



# STANDARD CAPACITOR

## Type 1409

- 0.001 to 1  $\mu\text{F}$
- $\pm 0.01\%$ /year stability
- calibration accuracy  $\pm 0.02\%$
- two- and three-terminal calibration provided



Type 1409-T



Type 1409-X



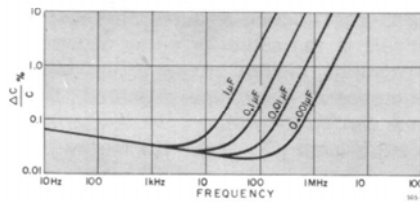
Type 1409-Y

The 1409 Standard Capacitors are fixed mica capacitors of very high stability for use as two- or three-terminal reference or working standards in the laboratory.

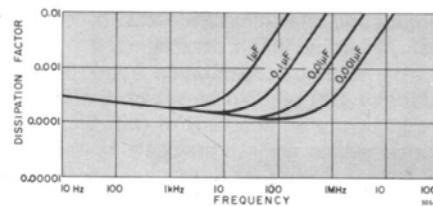
Typical capacitors, observed over more than ten years, have shown random fluctuations of less than  $\pm 0.01\%$  in measured capacitance with no evidence of systematic drift.

These capacitor units consist of a silvered-mica and foil pile, spring-held in a heavy metal clamping structure

for mechanical stability. The units are selected for low dissipation factor and are stabilized by heat cycling. They are housed, with silica gel to provide continuous desiccation, in cast aluminum cases, sealed with high-temperature potting wax. A well is provided in the wall of the case for the insertion of a dial-type thermometer. Three jack-top binding posts are provided on the top of the case and removable plugs on the bottom, for convenient parallel connection without error.



(Left) Change in capacitance as a function of frequency for typical Type 1409 Capacitors. The 1-kHz value on the plot should be used as a basis of reference in estimating frequency errors. (Right) Dissipation factor as a function of frequency.



### specifications

**Adjustment Accuracy:** Within  $\pm 0.05\%$  of the nominal capacitance value (two-terminal) marked on the case. Accuracy is guaranteed for two years under the terms of our standard warranty if the capacitor has not been damaged by excessive current or voltage.

**Calibration:** A certificate of calibration is supplied with each unit, giving both two- and three-terminal measured capacitances at 1 kHz and at a specified temperature. The measured value is the capacitance added when the standard is plugged directly into General Radio binding posts. This value is obtained by comparison, to a precision better than  $\pm 0.01\%$ , with working standards whose absolute values are known to an accuracy typically  $\pm 0.01\%$ , determined and maintained in terms of reference standards periodically calibrated by the National Bureau of Standards.

**Stability:** Capacitance change is less than 0.01% per year.

**Temperature Coefficient of Capacitance:**  $+35 \pm 10$  ppm per degree between  $10^\circ$  and  $70^\circ\text{C}$ .

**Dissipation Factor:** Less than 0.0003 at 1 kHz and  $23^\circ\text{C}$  (see curves). Measured dissipation factor at 1 kHz is stated in the certificate to an accuracy of  $\pm 0.00005$ .

**Series Inductance:** Typically  $0.050 \mu\text{H}$  for 1409-F through -M,  $0.055 \mu\text{H}$  for -R through -X, and  $0.070 \mu\text{H}$  for 1409-Y.

**Series Resistance at 1 MHz:** 0.02 ohm, except for 1409-Y, which is 0.03 ohm.

**Frequency Characteristics:** See curves. Series resistance varies as the square root of the frequency for frequencies above 100 kHz.

**Approx Terminal Capacitance:** From H terminal to case (G), 12 to

50 pF. From L terminal (outside foils of capacitor) to case, 300 to 1300 pF.

**Leakage Resistance:** 5000 ohm-farads or 100 G $\Omega$ , whichever is the lesser.

**Max Voltage:** 500 V pk below the limiting frequencies tabulated below. At high frequencies the allowable voltage is approx inversely proportional to frequency. These limits correspond to a temperature rise of  $40^\circ\text{C}$  for power dissipations of 5, 6, and 7.5 W for the small, medium, and large cases, respectively.

**Dimensions** (width x height x depth): 1409-Y,  $3\frac{1}{4} \times 5\frac{1}{2} \times 2\frac{1}{4}$  in. ( $85 \times 145 \times 70$  mm); 1409-X,  $3\frac{1}{4} \times 4 \times 2\frac{1}{4}$  in. ( $85 \times 105 \times 70$  mm); others,  $3\frac{1}{4} \times 4 \times 2$  in. ( $85 \times 105 \times 50$  mm).

**Weight:** Net,  $1\frac{1}{4}$  lb (0.6 kg); shipping, 4 lb (1.9 kg). Add approx  $\frac{1}{2}$  lb (0.2 kg) for 1409-X, and approx 1 lb (2.2 kg) for 1409-Y.

Catalog Number	Type	Nominal Capacitance $\mu\text{F}$	Frequency Limit for Max Volts	Price in USA
1409-9706	1409-F	0.001	4.7 MHz	\$ 55.00
1409-9707	1409-G	0.002	2.7 MHz	55.00
1409-9711	1409-K	0.005	1.3 MHz	55.00
1409-9712	1409-L	0.01	750 kHz	55.00
1409-9713	1409-M	0.02	430 kHz	60.00
1409-9718	1409-R	0.05	210 kHz	65.00
1409-9720	1409-T	0.1	120 kHz	70.00
1409-9721	1409-U	0.2	70 kHz	80.00
1409-9724	1409-X	0.5	35 kHz	120.00
1409-9725	1409-Y	-1.0	17 kHz	200.00