42 CrMo 4		4140	AS
19B	708A37	1.7220	35CD4	34 CrMo 4		4137	AS
24	817M40	1.6565	35NCD6	40 CrNiMo 6		4340	AS
26	826M40	1.6745	35NCD14	40 NiMoCr 10 5			AS
30B	835M30	1.6747	35NCD16	30 NiCrMo 16 6			AS
31	535A99	1.3505	100C6	100 Cr 6		52100	AS
202	214M15					1118	CCMFS
32A	045M10	1.0301	34C10	C 10		1010	CS
32M	210M15	1.0723		15 S 20		1117	CCMFS
36	655M13	1.5752	12NC15	14 NiCr 14		3415	AS
39B	835M15	1.6723	16NCD17	15 NiCrMo 16 5			AS
40B	722M24	1.7361	30CD12	32 CrMo 12			AS
43A	080M50		XC48H1			1049	AS
56AM	416S21	1.4005	Z12CF13	X 12 CrS 13		416	SHRS
58M	303S31	1.4305	Z10CNF18.9	X 10 CrNiS 18 9		303	SHRS
	316S33	1.4436	Z6CND17.12	X 5 CrNiMo 17 13 3		316	SHRS



PRIME NUMBER & FACTOR TABLE

From the table to find the lowest prime factor for 645, look along the top row for 600. Then look down the first column to find 45. Find where this column and line meet and this is the lowest prime factor, e.g. in this example for 645, 3 is the lowest prime factor. If a **P** appears in the square then the chosen figure is a prime number, e.g. 919.

From to	0 100	100 200	200 300	300 400	400 500	500 600	600 700	700 800	800 900	900 1000	1000 1100	1100 1200
1	P	P	3	7	P	3	P	P	3	17	7	3
3	P	P	7	3	13	P	3	19	11	3	17	P
5	P	3	5	5	3	5	5	3	5	5	3	5
7	P	P	3	P	11	3	P	7	3	P	19	3
9	3	P	11	3	P	P	3	P	P	3	P	P
11	P	3	P	P	3	7	13	3	P	P	3	11
13	P	P	3	P	7	3	P	23	3	11	P	3
15	3	5	5	3	5	5	3	5	5	3	5	5
17	P	3	7	P	3	11	P	3	19	7	3	P
19	P	7	5	11	P	3	P	P	3	P	P	3
21	3	11	13	3	P	P	3	7	P	3	P	19
23	P	3	P	17	3	P	7	3	P	13	3	P
25	5	5	3	5	5	3	5	5	3	5	5	3
27	3	P	P	3	7	17	3	P	P	13	3	7
29	P	3	P	7	3	23	17	3	P	P	3	P
31	P	P	3	P	P	3	P	17	3	7	P	3
33	3	7	P	3	P	13	3	P	7	3	P	11
35	5	3	5	5	3	5	5	3	5	5	3	5
37	P	P	3	P	19	3	7	11	3	P	17	3
39	3	P	P	3	P	7	3	P	P	3	P	17
41	P	3	P	11	3	P	P	3	29	P	3	7
43	P	11	3	7	P	3	P	P	3	23	7	3
45	3	5	5	3	5	5	3	5	5	3	5	5
47	P	3	13	P	3	P	P	3	7	P	3	31
49	7	P	3	P	P	3	11	7	3	13	P	3
51	3	P	P	3	11	19	3	P	23	3	P	P
53	P	3	11	P	3	7	P	3	P	P	3	P
55	5	5	3	5	5	3	5	5	3	5	5	3
57	3	P	P	3	P	P	3	P	P	3	7	13
59	P	3	7	P	3	13	P	3	P	7	3	19
61	P	7	3	19	P	3	P	P	3	31	P	3
63	3	P	P	3	P	P	3	7	P	3	P	P
65	5	3	5	5	3	5	5	3	5	5	3	5
67	P	P	3	P	P	3	23	13	3	P	11	3
69	3	13	P	3	7	P	3	P	11	3	P	7
71	P	3	P	7	3	P	11	3	13	P	3	P
73	P	P	3	P	11	3	P	P	3	7	29	3
75	3	5	5	3	5	5	3	5	5	3	5	5
77	7	3	P	13	3	P	P	3	P	P	3	11
79	P	P	3	P	P	3	7	19	3	11	13	3
81	3	P	P	3	13	7	3	11	P	3	23	P
83	P	3	P	P	3	11	P	3	P	P	3	7
85	5	5	3	5	5	3	5	5	3	5	5	3
87	3	11	7	3	P	P	3	P	P	3	P	P
89	P	3	17	P	3	19	13	3	7	23	3	29
91	7	P	3	17	P	3	P	7	3	P	P	3
93	3	P	P	3	17	P	3	13	19	3	P	P
95	5	3	5	5	3	5	5	3	5	5	3	5
97	P	P	3	P	7	3	17	P	3	P	P	3
99	3	P	13	3	P	P	3	17	29	3	7	11

