

Ftool Units

Parameter	SI units			US units		
	Symbol	Name	Factor of ref. SI unit	Symbol	Name	Factor of ref. SI unit
Length	m	meter	1.0	ft	foot	0.3048
	cm	centimeter	0.01	in	inch	0.0254
	mm	millimeter	0.001			
Displacement	mm	millimeter	0.001	in	inch	0.0254
	cm	centimeter	0.01	ft	foot	0.3048
	m	meter	1.0			
Rotation	rad	radian	1.0	rad	radian	1.0
	deg	degree	$\pi/180.0$	deg	degree	$\pi/180.0$
Section Size	mm	millimeter	0.001	in	inch	0.0254
	cm	centimeter	0.01	ft	foot	0.3048
	m	meter	1.0			
Section Area	mm ²		0.000001	in ²	inch ²	0.0254 ²
	cm ²		0.0001	ft ²	foot ²	0.3048 ²
	m²		1.0			
Section Inertia	mm ⁴		1.0e-12	in ⁴	inch ⁴	0.0254 ⁴
	cm ⁴		1.0e-08	ft ⁴	foot ⁴	0.3048 ⁴
	m⁴		1.0			
Force	kN	kilo-Newton	1.0	kip	kilo-pound	4.448
	N	Newton	0.001	lb	pound	0.004448
	tf	ton (weight) (3)	9.81			
Moment	kNm		1.0	ft-k	foot-kip	1.356
	Nm		0.001	ft-lb	foot-pound	0.001356
	tfm		9.81	in-k	inch-kip	0.11298
	kNcm		0.01	in-lb	inch-pound	0.00011298
	Ncm		0.00001			
	tfc		0.0981			
	kNmm		0.001			
	Nmm		0.000001			
	tfrm		0.00981			
Distributed Load	kN/m		1.0	k/ft	kip/foot	14.593
	N/m		0.001	lb/ft	pound/foot	0.014593
	tf/m		9.81	k/in	kip/inch	175.1
	kN/cm		100.0	lb/in	pound/foot	0.1751
	N/cm		0.1			
	tf/cm		981.0			
	kN/mm		1000.0			
	N/mm		1.0			
	tf/mm		9810.0			
Temperature	°C	centigrade	1.0	°F	Fahrenheit	$(T-32) \times 5/9$

Obs.:

- (1) Reference internal units are shown in **bold**. Internally, Ftool converts all units to these reference units.
- (2) The first unit of each parameter is the default one when the user selects either SI or US units.
- (3) Force or weight ton (*tonelada força* – tf – in Portuguese).
1 tf = 10³ kg·g
For conversion, it was adopted gravity acceleration $g = 9.81 \text{ m/seg}^2$.

Ftool Units (cont.)

Parameter	SI units			US units		
	Symbol	Name	Factor of ref. SI unit	Symbol	Name	Factor of ref. SI unit
Elasticity Modulus	MPa (4)	mega-Pascal	1000.0	ksi	kip/inch ²	6895.0
	GPa	giga-Pascal	1000000.0	psi	pound/inch ²	6.895
	tf/mm ²		9810000.0	k/ft ²	kip/foot ²	47.878
	N/cm ²		10.0	lb/ft ²	pound/foot ²	0.047878
	kN/cm ²		10000.0			
	tf/cm ²		98100.0			
	Pa	Pascal (N/m ²)	0.001			
	kN/m ²	kilo-Pascal	1.0			
	tf/m ²		9.81			
Specific Weight	kN/m ³		1.0	pcf	pound/foot ³	0.1571
	N/m ³		0.001	k/ft ³	kip/foot ³	157.1
	tf/m ³		9.81	lb/in ³	pound/inch ³	271.434
	kN/cm ³		1000000.0	k/in ³	kip/inch ³	271434.0
	N/cm ³		1000.0			
	tf/cm ³		9810000.0			
	kN/mm ³		1.0e+09			
	N/mm ³		1000000.0			
	tf/mm ³		9.81e+09			
Thermal Expansion Coeff.	1/°C		1.0	1/°F		1.8
Translat. Spring Stiffness	kN/m		1.0	k/ft	kip/foot	14.593
	N/m		0.001	lb/ft	pound/foot	0.014593
	tf/m		9.81	k/in	kip/inch	175.1
	kN/cm		100.0	lb/in	pound/foot	0.1751
	N/cm		0.1			
	tf/cm		981.0			
	kN/mm		1000.0			
	N/mm		1.0			
	tf/mm		9810.0			
Rotat. Spring Stiffness	kNm/rad		1.0	ft-k/rad	foot-kip/rad	1.356
	Nm/rad		0.001	ft-lb/rad	foot-pound/rad	0.001356
	tfm/rad		9.81	in-k/rad	inch-kip/rad	0.11298
	kNcm/rad		0.01	in-lb/rad	inch-pound/rad	0.00011298
	Ncm/rad		0.00001	ft-k/deg	foot-kip/deg	244.08/π
	tfcm/rad		0.0981	ft-lb/deg	foot-pound/deg	0.24408/π
	kNmm/rad		0.001	in-k/deg	inch-kip/deg	20.3364/π
	Nmm/rad		0.000001	in-lb/deg	inch-pound/deg	0.0203364/π
	tfmm/rad		0.00981			
	kNm/deg		180.0/π			
	Nm/deg		0.18/π			
	tfm/deg		1765.8/π			
	kNcm/deg		1.8/π			
	Ncm/deg		0.0018/π			
	tfcm/deg		17.658/π			
	kNmm/deg		0.18/π			
	Nmm/deg		0.00018/π			
	tfmm/deg		1.7658/π			

Obs.:

(4) Pascal units:

$$1 \text{ Pa} = 1 \text{ N/m}^2$$

$$1 \text{ kPa} = 10^3 \text{ N/m}^2 = 1 \text{ kN/m}^2$$

$$1 \text{ MPa} = 10^6 \text{ N/m}^2 = 10^3 \text{ kN/m}^2 = 1 \text{ N/mm}^2$$

$$1 \text{ GPa} = 10^9 \text{ N/m}^2 = 10^6 \text{ kN/m}^2 = 1 \text{ kN/mm}^2$$