Capacitor Basics

Symbols					
K	Dielectric Constant	**f**	Frequency	**L_t**	Test Life
A	Area	**L**	Inductance	**V_t**	Test Voltage
T_D	Dielectric Thickness	**∂**	Loss Angle	**V_o**	Operating Voltage
V	Voltage	**Φ**	Phase Angle	**T_t**	Test Temperature
T	Time	**L_o**	Operating Life	**T_o**	Operating Temperature
R_s	Series Resistance	**X&Y**	Exponent effect of voltage and temperature		

Value Codes - Farads			
	Pico	**Nano**	**Micro**
101	100pF		
102	1000pF	1nF	0.001uF
103	10000pF	10nF	0.01uF
104	100,000pF	100nF	0.1uF
105		1000nF	1uF
106			10uF

Metric Prefixes			
Pico	X 10^{-12}	**Deca**	X 10^{+1}
Nano	X 10^{-9}	**Kilo**	X 10^{+3}
Micro	X 10^{-6}	**Mega**	X 10^{+6}
Milli	X 10^{-3}	**Giga**	X 10^{+9}
Deci	X 10^{-1}	**Tera**	X 10^{+12}

Capacitance (farads)	English: $C = \frac{.224\ K\ A}{T_D}$ Metric: $C = \frac{.0884\ K\ A}{T_D}$
Energy Stored in Capacitors (Joules, watt-sec)	$E = \frac{1}{2}CV^2$
Linear Charge of a Capacitor (amperes)	$I = C\frac{dV}{dt}$
Total Impedance of a Capacitor (ohms)	$Z = \sqrt{R_S^2 + (X_c - X_L)^2}$
Capacitive Reactance (ohms)	$X_c = \frac{1}{2\pi fC}$
Inductive Reactance (ohms)	$X_L = 2\pi fL$
Dissipation Factor	D.F. = $\tan\partial(loss\ angle) = \frac{E.S.R.}{X_C} = (2\pi fC)$(E.S.R.)
Power Factor (%)	P.F. = Sine ∂(loss angle) = Cos Φ (phase angle) P.F. = (when less than 10%) = D.F.
Quality Factor (dimensionless)	Q = Cotan $\partial\ (loss\ angle) = \frac{1}{D.F.}$
Equivalent Series Resistance (ohms)	E.S.R. = (D.F.) (X_C) = (D.F.)/ (2πfC)
Power Loss (watts)	Power Loss = $(2\ \pi\ fCV^2)$(D.F.)
KVA (Kilowatts)	KVA = $2\ \pi\ fCV^2$ x 10^{-3}
Temperature Characteristic (ppm/°C)	T.C. = $\frac{C_t - C_{25}}{C_{25}\ (T_t - 25)}$ x 10^6
Cap Drift (%)	C.D. = $\frac{C_1 - C_2}{C_1}$ x 100
Reliability of Ceramic Capacitors	$\frac{Lo}{Lt} = \left(\frac{V_t}{V_o}\right)X\ \left(\frac{T_t}{T_o}\right)Y$
Capacitors in Series (Current the same)	Any number: $\frac{1}{C_T} = \frac{1}{c_1} + \frac{1}{c_2} \ldots \frac{1}{C_N}$ Two: CT= $\frac{c_1 c_2}{c_1 + c_2}$
Capacitors in Parallel (voltage the same)	$CT = c_1 + c_2 \ldots C_N$
Aging Rate	A.R. = $\%\Delta C/decade\ of\ time$
Decibels	dB = 20 log