Appendix I
SI base units

1 THE SEVEN BASE UNITS IN THE INTERNATIONAL SYSTEM OF UNITS (SI)

Quantity	Name of base SI Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

2 SOME DERIVED SI UNITS WITH THEIR SYMBOL/DERIVATION

Quantity	Common symbol	Unit	Symbol	Derivation
Term		**Term**		
Length	a, b, c	metre	m	SI base unit
Area	A	square metre	m^2	
Volume	V	cubic metre	m^3	
Mass	m	kilogram	kg	SI base unit
Density	ρ (rho)	kilogram per cubic metre	kg/m^3	
Force	F	newton	N	$1\ N = 1\ kgm/s^2$
Weight force	W	newton	N	9.80665 N = 1 kgf
Time	t	second	s	SI base unit
Velocity	v	metre per second	m/s	
Acceleration	a	metre per second per second	m/s^2	
Frequency (cycles per second)	f	hertz	Hz	1 Hz = 1 c/s
Bending moment (torque)	M	newton metre	Nm	
Pressure	P, F	newton per square metre	Pa (N/m^2)	$1\ MN/m^2 = 1\ N/mm^2$
Stress	σ (sigma)	newton per square metre	Pa (N/m^2)	
Work, energy	W	joule	J	1 J = 1 Nm
Power	P	watt	W	1 W = 1 J/s
Quantity of heat	Q	joule	J	
Thermodynamic temperature	T	kelvin	K	SI base unit
Specific heat capacity	c	joule per kilogram degree kelvin	J/ kg × K	
Thermal conductivity	k	watt per metre degree kelvin	W/m × K	
Coefficient of heat	U	watt per square metre kelvin	w/ m^2 × K	

3 MULTIPLES AND SUB MULTIPLES OF SI–UNITS COMMONLY USED IN CONSTRUCTION THEORY

Factor	Prefix	Symbol
10^{6}	mega	M
10^{3}	kilo	k
(10^{2}	hecto	h)
(10	deca	da)
(10^{-1}	deci	d)
(10^{-2}	centi	c)
10^{-3}	milli	m
10^{-6}	micro	u

Prefix in brackets should be avoided.

Appendix II
Conversion tables

- Practical values for use in everyday calculations
- Note, the conversion factors marked * are exact

1 LENGTH

Metre	Inch	Foot	Yard
1*	39.3701	3.2808	1.0936
0.0254*	1*	0.0833	0.0278
0.3048*	12	1*	0.3333
0.9144*	36	3	1*

1km = 0.6214 miles

2 AREA

m^2	cm^2	mm^2	in^2	ft^2	yd^2	acre	ha
1*	10 000	10^6*	1 550.0031	10.7639	1.196	0.2471×10^{-3}	0.1×10^{-3}
0.1×10^{-3}	1*	100*	0.155	1.0764×10^{-3}	11.96×10^{3}	24.71×10^{-9}	0.1×10^{-6}*
10^{-6}*	0.01*	1*	1.55×10^{-3}	10.7639×10^{-6}	1.196×10^{6}	0.2471×10^{-9}	0.1×10^{-9}*
0.64516×10^{-3}	6.4516*	645.16*	1*	6.9444×10^{-3}	0.7716×10^{-3}	0.1594×10^{-6}	64.516×10^{-9}
0.09290304*	929.0304	92903.044	144*	1*	0.1111	22.9568×10^{-6}	9.2903×10^{-6}
0.83612736*	8361.2736	0.8361×10^{6}	1296*	9*	1*	0.2066×10^{-3}	83.6136×10^{-6}
4046.8561	40.4685×10^{6}	4.0469×10^{9}	6272640*	43560*	4840*	1*	0.4047
10000	100×10^{6}	10^{9}	15.5×10	107639.1	11959.9	2.4711	1*

3 VOLUME

m^3	cm^3	in^3	ft^3	yd^3
1*	10^6	61023.744	35.3147	1.3080
10^{-6}	1*	0.0610	35.3146×10^{-5}	1.3080×10^{-6}
16.387×10^{-6}	16.387064*	1*	0.5787×10^{-3}	21.4334×10^{-6}
0.0283	28316.847	1728*	1*	0.0320
0.7646	764554.86	46656*	27*	1*

4 MASS

kg	g	pound	oz
1*	1000*	2.2046	35.274
0.001*	1*	2.205×10^{-3}	0.0353
0.45359237*	453.5924	1*	16*
0.0283	28.3495	0.0625*	1*

5 DENSITY

kg/m³	lb/ ft³	lb/in³
1*	0.0624	3.6106×10^{-5}
16.0185	1*	5.787×10^{-4}
27679.906	1728*	1*

