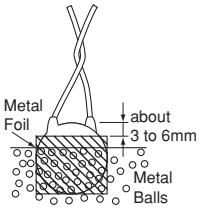
Safety Standard Certified Type KY/KH/KX Specifications and Test Methods

Operating Temperature Range: -25 to +125°C

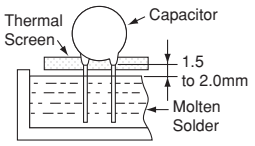
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Appearance and Dimensions</td><td>No visible defect, and dimensions are within specified range.</td><td>The capacitor should be visually inspected for evidence of defect.
Dimensions should be measured with slide calipers.</td></tr>
<tr><td>2</td><td colspan="2">Marking</td><td>To be easily legible</td><td>The capacitor should be visually inspected.</td></tr>
<tr><td>3</td><td colspan="2">Capacitance</td><td>Within specified tolerance</td><td rowspan="2">The capacitance, dissipation factor and Q should be measured at 20˚C with 1±0.1kHz (char. SL: 1±0.1MHz) and AC5V(r.m.s.) max.</td></tr>
<tr><td>4</td><td colspan="2">Dissipation Factor (D.F.)
Q</td><td><table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.≦2.5%</td></tr><tr><td>F</td><td>D.F.≦5.0%</td></tr><tr><td>SL</td><td>Q≧400+20C*1(C<30pF)
Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>5</td><td colspan="2">Insulation Resistance (I.R.)</td><td>10000MΩ min.</td><td>The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.
The voltage should be applied to the capacitor through a resistor of 1MΩ.</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Dielectric Strength</td><td>Between Lead Wires</td><td>No failure</td><td>The capacitor should not be damaged when the test voltages from Table 1 are applied between the lead wires for 60 sec.
<Table 1><table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KY</td><td>For lead spacing F=5mm AC2000V(r.m.s.)
For lead spacing F=7.5mm AC2600V(r.m.s.)</td></tr><tr><td>KH</td><td>AC2600V(r.m.s.)</td></tr><tr><td>KX</td><td>AC4000V(r.m.s.)</td></tr></table></td></tr>
<tr><td>Body Insulation</td><td>No failure</td><td>First, the terminals of the capacitor should be connected together. Then, as shown in the figure at right, a metal foil should be closely wrapped around the body of the capacitor to the distance of about 3 to 6mm from each terminal.
Then, the capacitor should be inserted into a container filled with metal balls of about 1mm diameter. Finally, AC voltage from Table 2 is applied for 60 sec. between the capacitor lead wires and metal balls.
 
<Table 2><table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KY</td><td>AC2600V(r.m.s.)</td></tr><tr><td>KH</td><td>AC2600V(r.m.s.)</td></tr><tr><td>KX</td><td>AC4000V(r.m.s.)</td></tr></table></td></tr>
<tr><td>7</td><td colspan="2">Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within $^{+20}_{-55}$%</td></tr><tr><td>F</td><td>Within $^{+30}_{-80}$%</td></tr></table>(Temp. range: -25 to +85°C)
<table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to -1000ppm/°C</td></tr></table>(Temp. range: +20 to +85°C)</td><td>The capacitance measurement should be made at each step specified in Table 3.
<Table 3><table><tr><th>Step</th><th>Temperature (ºC)</th></tr><tr><td>1</td><td>20±2</td></tr><tr><td>2</td><td>-25±2</td></tr><tr><td>3</td><td>20±2</td></tr><tr><td>4</td><td>85±2</td></tr><tr><td>5</td><td>20±2</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Solderability of Leads</td><td>Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.</td><td>The lead wire of a capacitor should be dipped into molten solder for 2±0.5 sec.
The depth of immersion is up to about 1.5 to 2.0mm from the root of lead wires.
Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C
H63 Eutectic Solder 235±5°C</td></tr>
</table>

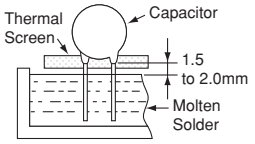
*1 "C" expresses nominal capacitance value (pF).

Continued on the following page.

Safety Standard Certified Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="4">9</td><td rowspan="4">Soldering Effect (Non-Preheat)</td><td>Appearance</td><td>No marked defect</td><td rowspan="4">As shown in the figure, the lead wires should be immersed in solder of 350±10°C or 260±5°C up to 1.5 to 2.0mm from the root of terminal for 3.5±0.5 sec. (10±1 sec. for 260±5°C).
 

Pre-treatment:
Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*2 for 24±2 hrs. before initial measurements.
Post-treatment:
Capacitor should be stored for 1 to 2 hrs. at room condition.*2</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>I.R.</td><td>1000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6</td></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Soldering Effect (On-Preheat)</td><td>Appearance</td><td>No marked defect</td><td rowspan="4">First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.
Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.
 

