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## TOLERANCES

APC International, Ltd. provides piezoelectric ceramic elements manufactured to the industry standard tolerance values listed here. We can prepare elements to tighter tolerances on request. Items also are available "as fired," (without an OD, ID, length, or width machining tolerance), when dimensional requirements are not critical.

Common tolerances for electrical / piezoelectric characteristics are:

- Capacitance:  $\pm 20\%$
- d33 value:  $\pm 20\%$
- Frequency:  $\pm 5\%$  (Frequency tolerances as tight as  $\pm 0.5\%$  are available upon request)

### Standard Machining Tolerances for APCI Ceramic Parts

| Nominal Value                                    | Standard Tolerance (±) |
|--|------------------------|
| <b>Disc/Ring/Cylinder (Tube): Outer Diameter</b> |                        |
| <1.000"  | 0.010"                 |
| $\geq 1.000"$ to <1.500"                         | 0.015"                 |
| $\geq 1.500"$ to <2.000"                         | 0.025"                 |
| $\geq 2.000"$                                    | 0.040"                 |
| <25 mm   | 0.25 mm                |
| $\geq 25$ mm to <38 mm                           | 0.38 mm                |
| $\geq 38$ mm to <50 mm                           | 0.60 mm                |
| $\geq 50$ mm                                     | 1.00 mm                |
| <b>Ring/Cylinder (Tube): Inner Diameter</b>      |                        |
| <0.250"  | 0.010"                 |
| $\geq 0.250"$ to <0.500"                         | 0.015"                 |
| $\geq 0.500"$ to <1.000"                         | 0.020"                 |
| $\geq 1.000"$                                    | 0.025"                 |
| <6 mm  | 0.25 mm                |
| $\geq 6$ mm to <13 mm                            | 0.38 mm                |
| $\geq 13$ mm to <25 mm                           | 0.50 mm                |
| $\geq 25$ mm                                     | 0.60 mm                |
| <b>Plate: Length or Width</b>                    |                        |
| <0.500"  | 0.005"                 |
| $\geq 0.500"$ to <1.000"                         | 0.010"                 |
| $\geq 1.000"$ to <1.500"                         | 0.015"                 |
| $\geq 1.500"$ to <2.000"                         | 0.025"                 |
| $\geq 2.000"$                                    | 0.040"                 |
| <13 mm   | 0.13 mm                |
| $\geq 13$ mm to <25 mm                           | 0.25 mm                |
| $\geq 25$ mm to 38 mm                            | 0.38 mm                |
| $\geq 38$ mm to <50 mm                           | 0.60 mm                |
| $\geq 50$ mm                                     | 1.00 mm                |
| <b>All Parts: Thickness</b>                      |                        |
| 0.008" to <0.200"                                | 0.001"                 |
| $\geq 0.200"$                                    | 0.002"                 |
| 0.20 mm to <5.00 mm                              | 0.025 mm               |
| $\geq 5.00$ mm                                   | 0.05 mm                |

### Permissible Irregularities

| Irregularity  | Linear Std. Dimen.  | Allowable Size | Linear Metric Dimen. | Allowable Size |
|---|---|----------------|----------------------|----------------|
| Physical Chips  | <0.250"   | ≤0.040"        | <6.35mm              | ≤1.00mm        |
|   | ≥0.250" <0.500"   | ≤0.080"        | ≥6.35mm <13.00mm     | ≤2.00mm        |
|   | ≥0.500" <1.000"   | ≤0.100"        | ≥13.00mm <25.00mm    | ≤2.50mm        |
|   | ≥1.000"   | ≤0.125"        | ≥25.00mm             | ≤3.17mm        |
| Silver Flaws  | Total combined area of silver flaws is not to exceed 0.5% of total electrode area |                |                      |                |
| Cracks  | Parts are to be free of cracks  |                |                      |                |
| Standard physical inspections are performed with no magnification, roughly 12" from workspace |   |                |                      |                |

We will attach electrical leads on request. Common leads are:

- 26AWG to 32AWG / ranging from 2" to 6" in length
- Stock size is 32AWG / 6" in length
- Other sizes are available upon request

Please be specific when requesting parts, tolerances, or electrode patterns. Provide drawings or sketches for parts or electrode patterns, and include ID tolerance if requesting rings or cylinders (tubes). For custom electrical leads, please specify AWG and length and provide a drawing showing the desired locations.

Contact APC International today to discuss your piezoelectric ceramic or piezo device requirements.

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