6 FORCE

N	kgf (=kp)	Lbf
1*	0.102	0.2248
9.80665*	1*	0.2246
4.4482	0.4536	1*

7 PRESSURE AND STRESS

Pa = N/m²	mm Hg (0°C)	UK ton–force/in² (tonf/in²)	Pound force/in² (LBF/in² (= psi))
1*	7.5006×10^{-3}	64.7488×10^{-9}	0.145×10^{-3}
133.322	1*	115841.53	0.0193
15.4443×10^{6}	8.6325×10^{-6}	1*	2239.4237
6894.76	51.7283	446.543×10^{-6}	1*

8 VELOCITY

m/s	km/h	ft/s	mile/h
1*	3.6*	3.2808	2.2369
0.2778	1*	0.9113	0.6214
0.3048*	1.0973	1*	0.6818
0.447	1.609344*	1.4667	1*

9 TEMPERATURE

°C	°F	°K
°C	(1.8 × °C) + 32*	°C + 273.15*
(°F – 32)1.8*	°F*	(°F – 32) / 1.8 + 273.15*
°K – 273.15*	(1.8(°K – 273.15)) + 32'	°K*

10 ENERGY

J, Nm, Ws	kWh	kcal	ft 1bf	therm
1*	$0–2778 \times 10^{6}$	0.2388×10^{-3}	0.7376	9.4781×10^{-9}
3.6 × 106*	1*	859.845	2.6552×10^{6}	0.341
4.1868×10^{3}	1.163×10^{-3}	1*	3.088×10^{3}	39.6832×10^{-6}
1.3558	0.3766×10^{-6}	0.3238×10^{-3}	1*	12.8506×10^{-9}
105.505×10^{6}	29.3071	25 199.56	77.8168×10^{6}	1*

11 POWER

W, Nm/s, J/S	hp	ft lbf/s	Btu/h
1*	1.341×10^{-3}	0.7376	3.4121
745.7	1*	550*	2544.4328
1.3558	1.81820×10^{-3}	1*	4.6262
0.2931	0.393×10^{-3}	0.2162	1*

Appendix III
Greek alphabet

Capital	Lower case	Name	Capital	Lower case	Name
A	α	alpha	N	ν	nu
B	β	beta	Ξ	ε	xi
Γ	γ	gamma	O	o	omicron
Δ	δ	delta	Π	π	pi
E	ε	epsilon	P	ρ	rho
Z	ζ	zeta	Σ	σ (at end of word) c	sigma
H	η	eta	T	τ	tau
Θ	θ	theta	Y	υ	upsilon
I	i	iota	Φ	ϕ	phi
K	κ	kappa	X	x	chi
Λ	λ	lambda	Ψ	ψ	psi
M	μ	mu	Ω	ω	omega

Appendix IV
List of symbols

a, b, c, d, = length, width depth etc
a = acceleration
A = cross sectional area
C = compression force
(suffix) $_c$ = compression
d = diameter
δ = deflection (delta)
D = diameter, dead load
e = eccentricity, distance
E = modulus of elasticity
ε = direct strain (epsilon)
θ = angle, rotation (theta)
f, σ = stress (tension or compression) (sigma)
F, P, R = force, reaction
g = acceleration due to gravity
h = distance, lever arm
H = height, depth, horizontal force
I = second moment of area, moment of inertia, imposed load
k = constant
l, L = length, span
ΔL = change in length
λ = slenderness ratio (lambda)
m = mass, metre
M = moment, bending moment
μ = coefficient of friction (mu)
N = newton
N_x A_x = neutral axis
P = pressure, stress
Q = shearing force
r = radius, distance, radius of gyration
t = thickness
(suffix) $_t$ = tension
T = tension force
τ = shear stress (tau)
V = volume
w = specific weight, intensity of loading
(suffix) $_w$ = working or allowable value
W = weight force, load
X = horizontal axis
Y = vertical axis
X-X, Y-Y = reference
Z = section modulus
> = greater than
< = less than
Σ = summation (capital sigma)
ρ = density (rho)