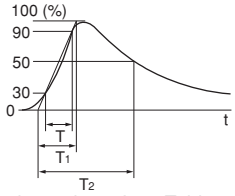
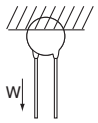
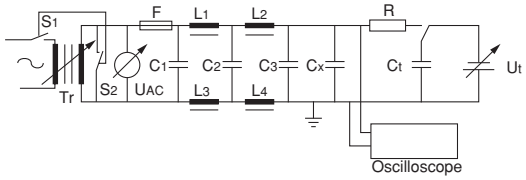
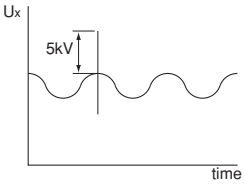
Pre-treatment:
Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*2 for 24±2 hrs. before initial measurements.
Post-treatment:
Capacitor should be stored for 1 to 2 hrs. at room condition.*2</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>I.R.</td><td>1000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No marked defect</td><td rowspan="3">The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz.
Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.≦2.5%</td></tr><tr><td>F</td><td>D.F.≦5.0%</td></tr><tr><td>SL</td><td>Q≧400+20C*1(C<30pF)
Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td rowspan="4">12</td><td rowspan="4">Humidity (Under Steady State)</td><td>Appearance</td><td>No marked defect</td><td rowspan="4">Set the capacitor for 500±12 hrs. at 40±2°C in 90 to 95% relative humidity.
Post-treatment:
Capacitor should be stored for 1 to 2 hrs. at room condition.*2</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E, F</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ± 5%</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.≦5.0%</td></tr><tr><td>F</td><td>D.F.≦7.5%</td></tr><tr><td>SL</td><td>Q≧275+5/2C*1(C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td rowspan="4">13</td><td rowspan="4">Humidity Loading</td><td>Appearance</td><td>No marked defect</td><td rowspan="4">Apply the rated voltage for 500±12 hrs. at 40±2°C in 90 to 95% relative humidity.
Post-treatment:
Capacitor should be stored for 1 to 2 hrs. at room condition.*2</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E, F</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ± 5%</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.≦5.0%</td></tr><tr><td>F</td><td>D.F.≦7.5%</td></tr><tr><td>SL</td><td>Q≧275+5/2C*1(C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td></td><td>Dielectric Strength</td><td>Per Item 6</td></tr>
</table>

*1 "C" expresses nominal capacitance value (pF).
*2 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Safety Standard Certified Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

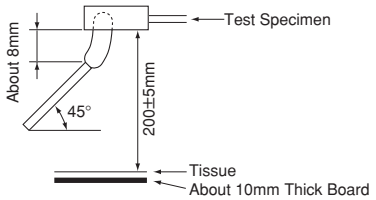
No.	Item		Specifications	Test Method
14	Life	Appearance	No marked defect	Impulse Voltage Each individual capacitor should be subjected to a 5kV (Type KX: 8kV) impulses for three times. Then the capacitors are applied to life test.  Front time (T_1) =1.2μs=1.67T Time to half-value (T_2) =50μs Apply a voltage from Table 4 for 1000 hrs. at 125+2/-0°C, and relative humidity of 50% max. <Table 4> Applied Voltage: 170% of Rated Voltage except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec. Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*2
		Capacitance Change	Within ±20%	
		I.R.	3000MΩ min.	
		Dielectric Strength	Per Item 6	
15	Robustness of Terminations	Tensile	Lead wire should not be cut off. Capacitor should not be broken.	As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N and keep it for 10±1 sec. 
		Bending		Each lead wire should be subjected to 5N of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.
16	Active Flammability		The cheesecloth should not be on fire.	The capacitor should be individually wrapped in at least one but not more than two complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The U_{AC} should be maintained for 2 min. after the last discharge.  $C_{1,2}$: 1μF±10% C_3 : 0.033μF±5% 10kV $L_{1\ to\ 4}$: 1.5mH±20% 16A Rod core choke C_t : 3μF±5% 10kV R : 100Ω±2% C_x : Capacitor under test U_{AC} : U_R±5% F : Fuse, Rated 10A U_R : Rated Voltage U_t : Voltage applied to C_t 

*2 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Safety Standard Certified Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>17</td><td colspan="2">Passive Flammability</td><td>The burning time should not exceed 30 sec.
The tissue paper should not ignite.</td><td>The capacitor under test should be held in the flame in the position that best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec.
Length of flame : 12±1mm
Gas burner : Length 35mm min.
Inside Dia. 0.5±0.1mm
Outside Dia. 0.9mm max.
Gas : Butane gas Purity 95% min.
 
</td></tr>
<tr><td rowspan="4">18</td><td rowspan="4">Temperature and Immersion Cycle</td><td>Appearance</td><td>No marked defect</td><td rowspan="4">The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.
<Temperature Cycle>
<table><tr><th>Step</th><th>Temperature (ºC)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25+0/-3</td><td>30</td></tr><tr><td>2</td><td>Room temp.</td><td>3</td></tr><tr><td>3</td><td>125+3/-0</td><td>30</td></tr><tr><td>4</td><td>Room temp.</td><td>3</td></tr></table>Cycle time: 5 cycles
<Immersion Cycle>
<table><tr><th>Step</th><th>Temperature (ºC)</th><th>Time (min)</th><th>Immersion Water</th></tr><tr><td>1</td><td>65+5/-0</td><td>15</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15</td><td>Salt water</td></tr></table>Cycle time: 2 cycles
Pre-treatment:
Capacitor should be stored at 85±2˚C for 1 hr., then placed at room condition*2 for 24±2 hrs.
Post-treatment:
Capacitor should be stored for 24±2 hrs. at room condition.*2</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E, F</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ± 5%</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.≦5.0%</td></tr><tr><td>F</td><td>D.F.≦7.5%</td></tr><tr><td>SL</td><td>Q≧275+5/2C*1(C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td></td><td>Dielectric Strength</td><td>Per Item 6</td><td></td></tr>
</table>

*1 "C" expresses nominal capacitance value (pF).
*2 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa