ENGINEERING CONSTANTS . . .

COMMONLY USED ENGINEERING CONSTANTS

Below are listed a variety of commonly used constants arranged numerically to permit ease of reference. Wherever an asterisk (*) is shown, the constant is exact as given, it being generally a mathematical constant or one fixed by definition. In cases where the first constant listed is followed by another in parenthesis, the first is the round number generally used, while the second is the more exact value.

0* deg. C. = freezing point of water.

1 = atomic wgt. hydrogen.

100* deg. C. = boiling point of water at atm. press.

10.764* sq.ft. = 1 sq. meter.

0.1134 hp. = available water power from 1 cu.ft.-sec. falling 1 ft.

1.134 ft. water at 62 deg. F. = 1 in. Hg. at 62 deg. F.

1,150.4 B.t.u. = Total heat sat. steam at atm. press.

11.52 lb. = theoret. air to burn 1 lb. carbon.

12 = atomic wgt. carbon (C).

12.387 cu.ft. = vol. 1 lb. air at 32 deg. F. and 14.7 lb. per sq.in.

12.52 lb. = wgt. theoret. combustion products from 1 lb. C.

1,273,239* circular mils = 1 sq.in.

13.144 cu.ft. = vol. 1 lb. air at 62 deg. F. and 14.7 lb. per sq.in.

1.3410 hp. = 1 kw.

14 = atomic wgt. nitrogen (N).

1.406 = V = ratio of C_p to C_v for air.

1.4142* = square root of 2.

14.223* lb. per sq.in. = 1 kg. per sq.cm. = 1 "metric atmosphere".

144* sq.in. = 1 sq.ft.

144 (143.15) B.t.u. = latent heat of fushion of ice.

14,600 B.t.u. per lb. = Cal. val. of carbon (C).

14.7 (14.696*) lb. per sq.in. = atm. press.

16* ounces = 1 lb.

16 = atomic wgt. oxygen (O).

0.1689 = C_v for air.

0.017138* grammes per litre = 1 grain per gal.

17.138* ppm = 1 grain per gal.

1.728* cu.in. = 1 cu.ft.

1.7321* = square root of 3.

1.8* B.t.u. per lb. = 1 kg. calorie per kg.

1.8* Fahrenheit degrees = 1 Centigrade degree.

18 = mol. wgt. water (H_2O).

2,000* lb. = 1 short ton.

2.0355 in. Hg. at 32 deg. F. = 1 lb. per sq.in.

2.0416 in. Hg. at 62 deg. F. = 1 lb. per sq.in.

2,116.3* lb. per sq.ft. = atm. press.

212* deg. F. = boiling point water at atm. press.

2.2046 lb.* = 1 kg.

223.8* × sq. root adiabatic heat drop = theoret. vel., ft. per sec., of steam expanding through nozzle.

2,240* lb. = long ton.

2.3026* × $\log_{10} a$ = $\log_e a$.

2.309 ft. water at 62 deg. F. = 1 lb. per sq.in.

231* cu.in. = 1 gal.

0.2375 = C_p for air.

2.54* cm. = 1 in.

2,545 (2,547) B.t.u. per hr. = 1 hp.

2.666 lb. = wgt. oxygen required to burn 1 lb. carbon.

27* cu.ft. = 1 cubic yard.

−270 deg. C. = absolute zero.

2.7183* = e = base hyperbolic logs.

27.71 in. water at 62 deg. F. = 1 lb. per sq.in.

277.274 cu.in. = 1 British gal.

28 = mol. wgt. nitrogen gas (N_2).

28 = mol. wgt. carbon monoxide (CO).

28.8 = equivalent mol. wgt. of air.

288,000* B.t.u. per 24 hr. = 1 ton of refrigeration.

29.921* in. Hg. at 32 deg. F. = atm. press.

3* ft. = 1 yard.

30 in. Hg. at 62 deg. = atm. press. (very closely).

3.1416* = π (Greek letter "pi") = ratio circumference of circle to diameter = ratio area of circle to square of radius.

32* deg. F. = freezing point of water = 0 deg. C.

32 = atomic wgt. sulphur (S).

32 = mol. wgt. oxygen gas (O_2).