Appendix V
Design tables and charts

1 REQUIREMENTS FOR BATCHING ORDINARY CONCRETE MIXES OF VARIOUS GRADES AND OF MEDIUM WORKABILITY

Grade	Water: cement ratio	Maximum size of aggregate (mm)	Cement: aggregate ratio[6]	Sand to total aggregate (%)	Batching by weight (kg dry materials per m³, litre per m³ concrete)				Batching by volume, naturally moist materials (litre per m³ concrete)				Litre per bag cement (50 kg)			Yield (m³)
					Cement	Sand	Stones	Maximum[1] water	Cement[2]	Sand[3]	Stones[4]	Maximum[5] water	Sand[3]	Stones[4]	Maximum[5] water	
C7	0.95	40	10.8	35	185	700	1 300	175	135	510	830	114	135	225	30	0.27
C7	0.95	20	9.4	40	205	770	1 160	194	155	560	740	131	135	180	32	0.24
C10	0.85	40	9.2	35	215	690	1 290	182	150	500	820	121	115	190	28	0.23
C10	0.85	20	8.1	40	235	760	1 140	199	175	550	730	137	115	155	29	0.21
C10	0.85	14	7.6	45	245	840	1 020	208	185	610	650	144	125	135	29	0.20
C15	0.75	40	7.8	35	250	680	1 270	187	185	490	810	128	100	160	25	0.20
C15	0.75	20	6.7	40	280	750	1 130	210	210	540	720	149	95	130	26	0.18
C15	0.75	14	6.4	45	290	840	1 020	217	215	600	650	154	105	110	26	0.17
C20	0.66	40	6.7	30	285	570	1 340	188	210	410	850	132	75	150	23	0.18
C20	0.66	20	5.7	35	325	650	1 200	214	240	470	770	157	70	120	24	0.15
C20	0.66	14	5.4	40	335	720	1 090	221	250	520	690	162	80	105	24	0.15
C25[7]	0.58	40	5.7	30	330	560	1 320	191	245	410	840	137	60	125	20	0.15
C25[7]	0.58	20	4.9	35	375	640	1 190	217	275	470	760	161	60	100	21	0.13
C25[7]	0.58	14	4.6	40	390	720	1 080	226	190	520	690	168	65	90	21	0.13
C30[7 8]	0.51	40	5.1	30	365	560	1 300	186	270	400	830	132	55	115	18	0.14
C30[7 8]	0.51	20	4.4	35	410	630	1 170	209	305	460	750	153	55	90	18	0.12
C30[7 8]	0.51	14	4.0	40	440	700	1 060	224	325	510	670	168	60	75	19	0.11
C35[7 8]	0.45	20	4.0	35	445	620	1 160	200	330	450	740	146	50	85	16	0.11

See footnotes at bottom of Appendix V: 2

2 REQUIREMENTS FOR BATCHING ORDINARY CONCRETE MIXES OF VARIOUS GRADES AND OF HIGH WORKABILITY

Grade	Water: cement ratio	Maximum size of aggregate (mm)	Cement: aggregate ratio[6]	Sand to total aggregate (%)	Batching by weight (kg dry materials per m³, litre per m³ concrete)				Batching by volume, naturally moist materials (litre per m³ concrete)				Litre per bag cement (50 kg)			Yield (m³)
					Cement	Sand	Stones	Maximum[1] water	Cement[2]	Sand[3]	Stones[4]	Maximum[5] water	Sand[3]	Stones[4]	Maximum[5] water	
C7	0.95	40	9.4	40	210	790	1 180	199	155	570	750	136	135	180	32	0.24
C7	0.95	20	8.2	45	235	870	1 060	223	175	630	680	159	135	145	34	0.21
C10	0.85	40	8.2	40	235	770	1 160	199	175	560	740	137	120	155	29	0.21
C10	0.85	20	7.3	45	255	840	1020	216	190	610	650	152	120	130	30	0.20
C10	0.85	14	7.0	50	265	930	930	225	195	670	590	161	125	110	30	0.19
C15	0.75	40	7.0	40	270	760	1 130	202	200	550	720	141	100	135	26	0.19
C15	0.75	20	6.1	45	305	830	1 020	228	225	610	650	165	100	105	27	0.16
C15	0.75	14	5.8	50	310	900	900	232	230	650	570	168	105		27	0.16
C20	0.66	40	6.1	35	305	650	1 210	201	225	470	770	143	75	125	23	0.16
C20	0.66	20	5.3	40	345	730	1100	227	255	530	700	168	75	100	24	0.14
C20	0.66	14	5.1	45	350	800	980	231	260	580	620	171	85	90	24	0.14
C27[7]	0.58	40	5.2	35	355	650	1 200	205	265	470	760	149	65	110	21	0.14
C27[7]	0.58	20	4.5	40	400	720	1 080	232	295	520	690	175	65	85	21	0.13
C27[7]	0.58	14	4.3	45	405	780	960	234	300	570	610	175	70	75	21	0.12
C30[7 8]	0.51	40	4.7	35	385	630	1 180	196	285	460	750	140	60	95	18	0.13
C30[7 8]	0.51	20	4.1	40	430	710	1 060	219	320	510	617	163	60	80	19	0.12
C30[7 8]	0.51	14	3.8	45	455	780	950	232	335	560	610	174	60	65	19	0.11
C35[7 8]	0.45	20	3.7	40	470	700	1 040	211	350	500	670	155	55	70	16	0.11

[1] Including moisture content in aggregate. Use less water if acceptable workability can be achieved.

[2] Bulk density 1 350kg/m³ i.e. 37 litre per bag of 50 kg.

