

# PZT Material Selection Guide

FUJI CERAMICS always has dozens of types of piezoelectric ceramic materials. Our seven (7) types of materials are presented here with properties similar to those commonly used internationally. We will also consider the feasibility of special requests, so please contact us from the inquiry form if you have any requests.

Material No.	Equivalent to	Applications	Characteristics
C-21	Navy I PZT-4	Ultrasonic cleaners Sonars Ultrasonic device for cosmetic	For high power driving
C-204	Navy I PZT-4	Ultrasonic humidifiers	Middle $Q_m$ High $k_{33}$ High $d_{33}$
C-64	Navy II PZT-5A	Ultrasonic flowmeters Bubble detective sensors	High $T_c$
C-602	Navy II PZT-5A	In-vehicle sensors Ultrasonic level meters	High $T_c$ Stable temp. coefficient
C-203	Navy III PZT-8	Ultrasonic cleaners Ultrasonic welders Ultrasonic cutters	High $d_{33}$ High $Q_m$ High $T_c$
C-62	Navy V PZT-5J	Ultrasonic medical probes	High $k_{33}$ High $d_{33}$
C-82	Navy VI PZT-5H	Ultrasonic medical probes	High $\epsilon_{33}^T$ High $d_{33}$ Low $Q_m$

## Material Properties

Material No.			C-21	C-204	C-64	C-602	C-203	C-62	C-82
Equivalent to			Navy I PZT-4		Navy II PZT-5A		Navy III PZT-8	Navy V PZT-5J	Navy VI PZT-5H
Coupling coefficients	$\times 10^{-2}$	$k_p$	59	63	63	53	59	68	65
		$k_{31}$	34	37	35	28	35	40	37
		$k_{33}$	71	74	73	68	71	77	75
		$k_t$	48	52	50	46	49	52	51
		$k_{15}$	74	71	71	64	70	76	70
Frequency constants	$m \cdot Hz$	$N_p$	2210	2110	1970	2160	2130	1960	2030
		$N_{31}$	1630	1530	1380	1510	1530	1440	1430
		$N_{33}$	1510	1450	1360	1480	1470	1350	1390
		$N_t$	2090	2070	1970	2100	2020	2040	2090
		$N_{15}$	910	930	850	950	920	850	900
Dielectric constants		$\epsilon_{11}^T/\epsilon_0$	1900	2240	1960	1560	1470	2730	3090
		$\epsilon_{33}^T/\epsilon_0$	1400	2200	1850	1520	1450	2600	3650
Dissipation factor	%	$\tan\delta$	0.30	0.25	1.50	1.30	0.30	1.65	1.90
Piezoelectric charge constants	$\times 10^{-12} m/V$	$d_{31}$	-131	-190	-185	-120	-145	-234	-266
		$d_{33}$	288	435	435	310	325	500	600
		$d_{15}$	634	650	670	460	520	860	781
Piezoelectric voltage constants	$\times 10^{-3} V \cdot m/N$	$g_{31}$	-10.7	-9.7	-11.4	-9.0	-11.2	-10.6	-8.3
		$g_{33}$	27.2	22.0	24.4	23.0	25.6	24.4	18.5
		$g_{15}$	37.7	32.7	38.5	33.0	39.6	35.6	28.6
Youngs modulus	$\times 10^{10} N/m^2$	$Y_{11}^E$	8.3	7.2	5.9	7.2	7.2	6.3	6.2
		$Y_{33}^E$	6.4	5.7	5.1	6.3	6.0	4.9	5.1
		$Y_{55}^E$	2.3	2.4	2.0	2.6	2.3	1.9	2.2
Poisson's ratio		$\sigma$	0.29	0.29	0.34	0.36	0.29	0.30	0.34
Mechanical Q		$Q_m$	1400	520	80	100	2000	75	65
Curie point	$^{\circ}C$	$T_c$	307	250	345	360	350	245	195
Density	$\times 10^3 kg/m^3$	$\rho$	7.80	7.65	7.70	7.90	7.70	7.60	7.50
Temp.coefficients	$f_r$ (ppm/ $^{\circ}C$ )	$f_r \cdot T_c$ -40~20 $^{\circ}C$	110	140	-180	30	240	-380	-260
		$f_r \cdot T_c$ 20~80 $^{\circ}C$	110	120	180	70	240	170	30
	$C$ (ppm/ $^{\circ}C$ )+ C57:C77	$C \cdot T_c$ -40~20 $^{\circ}C$	1810	1900	3500	1800	1900	3860	3650
		$C \cdot T_c$ 20~80 $^{\circ}C$	3630	3600	3600	2100	3200	5610	5440

Note : The property data and specifications described in this paper are reference values only and are not guaranteed values.

Please note that those specifications could be changed without notice for improvement.

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