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769

GENERAL UNIT CONVERSIONS

TECHNICAL SECTION | GENERAL

INTERNATIONAL to BRITISH units	BRITISH to INTERNATIONAL units	
Length 1 km = 0.621 371 mile 1 m = 1.09361 yd 1 dm = 0.328 084 ft 1 cm = 0.393 701 in 1 μ m = 0.039 370 μ in Area 1 km ² = 247.105 acres 1 m ² = 1.195 99 yd ² 1 cm ² = 0.155 000 in ² Volume 1 m ³ = 1.307 95 yd ³ 1 dm ³ = 0.035 314 7 ft ³ 1 cm ³ = 0.051 023 7 in ³ 1 l (litre) = 0.2200 gals. Velocity 1 km/h = 0.621 731 mile/h 1 m/s = 3.280 84 ft/s Acceleration 1 m-s ² = 3.280 84 ft/s ² Mass 1 kg = 2.204 62lb 1 g = 0.305 274 0 oz = 15.4324 gr (grain)	Length 1 mile = 1.609 34 km 1 furlong = 0.201 168 km 1 chain = 20.1168 m 1 yd = 0.914 4 m 1 ft = 0.304 8 1 in = 2.54 cm = 25.4mm 1 milli-inch ('thou') = 25.4 μ Area 1 Yd ² (square yard) = 0.836 127 m ² a ft ² (square foot) = 0.092 9030 m ² 1 in ² (square inch) = 6.451 6 cm ² Volume 1 yd ³ (cubic yard) = 0.764 555 m ³ 1 ft ³ (cubic foot) = 28.316 8 dm ³ 1 in ³ (cubic inch) = 16.387 1 cm ³ Capacity 1 gal = 4.546 09 dm ³ 1 qt (quart) = 1.136 51 dm ³ 1 pt (pint) = 0.568 261 dm ³ 1 gill = 0.142 065 dm ³ 1 fl oz = 28.413 1 cm ³ Moment of section (second moment of area) 1 ft ⁴ = 86.309 7 dm ⁴ 1 in ⁴ = 41.623 1 cm ⁴ Velocity 1 mile/h (m.p.h.) = 1.609 34 km/h 1 ft/s = 0.304 8 m/s 1 ft/min = 0.304 8 m/min	Acceleration 1 ft/s ² = 0.304 8 m/s ² (foot per second per second) Mass 1 ton = 1016.047 kg 1 stone = 6.350 29kg 1 lb = 0.453 592 37 kg 1 oz = 28.349 5 g 1 slug = 14.593 9 g Mass per unit length 1 lb/ft = 1.488 16 kg/m 1 lb/in = 17.858 0 kg/m 1 oz/in = 11.161 2 g/cm Density 1 ton/yd ³ = 1328.94 kg/m ³ (1.328 94 t/m ³) 1 lb/ft ³ = 16.018 5 kg/m ³ 1 lb/in ³ = 27.679 9 g/cm ³ 1 lb/gal = 0.099 776 3 kg/dm ³ = 0.099 78 kg/l 1 slug/ft ³ = 515.379 kg/m ³ Moments of Inertia 1 lb ft ² = 0.042 140 1 kg m ² 1 lb in ² = 2.926 40 kg cm ² 1 oz in ² = 0.182 900 kg cm ² 1 slug ft ² = 1.355 82 kg m ² Force 1 tonf = 9964.02 N 1 lbf = 4.448 22 N 1 ozf = 0.278 014 N

770 

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