[3] Moisture content 5% and bulk density 1 450kg/m³ (Sand with natural moisture will form a ball in the hand when squeezed, but the ball has a tendency to fall apart)

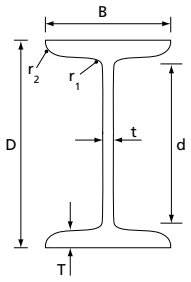
[4] Moisture content 2% and bulk density 1 600kg/m³.

[5] Excluding moisture according to [3] and [4] in aggregate. Use less water if acceptable workability can be achieved.

[6] Solid density of aggregate 2 600–2 700 kg/ m³

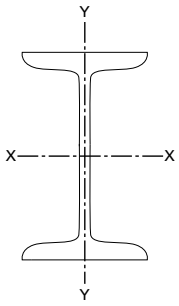
[7] Concrete of grade C25 and higher should preferably be batched by weight and the moisture content of the aggregate should be checked in order to achieve the intended grade. Batching requirements are nevertheless given for batching by volume and may be used when only in small quantities are required.

[8] Concrete of grade C30 and higher should be mixed in a mechanical mixer in order to achieve the intended grade.



3 DIMENSIONS AND PROPERTIES OF STEEL I-BEAMS

Nominal size	Mass Per metre	Depth of section (D)	Width of section (B)	Thickness		Radius		Depth between fillets d	Area of section
				Web (t)	Flange (T)	Root (r_1)	Toe (r_2)		
mm	kg	mm	mm	mm	mm	mm	mm	mm	cm²
254 × 203	81.85	254.0	203.2	10.2	19.9	19.6	9.7	166.0	104.4
254 × 114	37.20	254.0	114.3	7.6	12.8	12.4	6.1	199.2	47.4
203 × 152	52.09	203.2	152.4	8.9	16.5	15.5	7.6	133.2	66.4
203 × 102	25.33	203.2	101.6	5.8	10.4	9.4	3.2	161.0	32.3
178 × 102	21.54	177.8	101.6	5.3	9.0	9.4	3.2	138.2	27.4
152 × 127	37.20	152.4	127.0	10.4	13.2	13.5	6.6	94.3	47.5
152 × 89	17.09	152.4	88.9	4.9	8.3	7.9	2.4	117.7	21.8
152 × 76	17.86	152.4	76.2	5.8	9.6	9.4	4.6	111.9	22.8
127 × 114	29.76	127.0	114.3	10.2	11.5	9.9	4.8	79.4	37.3
127 × 114	26.79	127.0	114.3	7.4	11.4	9.9	5.0	79.5	34.1
127 × 76	16.37	127.0	76.2	5.6	9.6	9.4	4.6	86.5	21.0
127 × 76	13.36	127.0	76.2	4.5	7.6	7.9	2.4	94.2	17.0
114 × 114	26.79	114.3	114.3	9.5	10.7	14.2	3.2	60.8	34.4
102 × 102	23.07	101.6	101.6	9.5	10.3	11.1	3.2	55.1	29.4
102 × 64	9.65	101.6	63.5	4.1	6.6	6.9	2.4	73.2	12.3
102 × 44	7.44	101.6	44.4	4.3	6.1	6.9	3.3	74.7	9.5
89 × 89	19.35	88.9	88.9	9.5	9.9	11.1	3.2	44.1	24.9
76 × 76	14.67	76.2	80.0	8.9	8.4	9.4	4.6	38.0	19.1
76 × 76	12.65	76.2	76.2	5.1	8.4	9.4	4.6	37.9	16.3

