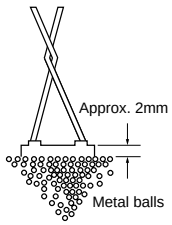
RPE Series Specifications and Test Methods

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Constant Type</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>-55 to +125˚C</td><td>Char. X7R: -55 to +125˚C
Char. Z5U: +10 to +85˚C
Char. Y5V: -30 to +85˚C</td><td>–</td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td colspan="2">See previous pages</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{0-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td colspan="2">No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimension and Marking</td><td colspan="2">See previous pages</td><td>Visual inspection, Vernier Caliper</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Dielectric Strength</td><td>Between Terminals</td><td colspan="2">No defects or abnormalities</td><td>The capacitors should not be damaged when DC voltages of 300%* of the rated voltage are applied between the terminals for 1 to 5 sec. (Charge/Discharge current ≦ 50mA)
*250% for char. X7R, Z5U, Y5V</td></tr>
<tr><td>Body Insulation</td><td colspan="2">No defects or abnormalities</td><td>The capacitor is placed in a container with metal balls of 1mm diameter so that each terminal, short-circuited, is kept approximately 2mm from the balls as shown in the figure, and 250% of the rated DC voltage is impressed for 1 to 5 sec. between capacitor terminals and metal balls. (Charge/Discharge current ≦ 50mA)
 
</td></tr>
<tr><td>6</td><td>Insulation Resistance</td><td>Between Terminals</td><td colspan="2">C≦0.047μF: 10,000MΩ min.
C>0.047μF: 500MΩ • μF min.
C: Nominal capacitance</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 min. of charging. (Charge/Discharge current ≦ 50mA)</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td colspan="2">Within the specified tolerance</td><td rowspan="2">The capacitance, Q/D.F. should be measured at 25˚C at the frequency and voltage shown in the table.
<table><tr><th>Item \ Capacitance</th><th>1000pF and below</th><th>more than 1000pF</th></tr><tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>AC0.5 to 5V (r.m.s.)</td><td>AC1±0.2V (r.m.s.)</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Q/Dissipation Factor (D.F.)</td><td>30pF min.: Q≧1,000
30pF max.: Q≧400+20C
C: Nominal capacitance (pF)</td><td>Char. X7R : 0.025 max.
Char. Z5U
Char. Y5V } : 0.05 max.</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Characteristics</td><td>Capacitance Change</td><td>Within the specified tolerance (Table A on last column)</td><td>Within the specified tolerance (Table B on last column)</td><td rowspan="3">The capacitance change should be measured after 5 min. at each specified temperature stage.
(1) Temperature Compensating Type
The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5 (-55 to +125˚C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as shown in Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in step 1, 3 and 5 by the cap. value in step 3.
<table><tr><th>Step</th><th>Temperature (˚C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>-55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>25±2</td></tr></table>(2) High Dielectric Constant Type
The ranges of capacitance change compared with the 25˚C value over the temperature ranges as shown in Table B should be within the specified ranges.</td></tr>
<tr><td>Temperature Coefficient</td><td>Within the specified tolerance (Table A on last column)</td><td></td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05pF (whichever is larger)</td><td></td></tr>
</table>

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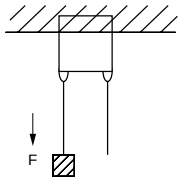
No.	Item		Specifications		Test Method
			Temperature Compensating Type	High Dielectric Constant Type	
10	Terminal Strength	Tensile Strength	Termination not to be broken or loosened		As in the figure, fix the capacitor body, apply the force gradually to each lead in the radial direction of the capacitor until reaching 10N and then keep the force applied for 10±1 sec. 
		Bending Strength	Termination not to be broken or loosened		Each lead wire should be subjected to a force of 2.5N and then bent 90° at the point of egress in one direction. Each wire is then returned to the original position and bent 90° in the opposite direction at the rate of one bend per 2 to 3 sec.
11	Vibration Resistance	Appearance	No defects or abnormalities		The capacitor is soldered securely to a supporting terminal and a 10 to 55Hz vibration of 1.5mm peak-peak amplitude is applied for 6 hrs. total, 2 hrs. in each mutually perpendicular direction. Allow 1 min. to cycle the frequency from 10Hz to 55Hz and the converse.
		Capacitance	Within the specified tolerance		
		Q/D.F.	30pF min.: Q≧1,000 30pF max.: Q≧400+20C C: Nominal capacitance (pF)	Char. X7R : 0.025 max. Char. Z5U, Char. Y5V: 0.05 max.	
12	Solderability of Leads		Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.		The terminal of a capacitor is dipped into a 25% ethanol (JIS-K-8101) solution of rosin (JIS-K-5902) and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5mm to 2mm from the terminal body. Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder
13	Resistance to Soldering Heat	Appearance	No defects or abnormalities		The lead wire is immersed in the melted solder 1.5mm to 2mm from the main body at 270±5°C for 3±0.5 sec. (L3.5 x W3.0 (mm) type) or 350±10°C for 3.5±0.5 sec. (all other types). The specified items are measured after 24±2 hrs. (temperature compensating type) or 48±4 hrs. (high dielectric type). • Initial measurement for high dielectric constant type The capacitors are heat treated for 1 hr. at 150^{+0}_{-10}°C, allowed to set at room temperature for 48±4 hrs., and given an initial measurement.
		Capacitance Change	Within ±2.5% or ±0.25pF (whichever is larger)	Char. X7R : Within ±7.5% Char. Z5U, Char. Y5V: Within ±20%	
		Dielectric Strength (Between Terminals)	No defects		
14	Temperature and Immersion Cycle	Appearance	No defects or abnormalities		First, repeat the following temperature/time cycle 5 times : ≫ lowest operating temperature ±3°C/30±3 min. ≫ ordinary temperature/3 min. max. ≫ highest operating temperature ±3°C/30±3 min. ≫ ordinary temperature/3 min. max. Next, repeat twice the successive cycles of immersion, each cycle consisting of immersion in a fresh water at 65^{+5}_{-0}°C for 15 min. and immersion in a saturated aqueous solution of salt at 0±3°C for 15 min. The capacitor is then promptly washed in running water, dried with a drying cloth, and allowed to sit at room temperature for 24±2 hrs. (temperature compensating type) or 48±4 hrs. (high dielectric type). • Initial measurement for high dielectric constant type The capacitors are heat treated for 1 hr. at 150^{+0}_{-10}°C, allowed to sit at room temperature for 48 ±4 hrs., and given an initial measurement.
		Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	Char. X7R: Within ±12.5% Char. Z5U, Char. Y5V: Within ±30%	
		Q/D.F.	30pF min.: Q≧350 10pF to 30pF: Q≧275+5C/2 10pF max.: Q≧200+10C C: Nominal capacitance (pF)	Char. X7R: 0.05 max. Char. Z5U, Char. Y5V: 0.075 max.	
		Insulation Resistance	1,000MΩ or 50MΩ • μF min. (whichever is smaller)		
		Dielectric Strength (Between Terminals)	No defects or abnormalities		

