CAPACITORS WIRED IN SERIES CONNECTION

When capacitors are connected in *series*, the effect is similar to a single capacitor with increased distance between the two plates resulting to reduced capacitance. The total capacitance value is less than any of the initial value of the capacitors. Below is a schematic diagram showing the equivalent circuit of the combined capacitor:

\[
\frac{1}{C_1} + \frac{1}{C_2} + \ldots + \frac{1}{C_n} \rightarrow \frac{1}{C_{total}}
\]

To determine the total value of the connected capacitors in *series*, the equation is:

\[
C_{total} = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \ldots + \frac{1}{C_n}}
\]

As an example, we can calculate the total capacitance when *two capacitors* with a value of *40 uF each* are connected in *series*. Using the equation, we will obtain a value of *20 uF*.

\[
C_{total} = \frac{1}{\frac{1}{40} + \frac{1}{40}} = \frac{1}{0.025 + 0.025} = \frac{1}{0.05} = 20 \text{ uF}
\]

Below are images showing actual *40 uF* capacitors connected in *series*. The reading from the multimeter is the same as the value obtained using the equation, which is *20 uF*. 

Two 40 uF capacitors wired in series.  
The total capacitance is 20 uF.
CAPACITORS WIRED IN PARALLEL CONNECTION

When capacitors are connected in parallel, the effect is similar to a single capacitor with wider plate surface area resulting to increased capacitance. Below is a schematic diagram showing the equivalent circuit of the combined capacitor:

\[
\begin{align*}
\text{C}_1 & \quad \text{equivalent to} \quad \text{C}_2 \\
\end{align*}
\]

Calculating the total capacitance of capacitors connected in parallel is much easier. It can be done by simply adding the capacitance of each capacitor connected:

\[
\text{C}_{\text{total}} = \text{C}_1 + \text{C}_2 + \ldots \text{C}_n
\]

As an example, to calculate the combined capacitance of two capacitors with 40 uF each and connected in parallel, simply add the two capacitance for a resulting value of 80 uF.

\[
\begin{align*}
\text{C}_{\text{total}} &= \text{C}_1 + \text{C}_2 \\
&= 40 + 40 \\
&= 80 \text{ uF}
\end{align*}
\]

Below are images showing actual 40 uF capacitors connected in parallel. The reading from the multimeter, which is 80.1 uF, is almost the same as the calculated value. The 0.1 uF deviation is caused by the capacitance tolerance that each capacitor has.