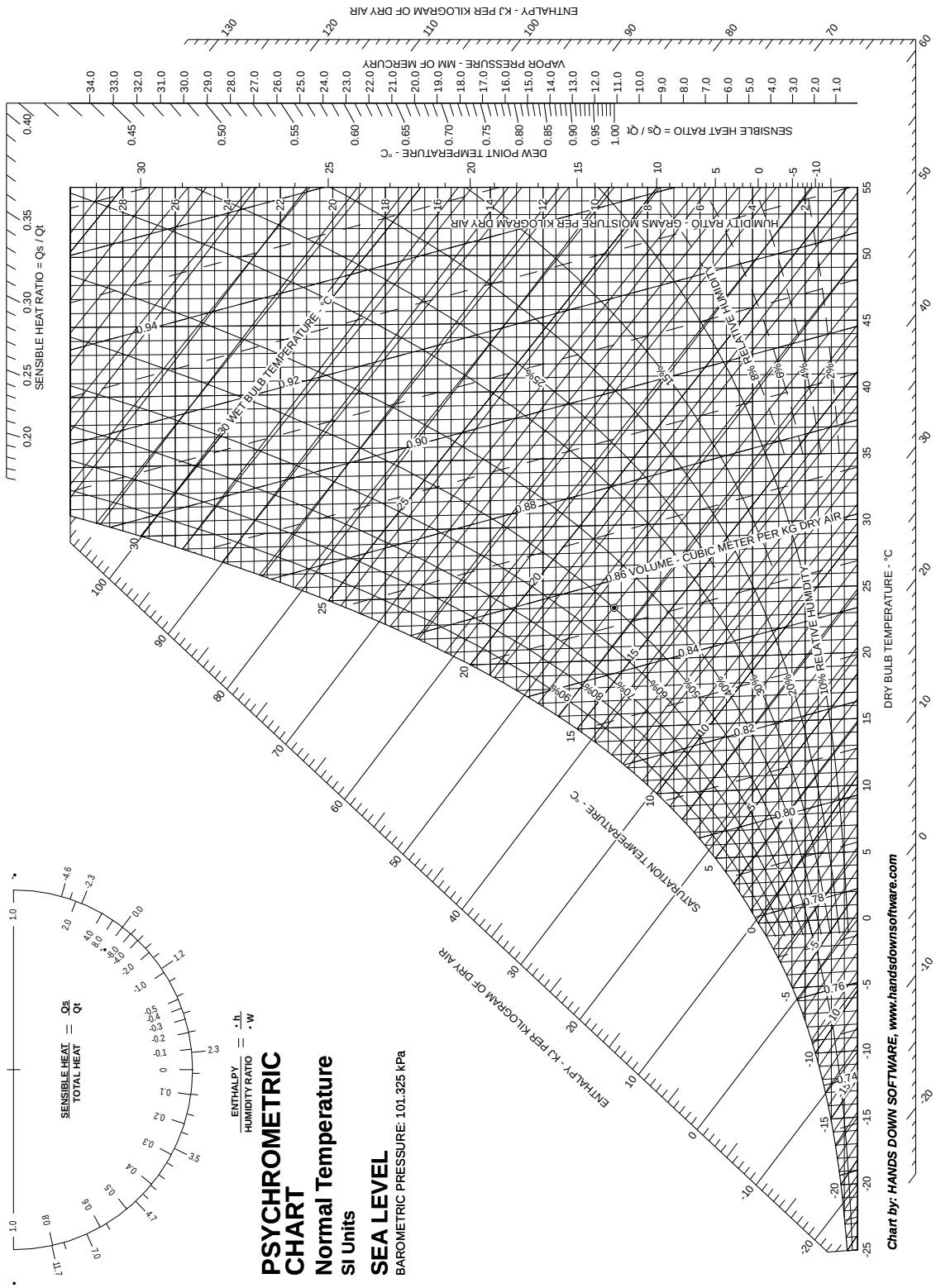


3 JOISTS, DIMENSION AND PROPERTIES *(continued)*

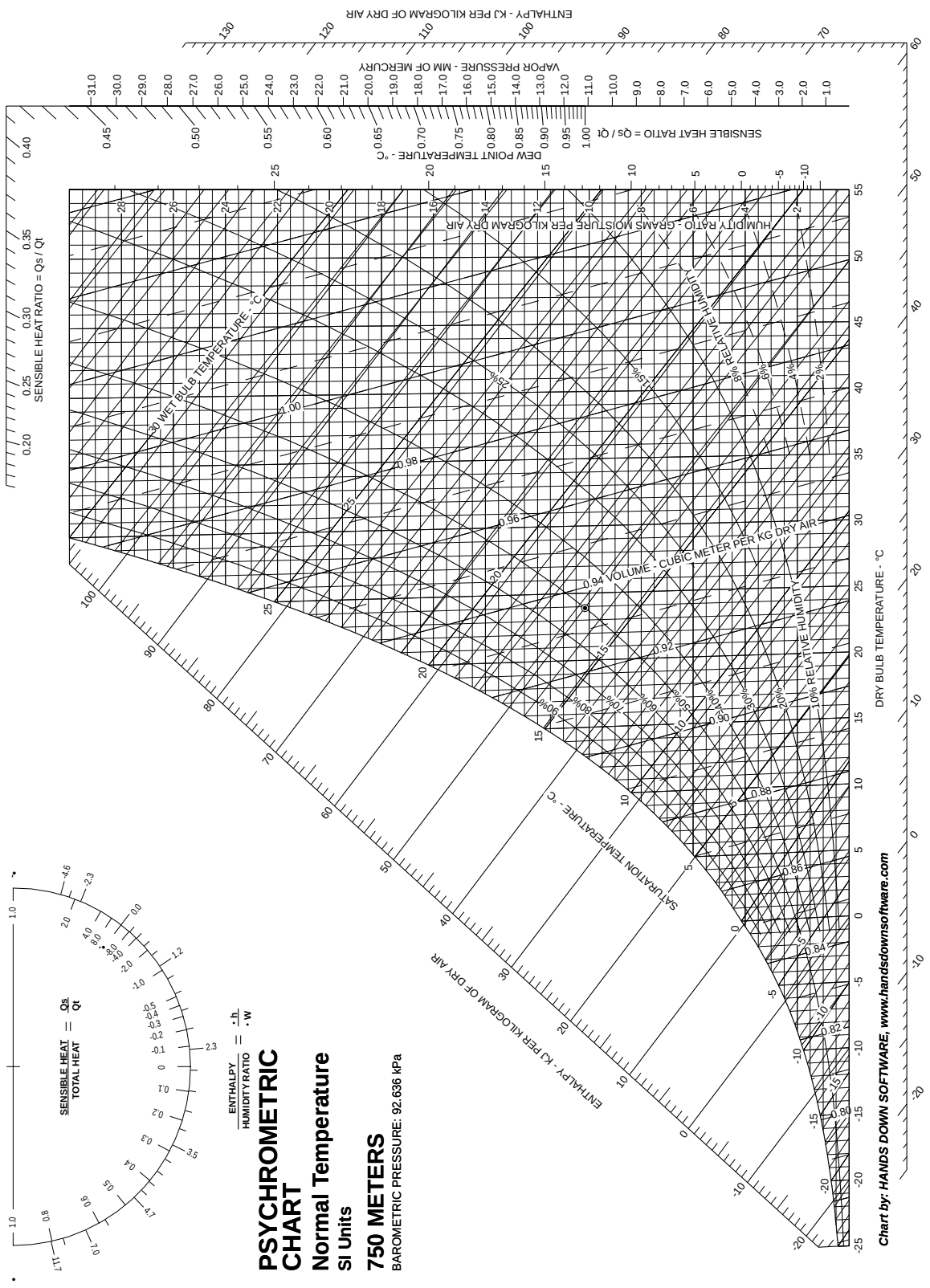
Minimal size	Moment of inertia			Radius of gyration		Elastic modulus		Ratio
	Axis x–x		Axis	Axis	Axis	Axis	Axis	D/T
	Gross	Net	y–y	x–x	y–y	x–x	y–y	
mm	cm^4	cm^4	cm^4	cm	cm	cm^3	cm^4	
254 × 203	12 016	10 527	2 278	10.7	4.67	946.1	224.3	12.8
254 × 114	5 092	4 243	270.1	10.4	2.39	401.0	47.19	19.8
203 × 152	4 789	4 177	813.2	8.48	3.51	471.4	106.7	12.3
203 × 102	2 294	2 024	162.6	8.43	2.25	225.8	32.02	19.6
178 × 102	1 519	1 339	139.2	7.44	2.25	170.9	27.41	19.7
152 × 127	1 818	1 627	378.8	6.20	2.82	238.7	59.65	11.5
152 × 89	881.1	762.6	85.98	6.36	1.99	115.6	19.34	18.4
152 × 76	873.7	736.2	60.77	6.20	1.63	114.7	15.90	15.9
127 × 114	979.0	800.9	241.9	5.12	2.55	154.2	42.32	11.0
127 × 114	944.8	834.6	235.4	5.26	2.63	148.8	41.19	11.2
127 × 76	569.4	476.1	60.35	5.21	1.70	89.66	15.90	13.3
127 × 76	475.9	400.0	50.18	5.29	1.72	74.94	13.17	16.7
114 × 114	735.4	651.2	223.1	4.62	2.54	128.6	39.00	10.7
102 × 102	486.1	425.1	154.4	4.06	2.29	95.72	30.32	9.9
102 × 64	217.6	182.2	25.30	4.21	1.43	42.84	7.97	15.4
102 × 44	152.3	126.9	7.91	4.01	0.91	30.02	3.44	16.7
89 × 89	306.7	263.7	101.1	3.51	2.01	69.04	22.78	9.0
76 × 76	171.9	144.1	60.77	3.00	1.78	45.06	15.24	9.1
76 × 76	158.6	130.7	52.03	3.12	1.78	41.62	13.60	9.1

In calculating the net moment of inertia, one hole is deducted from each flange.

