CAPACITALK™

Capacitor At Load

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No. 108

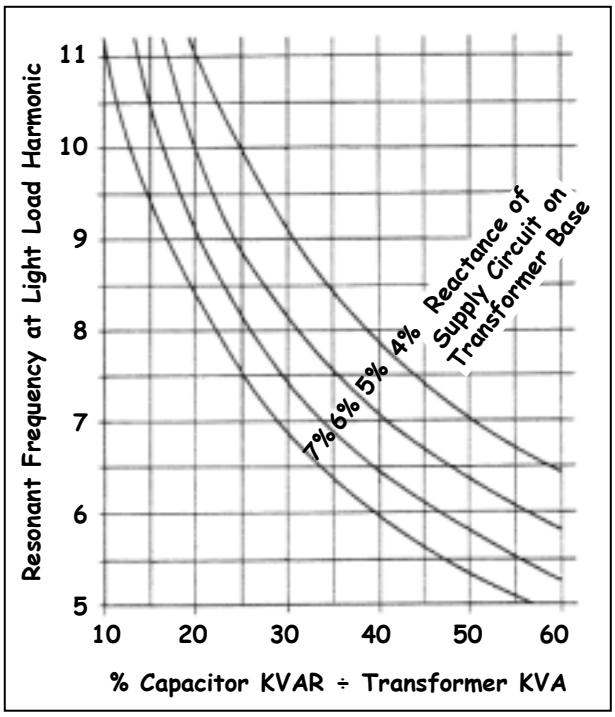
Excessive "Floating" Capacitors at Light Loads Can Be Dangerous

It's natural, when planning capacitors for substations or feeders, to focus on reducing the line current when loads are heavy. But to neglect light load conditions invites *trouble*. For one thing, when too much capacitance is left "floating" on the line at light loads, voltage rise can be so great that motors, lamps and controls can burn out. Many a plant has learned this to its sorrow. But another less obvious way in which "floating" capacitors can cause trouble is by creating a circuit that "tunes" with the system inductance, commonly at 300 to 420 Hz.

At heavy loads, the circuit will resonate at about the same frequency, but the resistance in the load may dampen any oscillations that are excited by shocks from repetitive or one-time sources chopped—wave devices or arcing switches.

At light loads, however, this dampening has decreased and the resonant circuit may respond to any excitation that occurs. High transient currents and voltage can develop, and equipment may be damaged by heating or by breakdown of insulation.

Unbalanced load, or other similar conditions can aggravate the trouble, with Ferro resonance topping it off.



Floating Capacitance Chart

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A good way to minimize the probability of such difficulties is to select capacitors that will not resonate with the system at the lower harmonics. This can be done in two different ways, with the help of the curves in the chart on the previous page.

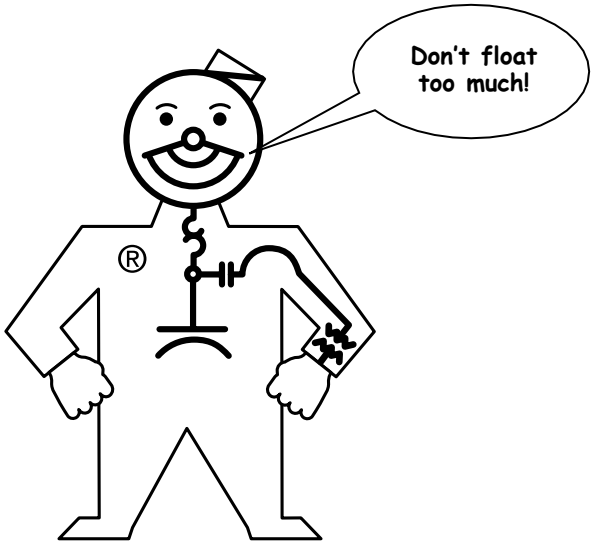
The chart shows the natural frequency of the tuned circuit vs. capacitor load in percent of transformer rating. Each curve in the chart is for a different value of circuit reactance, covering the range likely to be met in practice. The circuit impedance is principally that of the transformer (typically 5%, which is practically equal to its reactance).

Therefore, you can use the transformer's impedance, along with the chart, to get an idea of the amount of capacitance to "float."

But even if the rest of the circuit (utility system plus any lines that may be between transformer and capacitor) is only 10%–20% of the transformer's impedance, it can make a significant difference in "floatable" capacitance. For example, whereas it takes 24% capacitance to tune a 5% Z system to the 9th harmonic, it takes only 20% for a 6% Z system.

Therefore, in marginal cases, it is safer to include all reactance. The best thing to do is to use our **C**apacitor **A**t **L**oad (**CAL**). By doing this you will not have any excess capacitors on your system. And you will never have to worry about tuning to an "unfriendly" frequency.

Experience shows that you avoid trouble by limiting the quantity of floating capacitors to 20% of the KVA of the transformer that feeds them—for example, 200 KVAR on a 1000-KVA transformer. The reason for using this "rule of thumb" is that, by imposing such a limit, you are avoiding resonance at the lower harmonics, where the energy levels are higher.



If you have any questions for **CAL** about your power factor capacitors, simply write to **Myron Zucker, Inc.**, or e-mail us at **info@myronzucker.com**.

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