Effects of Arcing in Relays

A concern when using electromechanical power relays is the so called "stuck contact", that is the situation where two contacts are soldered to each other by the heat generated by arcing.

Arcing happens when opening a current carrying contact. The arc is the current continuing flowing through the air gap separating the two contacts. In general the gap is large enough to prevent arcing, except that the instant the contacts open, the gap is thin enough to allow the formation of an arc. Arc temperature is sufficiently high to vaporize the contact material and creating the conditions for soldering the two contacts together.

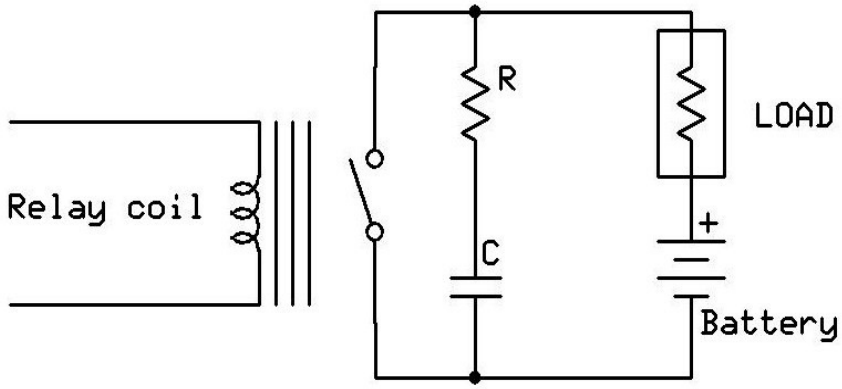
The more severe is the arcing, the more probable is to have stuck contacts. Arcing severity is greater:

- the greater is the current.
- the greater is the voltage.
- The greater is the inductive component of the load. Best is a purely resistive load.
- the voltage is DC versus AC. AC voltage periodically drops to zero, helping turning off the arc. Conversely a DC voltage will tend to support arcing indefinitely.

The worst contributor is the inductance value L of the load. An inductor will force current through opening contacts to dissipate its stored magnetic energy ½ LI^2

A secondary issue is the noise associated with arcing (the first emergency radio transmitters ever used on ships utilized the high content of noise of an arc by generating a spark, which ensured a very large transmitted bandwidth so to pass through almost any radio receiver no matter to which frequency it was tuned). It is desirable to suppress such noise.

A fairly common method for arcing minimization is the use of a RC network across the contact. See figure below.



The Value of R and C are calculated according to the following formulas.

- C in microfarad = (0.5 to 1) x Current the capacitor must be **NON**-polarized
- R = (0.5 to 1) x Voltage

As an example, a relay switching 5 Amp under 24 Volt would use:

C = 2.5 to 5 microfarad

R = 12 to 24 Ohm

The resistor size can be small (typically 1 Watt) since it only conducts during the switching.