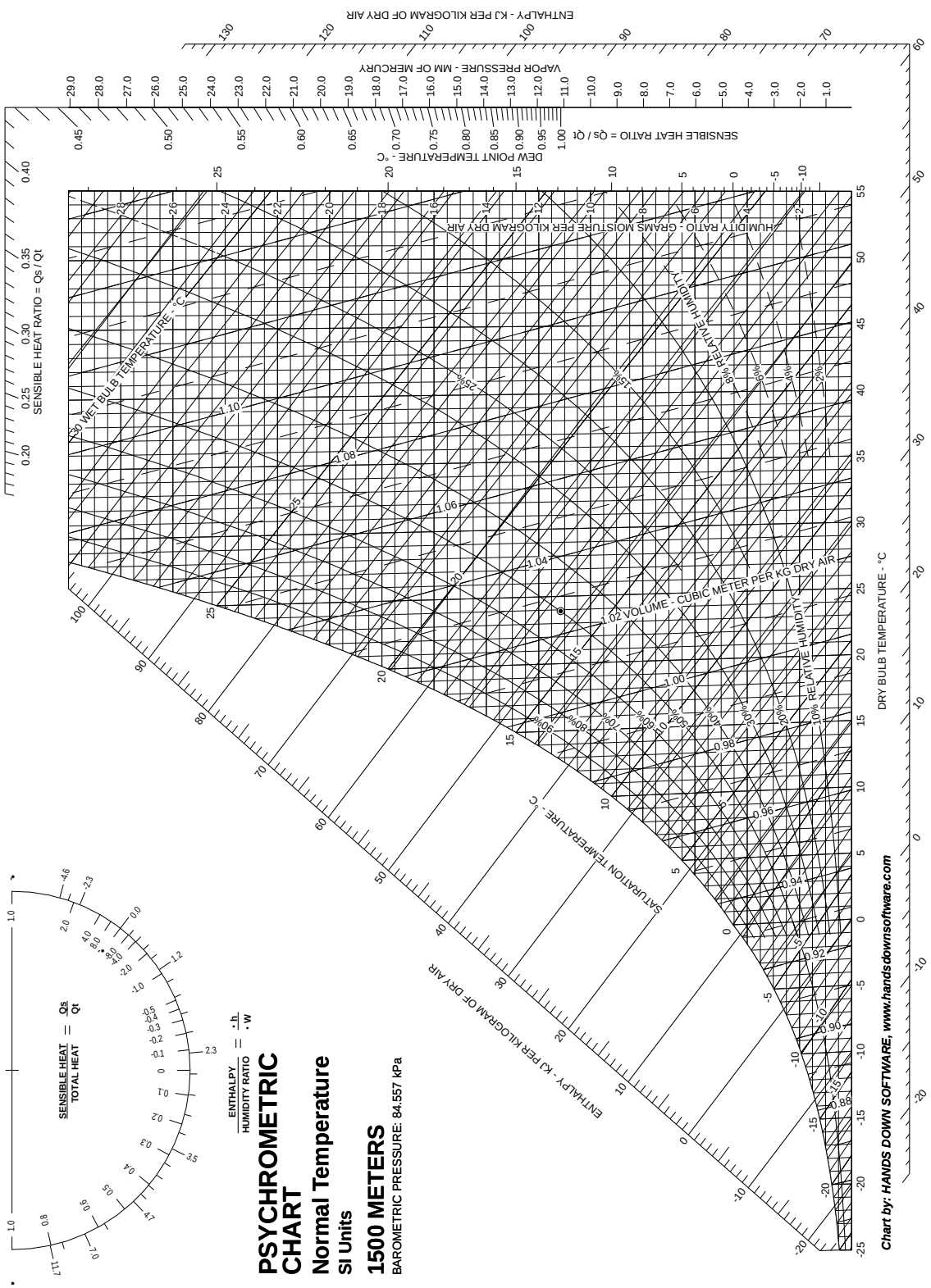
4 PSYCHROMETRIC CHART SEA LEVEL



5 PSYCHROMETRIC CHART 750M ABOVE SEA LEVEL



6 PSYCHROMETRIC CHART 1 500M ABOVE SEA LEVEL



7 TYPICAL PROPERTIES OF COHESIONLESS MATERIAL

Material	Angle of shearing resistance θ (deg)	Specific mass (kg/m³)*
Gravel	35–45	16–20
Sand		
– loose	25–35	17–19
– compact	30–40	18–21
Organic topsoil	15–30	13–18
Broken brick	35–45	1 1–16
Ashes and clinker	35–45	6–10
Maize corn	30	7–8
Rice	30–45	5–6
Millet	30–45	6–7
Soya	30	7–8.5
Potatoes	35	7
Fertilizer (general)	35	10

*Multiplied by 10^2

8 TYPICAL SPECIFIC MASS OF MATERIALS

Material	Specific mass (kg/m³)*
Concrete	
– unreinforced	23
– reinforced	24
– lightweight	7–15
Masonry	
– granite	26
– limestone	20–26
– sandstone	21–25
– slate	25–28
Brickwork	12–20
Timber	
– softwoods	4–7
– hardwoods	6–12
Steel	77

*Multiplied by 10^2

9 TYPICAL ALLOWABLE BEARING CAPACITIES

Material	Allowable bearing capacity (kN/m²)
Plain concrete	2 000–6 000
Masonry or brickwork	1 500–5 000
Compact sands and gravels	300–600
Loose sands and gravels	150–400
Solid non-fissured rocks	600–3 000
Hard clays and soft rocks	300–600
Stiff clays and sandy clays	150–300
Firm clays and sandy days	75–150
Soft clays and silts	0–75
Fill and made ground	Variable

