



Physical and Piezoelectric Properties of APC Materials

APC Material:	840	841	850	855	880
Navy Equivalent	Navy I	--	Navy II	Navy VI	Navy III
Relative Dielectric Constant					
K^T	1275	1375	1900	3300	1050
Dielectric Dissipation Factor (Dielectric Loss(%))*					
$\tan \delta$	0.60	0.40	≤ 2.00	≤ 2.50	0.40
Curie Point (°C)**					
T_c	325	320	360	200	310
Electromechanical Coupling Factor					
k_p	0.59	0.60	0.63	0.68	0.50
k_{33}	0.72	0.68	0.72	0.76	0.62
k_{31}	0.35	0.33	0.36	0.40	0.30
k_{15}	0.70	0.67	0.68	0.66	0.55
Piezoelectric Charge Constant (10^{-12} C/N or 10^{-12} m/V)					
d_{33}	290	300	400	630	215
$-d_{31}$	125	109	175	276	95
d_{15}	480	450	590	720	330
Piezoelectric Voltage Constant (10^{-3} Vm/N or 10^{-3} m²/C)					
g_{33}	26.5	25.5	24.8	21.0	25.0
$-g_{31}$	11.0	10.5	12.4	9.0	10.0
g_{15}	38.0	35.0	36.0	27.0	28.0
Young's Modulus (10^{10} N/m²)					
Y_{11}^E	8.0	7.6	6.3	5.9	9.0
Y_{33}^E	6.8	6.3	5.4	5.1	7.2
Frequency Constants (Hz*m or m/s)					
N_L (longitudinal)	1524	1700	1500	1390	1725
N_T (thickness)	2005	2005	2040	2079	2110
N_p (planar)	2130	2055	1980	1920	2120
Density (g/cm³)					
ρ	7.6	7.6	7.6	7.6	7.6
Mechanical Quality Factor					
Q_m	500	1400	80	65	1000

The values listed above pertain to test specimens. They are for reference purposes only and cannot be applied unconditionally to other shapes and dimensions. In practice, piezoelectric materials show varying values depending on their thickness, actual shape, surface finish, shaping process and post-processing.

Note: measurements made 24 hours after polarization.

Maximum voltage: 5-7 VAC /mil for 850, 851, 855, Type VI VDC ~2X.

9-11 VAC /mil for 840, 841, 842, 844, 880, 881 VDC ~2X.

*At 1 kHz, low field.

**Maximum operating temperature = Curie point/2.

Standard Tolerances

(Tighter tolerances available on request)

- Capacitance: $\pm 20\%$

- d_{33} Value: $\pm 20\%$

- Frequency: $\pm 5\%$ (to $\pm 0.5\%$ on request)



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APC Material:	842	844	851	Type VI	881
Relative Dielectric Constant					
K^T	1375	1500	1950	3400	1030
Dielectric Dissipation Factor (Dielectric Loss(%))*					
$\tan \delta$	0.45	0.40	1.50	1.70	0.40
Curie Point (°C)**					
T_c	325	320	360	180	310
Electromechanical Coupling Factor					
k_p	0.65	0.68	0.71	0.77	0.58
k_t	0.48	0.48	0.51	0.52	0.46
Piezoelectric Charge Constant (10^{-12} C/N or 10^{-12} m/V)					
d_{33}	300	300	400	650	220
Piezoelectric Voltage Constant (10^{-3} Vm/N or 10^{-3} m²/C)					
g_{33}	26.3	24.5	24.8	20.9	26.7
Young's Modulus (10^{10} N/m²)					
Y_{11}^E	8.0	7.6	6.3	5.9	9.0
Y_{33}^E	6.8	6.3	5.4	5.1	7.2
Frequency Constants (Hz*m or m/s)					
N_T (thickness)	2050	2050	2040	2040	2050
N_p (planar)	2230	2250	2080	1980	2300
Density (g/cm³)					
ρ	7.6	7.7	7.6	7.6	7.6
Mechanical Quality Factor					
Q_m	600	1500	80	65	1000

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Standard Tolerances

(Tighter tolerances available on request)

- Capacitance: ±20%

- d_{33} Value: ±20%

- Frequency: ±5% (to ±0.5% on request)

Updated: Nov. 2013

QF-MP Rev. 2