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The effect of contact closure in vacuum with fault current on prestrike arcing time, contact welding and the field enhancement factor.

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Experiments were performed with vacuum interrupters containing Cu-Cr (25wt.%) and W-Cu (10wt.%) contacts. The vacuum interrupters were placed in a spring mechanism, which was placed in a tuned, capacitor bank, electrical test circuit. The capacitor bank was charged to 250kV, which allowed a symmetrical fault current of 50kA (peak) at 30 Hz. As the vacuum interrupter's contacts closed a prestrike arc occurred when the contact spacing was small enough. This contact gap was recorded. The prestrike arc initiated the ac current, which was interrupted after one half cycle. The contacts were then opened with no current. This process was repeated 5 times. As the experiment progressed the prestrike arcing time increased; i.e. the contact gap broke down at larger and larger gaps during the closing operation. We explained this phenomenon by considering the effect of the prestrike arc and the subsequent contact welding on the surface structure of the contacts. The change in the contact's surface structure results in an increase of the filed enhancement factor, which, in turn, leads to the vacuum breakdown of the contacts at ever increasing contact gaps. For the Cu-Cr contacts the prestrike arcing time is eventually long enough that the contacts formed a weld that the mechanism could not break. Although the prestrike arcing time with the W-Cu contacts did increase the mechanism would always break any welds that formed.