Note: the values for soils apply where the foundation is 1m or more wide and at a depth of at least 0.6m. The allowable bearing capacity is about one-third of the ultimate bearing capacity

10 TYPICAL STRENGTH PROPERTIES AND ALLOWABLE STRESSES (N/mm²)

Mild-steel Sections	
Young's modulus (E)	206 000
Tension or compression stress in bending	155–165
Axial tension	155 (depends on slenderness ratio)
Bearing	190
Shear	115
Mild-steel rivets and bolts	
Axial tension	
– rivets	100
– bolts	120
Shear	
– rivets	90–100
– bolts	80
Bearing	
– (double shear) rivets	265–315
– bolts	200

Timber (green > 18% moisture)

	Softwoods	Hardwoods
	(values in thousands)	
Young's modulus (E)	4–12	5–19
Bending or tension parallel to grain	3–1 1	4–27
Compression parallel to grain	2 ½ –8 ½	4–27
Compression perpendicular to grain	¾–1½	1½ –5½
Shear parallel to grain	½ –1¼	¾–3 ½

Extracts from B.S. 499 and C.P. 112 are reproduced by permission of the British Standards Institution. Complete copies of the standard can be obtained from them at Linford Wood, Milton Keynes, MK146LE, England.

Appendix VI
Number of pens and stalls required in breeding pig units of various sizes

Choose values at the upper part of the intervals given where management, housing and production performance is of good standard and the production intensity is high

Num-ber of pigs in the herd	Combined pen Piglets to 12 weeks in farrowing pen	Piglets transferred from to weaner pens at 2 farrowing weeks after weaning				Places in service/ gestation pens weaning at		Boar pens	gilt pens 4–6 gilts	Two-stage pens for 10–12 growers	Finishing pens for 8–10 finishers	One-stage finishing pens for 8–11 finishers
		Farrowing pens: weaning at		Pens for 7–11 weaners weaning at								
		6 wks	8 wks	6 wks	8 wks	6 wks	8 wks					
2	1	–	–	–	–	2	2	0	0	1	1	2
4	2	–	–	–	–	3	3	0	0	2	2	4
6	3	–	–	–	–	5	4	0	0	3	3	6
8	4	–	–	–	–	6	5	0	0	3	3	6
10	5	–	–	–	–	7	6	1	1	4	4	7–8
15	8	–	–	–	–	9–11	8–11	1	1	5	6	9–11
20	10	–	–	–	–	12–15	11–14	1	2	7	8	12–15
25	13	–	–	–	–	15–19	14–18	2	3	8–9	9–10	15–19
30	14–16	9–10	11–12	7–8	4–5	18–24	16–20	2	3	10–12	11–13	20–25
40	18–22	12–14	14–16	9–11	5–7	25–30	22–28	2	4	12–14	13–16	25–30
50	23–28	15–17	18–20	12–14	6–9	30–36	28–35	3	5–6	14–16	15–19	30–35
60	27–33	18–21	21–24	14–16	8–11	35–45	33–42	4	6–7	16–20	20–25	35–45
80	38–44	25–28	28–32	18–22	10–14	45–60	44–55	5	8–10	23–26	27–34	50–60
100	45–55	31–34	35–38	23–27	13–18	60–75	55–70	6	10–13	–	–	60–70
120	60–70	37–41	42–46	27–32	16–22	75–90	60–85	7	12–15	–	–	70–90
150	80–90	47–51	53–57	35–41	22–27	90–100	75–95	8	15–18	–	–	90–110
200	110–120	62–68	70–76	55–65	28–36	110–140	100–130	9	20–25	–	–	130–150

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Rural structures in the tropics

DESIGN AND DEVELOPMENT

This book is an effort by FAO to compile an up-to-date, comprehensive text on rural structures and services in the tropics, focusing on structures for small- to medium-scale farms and, to some extent, village-scale agricultural infrastructure. The earlier edition, entitled *Farm structures in tropical climates. A textbook for structural engineering and design*, published in 1986, has been used for over two decades as a standard textbook for teaching undergraduate and postgraduate courses on rural structures and services in universities throughout sub-Saharan Africa.

This second edition will help to improve teaching – at all educational levels – on the subject of rural buildings in developing countries of the tropics and it will assist professionals currently engaged in providing technical advice on rural structures and services, from either agricultural extension departments or non-governmental rural development organizations. This book will also provide technical guidance in the context of disaster recovery and rehabilitation, for rebuilding the sound rural structures and related services that are key to development and economic sustainability.

While this book is intended primarily for teaching university- and college-level agricultural engineering students about rural structures and services, resources might be made available to produce textbooks based on this material for teaching at other educational levels. Although parts of the background material relate specifically to East and Southeast Africa, the book's principles apply to the whole of tropical Africa, Latin America and South Asia because, while building traditions may vary, the available materials are similar.

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