32.5* gal. = 1 barrel.

3.2808* ft. = 1 meter.

33,000* ft.-lb. per min. = 1 hp.

33.947 ft. water at 62 deg. F. = atm. press.

3,415 B.t.u. = 1 kw.-hr.

3.45* lb. steam "f. & a. 212" per sq.ft. per hr. = rated boiler evaporation.

34.56 lb. = wgt. air to burn 1 lb. hydrogen (H).

35.314* cu.ft. = 1 cu. meter.

3.785* liters = 1 gal.

39.37* in. = 1 meter = 100 cm.

3.9683* B.t.u. = 1 kg. calorie.

4,000 B.t.u. (4,050) = cal. val. of sulphur (S).

4.32 lb. = wgt. air req. to burn 1 lb. sulphur (S).

0.433 lb. per sq.in. = 1 ft. of water at 62 deg. F.

44 = mol. wgt. carbon dioxide (CO_2).

0.45359* kg. = 1 lb.

−460 (459.6) deg. F. = absolute zero.

0.47 B.t.u. per pound per deg. F. = approx. specific heat of superheated steam at atm. press.

0.491 lb. per sq.in. = 1 in. Hg. at 62 deg. F.

5.196 lb. per sq.ft. = 1 in. water at 62 deg. F.

5,280* ft. = 1 mile.

53.32 = R, for air, in equation: PV = MRT.

550* ft.-lb. per sec. = 1 hp.

57.296* deg. = 1 radian (angle).

58.349* grains per gal. = 1 gram per liter.

59.76 lb. = wgt. 1 cu.ft. water at 212 deg. F.

61.023* cu.in. = 1 liter.

62,000 B.t.u. = cal. val. (higher) hydrogen (H).

0.62137* miles = 1 kilometer.

0.062428* lb. per cu.ft. = 1 kg. per cu. meter.

62.5 (62.355) lb. = wgt. 1 cu.ft. water at 62 deg. F.

7,000* grains = 1 lb.

0.0735 in. Hg. at 62 deg. F. = 1 in. water at 62 deg. F.

746 (745.7) watts = 1 hp.

7.5 (7.4805*) gal. = 1 cu.ft.

760* millimeters Hg. = atm. press. at 0 deg. C.

0.07608 lb. = wgt. 1 cu.ft. air at 62 deg. F. and 14.7 lb. per sq.in.

778 (777.5) ft.-lb. = 1 B.t.u.

0.7854* (= 3.1416 ÷ 4) × diameter squared = area circle.

8 = lb. oxygen required to burn 1 lb. hydrogen (H).

8.025* (= square root of 2g) × square root of head (ft.) = theoretical velocity, ft. per sec.

0.08073 lb. = wgt. 1 cu.ft. air at 32 deg. and 14.7 lb. per sq.in.

8⅓ (8.3356) lb. = wgt. 1 gal. water at 62 deg. F.

8,760* hr. = 1 year of 365 days.

88* ft. per sec. (min.) = 1 mile per min. (hr.).

9* sq.ft. = 1 sq.yd.

0.0929* sq. meters = 1 sq.ft.

970.4 B.t.u. = Latent heat of evap. of water at 212 deg. F.

FORMULAS FOR DETERMINING GEAR DIMENSIONS
BY METRIC PITCH

Module is the pitch diameter in millimetres divided by the number of teeth in the gear. Pitch diameter in millimetres is the Module multiplied by the number of teeth in the gear.

M = Module.
D′ = The pitch diameter of gear in millimetres.
D = The whole diameter of gear in millimetres.
N = The number of teeth in gear.
D″ = The working depth of teeth.
t = Thickness of teeth on pitch line.
f = Amount added to depth for clearance.
D.P. = Diametral Pitch

Then

$M = \dfrac{D'}{N}$ or $\dfrac{D}{N+2}$
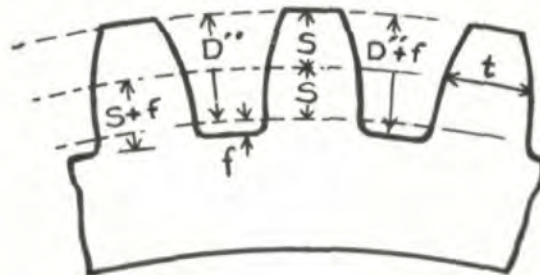
$D' = NM.$

$D = (N + 2) M.$

$N = \dfrac{D'}{M}$ or $\dfrac{D}{M} - 2$

$D'' = 2 M.$

$t = M\ 1.5708.$

$f = \dfrac{M\ 1.5708}{10} = .157\ M.$

$M = \dfrac{25.4}{D.P.}$

$D.P. = \dfrac{25.4}{M}$

The Module is equal to the part marked "S" in diagram, measured in millimetres and parts of millimetres.

