Capacitors: is one as good as another?

Choosing the right kind of capacitor is just as important as choosing the right value. The wrong kind can kill a project just as fast as a wiring error. Here's why.

If you're just getting into electronics, you've probably noticed that *capacitors* with the same voltage and capacity ratings come in a wide variety of sizes and shapes. But, you've decided that it's what's inside that counts. So, one capacitor is just as good as any other with the same ratings.

But, is one capacitor as good as another? It really depends on the way you're going to use them.

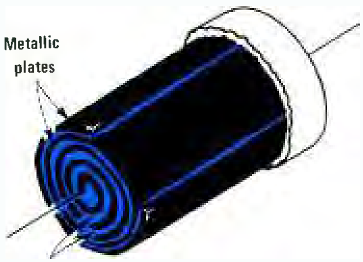
Capacitors can be classified in two ways—how they're made, and what materials are used in their construction. Metal plates and sheets of glass were used to make capacitors in the early days of radio when size was of no importance. Today, however, size is very important.

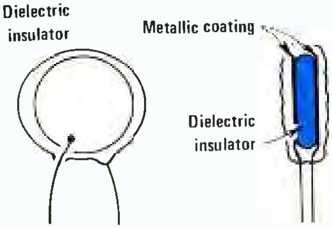
The easiest way to get large surface areas into small packages is to use flexible materials such as metal foil and paper or plastic sandwiched together and rolled into a tubular form. The resulting tubular capacitors provide relatively high capacity and working voltages in relatively small packages.

Tubular construction has a very serious disadvantage, however. Because of the rolled construction, tubular capacitors behave as if there is a small inductor built-in. At the higher frequencies encountered in CB sets, fm tuners and televisions, the *self-inductance* becomes very significant. In some cases, a single tubular capacitor can act like a self-contained oscillator circuit.

Most tubular capacitors have a paper *dielectric*—the insulator between foil strips. Although paper makes a fine dielectric at low frequencies, it looses its insulating properties at very high frequencies.

Some tubular capacitors have plastic film dielectrics. Generally, these make much better dielectrics at high frequencies than paper. And because the same insulating ability can be obtained with less plastic than paper, plastic dielectric capacitors are smaller than paper units of the same ratings. But even the low-loss polystyrene capacitors aren't suitable for high frequency work because of self-inductance.





(B)

Tubular capacitors (A) are made by rolling strips of paper or plastic insulation sandwiched between strips of metal foil. Ceramic disc capacitors (B) are made by coating the faces of a ceramic wafer with a metallic film.

The best way to reduce the self-inductance of a capacitor is to use classical parallel straight-plate construction. The most common example is the ceramic *disc* capacitor. It consists of a thin wafer of ceramic material coated on each face with a metallic film, to which leads are attached. The thickness of the ceramic wafer depends on the maximum voltage the capacitor must handle.

Although ceramics make excellent capacitor dielectrics, they are not without their faults. Most ceramic capacitors have high *temperature coefficients*. This means that as the temperature changes, the value of capacitance also changes. In most applications, this change in capacitance is unimportant. There are circuits, however, where the capacitance must remain fixed in value regardless of temperature.

Some ceramic capacitors are made in such a way that their capacitance remains constant. But, these are expensive. If you need a capacitor with excellent high frequency characteristics and a low temperature coefficient, the *mica* capacitor is your best bet.

Mica capacitors are made by sandwiching layers of mica between layers of metal foil. Although slightly larger than ceramic capacitors of the same ratings, mica units are smaller than equivalent tubular capacitors of the same ratings.