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No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Constant Type	Test Method
15	Humidity (Steady State)	Appearance	No defects or abnormalities		Set the capacitor for 500^{+24}_{0} hrs. at 40±2°C in 90 to 95% humidity. Remove and set for 24±2 hrs. (temperature compensating type) and 48±4 hrs. (high dielectric constant type) at room temperature, then measure. • Initial measurement for high dielectric constant type The capacitors are heat treated for 1 hr. at 150^{+0}_{-10}°C, allowed to sit at room temperature for 48±4 hrs. and given an initial measurement.
		Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	Char. X7R : Within ±12.5% Char. Z5U, Char. Y5V : Within ±30%	
		Q/D.F.	30pF min.: Q≧350 10pF to 30pF: Q≧275+5C/2 10pF max.: Q≧200+10C C: Nominal capacitance (pF)	Char. X7R : 0.05 max. Char. Z5U, Char. Y5V : 0.075 max.	
		Insulation Resistance	1,000MΩ or 50MΩ • μF min. (whichever is smaller)		
16	Humidity Load	Appearance	No defects or abnormalities		Apply the rated voltage for 500^{+24}_{0} hrs. at 40±2°C and in 90 to 95% humidity. Remove and set for 24±2 hrs. (temperature compensating type) and 48±4 hrs. (high dielectric constant type) at room temperature, then measure. (Charge/Discharge current ≦50mA)
		Capacitance Change	Within ±7.5% or ±0.75pF (whichever is larger)	Char. X7R : Within ±12.5% Char. Z5U, Char. Y5V : Within ±30%	
		Q/D.F.	30pF min.: Q≧200 30pF max.: Q≧100+10C/3 C: Nominal capacitance (pF)	Char. X7R : 0.05 max. Char. Z5U, Char. Y5V : 0.075 max.	
		Insulation Resistance	500MΩ or 25MΩ • μF min. (whichever is smaller)		
17	High Temperature Load	Appearance	No defects or abnormalities		Apply 200% of the rated voltage for 1000^{+48}_{0} hrs. at the maximum operating temperature. Remove and set for 24±2 hrs. (temperature compensating type) and 48 ±4 hrs. (high dielectric constant type) at room temperature, then measure. (Charge/Discharge current ≦50mA) • Initial measurement for high dielectric constant type A voltage treatment should be given to the capacitor in which a DC voltage of 200% of the rated voltage is applied for 1 hr. at the maximum operating temperature ±3°C. Then set for 48±4 hrs. at room temperature and conduct initial measurement.
		Capacitance Change	Within ±3% or ±0.3pF (whichever is larger)	Char. X7R : Within ±12.5% Char. Z5U, Char. Y5V : Within ±30%	
		Q/D.F.	30pF min.: Q≧350 10pF to 30pF: Q≧275+5C/2 10pF max.: Q≧200+10C C: Nominal capacitance (pF)	Char. X7R : 0.04 max. Char. Z5U, Char. Y5V : 0.075 max.	
		Insulation Resistance	1,000MΩ or 50MΩ • μF min. (whichever is smaller)		
18	Solvent Resistance	Appearance	No defects or abnormalities		The capacitor should be fully immersed, unagitated, in reagent at 20 to 25°C for 30±5 sec. and then remove gently. Marking on the surface of the capacitor should immediately be visually examined. Reagent: • Isopropyl alcohol
		Marking	Legible		

Table A

Char.	Nominal Values (ppm/°C) *1	Capacitance Change from 25°C (%)					
		–55°C		–30°C		–10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0±30	0.58	–0.24	0.40	–0.17	0.25	–0.11

*1: Nominal values denote the temperature coefficient within a range of 25 to 125°C

Table B

Char.	Temp. Range	Reference Temp.	Cap. Change Rate
X7R	–55 to +125°C	25°C	Within ±15%
Z5U	+10 to + 85°C		Within $^{+22}_{-56}$%
Y5V	–30 to + 85°C		Within $^{+22}_{-82}$%