Pitches Commonly Used—Module in Millimetres

Module	Corresponding English Diametral Pitch
½ mm.	50.800
¾	33.867
1	25.400
1.25	20.320
1.5	16.933
1.75	14.514
2	12.700
2.25	11.288
2.5	10.160
2.75	9.236
3	8.466
3.5	7.257
4	6.350
4.5	5.644
5	5.080
5.5	4.618
6	4.233
7	3.628
8	3.175
9	2.822
10	2.540
11	2.309
12	2.117
13	1.954
14	1.814
15	1.693
16	1.587

CONVERTING METRIC INTO INCHES

Millimetres × .03937 = inches.
Millimetres ÷ 25.4 = inches.
Centimetres × .3937 = inches.
Centimetres ÷ 2.54 = inches.
Metres × 39.37 = inches. (Act Congress).
Metres × 3.281 = feet.
Metres × 1.094 = yards.
Kilometres × .621 = miles.
Kilometres ÷ 1.6093 = miles.
Kilometres × 3280.87 = feet.
Square Millimetres × .00155 = square inches.
Square Millimetres ÷ 645.16 = square inches.
Square Centimetres × .155 = square inches.
Square Centimetres ÷ 6.451 = square inches.
Square metres × 10.764 = square feet.
Square Kilometres × 247.1 = acres.
Hectare × 2.471 = acres.
Cubic Centimetres ÷ 16.383 = cubic inches.
Cubic Centimetres ÷ 3.69 = Fl. drachms (U.S. Phar.)
Cubic Centimetres ÷ 29.57 = Fl. ounces (U.S. Phar.)
Cubic Metres × 35.315 = cubic feet.
Cubic Metres × 1.308 = cubic yards.
Cubic Metres × 264.2 = gallons (231 cubic inches).
Litres × 61.022 = cubic inches (Act Congress).
Litres × 33.84 = fluid ounce (U.S. Phar.).
Litres × .2642 = gallons (231 cubic inches).
Litres ÷ 3.78 = gallons (231 cubic inches).

Litres ÷ 28.316 = cubic feet.
Hectolitres × 3.531 = cubic feet.
Hectolitres × 2.84 = bushels (2150.42 cubic inches).
Hectolitres × .131 = cubic yards.
Hectolitres ÷ 26.42 = gallon (231 cubic inches).
Grammes × 15.432 = grains (Act Congress).
Grammes ÷ 981 = dynes.
Grammes (water) ÷ 29.57 = fluid ounce.
Grammes ÷ 28.35 = ounce avoirdupois.
Grammes per cubic cent. ÷ 27.7 = lbs. per cu. inch.
Joule × .7373 = foot pounds.
Kilo-grammes × 2.2046 = pounds.
Kilo-grammes × 35.3 = ounces avoirdupois.
Kilo-grammes ÷ 907.18581 = tons (2000 lbs.) or × .00110231.
Kilo-grammes per sq. cent. × 14.223 = lbs. per sq. in.
Kilo-gram-metres × 7.233 = foot pounds.
Kilo per Metre × .672 = pounds per foot.
Kilo per Cubic Metre × .026 = pounds per cubic ft.
Kilo per Cheval × 2.235 = pounds per H.P.
Kilo-Watts × 1.34 = Horse-Power.
Watts ÷ 746 = Horse-Power.
Watts ÷ .7373 = foot pounds per second.
Calorie × 3.968 = B.T.U.
Cheval Vapeur × .9863 = Horse-Power.
(Centigrade × 1.8) + 32 = degree Fahr.
Gravity Paris = 980.94 centimetres per second.