POWER CONTACT ARC SUPPRESSION
How Effective Are Snubbers vs. a Power Contact Arc Suppressor?
By Reinhold Henke and Bob Thorbus

Contact Current Arcing

"Snubber" is a nickname given to a configuration of components, such as a series-RC-network, which are typically used to suppress spark-related transients or as rise-time limiters. In addition, snubbers are often deployed as "arc suppressors", due to a mistaken belief that the terms "arc" and "spark" are interchangeable.

This paper introduces a figure of merit that we call the **Contact Arc Suppression Factor** (**CASF**), which is a quantitative figure of merit of arc suppression capability. The **CASF** is used to compare the arc suppression capability of both a common RC snubber (in this case, a CDE/ITW Quencharc®) and an Arc Suppression Technologies NOsparc® brand **Electronic Power Contact Arc Suppressor** (**EPCAS**). (AC power tests involved switching a 120Vac, 10A, 1:1 transformer load; DC power tests involved switching a 24Vdc, 2.3H, inductive load.)

Contact Arc Suppression Factor (CASF):

$$\text{CASF} = W_{(arc)} / W_{(arclet)}$$

Where $W_{(arc)}$ = Unsuppressed arc energy and $W_{(arclet)}$ = Suppressed arc energy. The unsuppressed and suppressed arc energy must be obtained graphically from oscilloscope measurements. The unsuppressed and suppressed arc energy is expressed in Watt seconds [**Ws**] or Joules [**J**]. The resulting Contact Arc Suppression Factor [**CASF**] is dimensionless.

$$W_{(arc)} = V_{(arc)} * I_{(arc)} * T_{(arc)}$$

Where $V_{(arc)}$: Arc burn voltage, $I_{(arc)}$: Arc burn current, is approximately $I_{(load)}$, where $I_{(load)}$ may be in the range from a few Ampere [**A**] to kilo Ampere [**kA**]; and $T_{(arc)}$: Arc burn duration, can be on the order of microseconds [**µs**] to seconds [**s**].

$$W_{(arclet)} = V_{(arclet)} * I_{(arclet)} * T_{(arclet)}$$

Where $V_{(arclet)}$: Arc ignition voltage, depending on the contact metal. E.g. about 12**V** for silver indium tin oxide; $I_{(arclet)}$: Arclet current, is approximately $I_{(load)}$ and may be in the range from a few Ampere [**A**] to kilo Ampere [**kA**]; and $T_{(arclet)}$: Arclet burn duration, is on the order of a few microseconds [**µs**].

New, Unused Contact

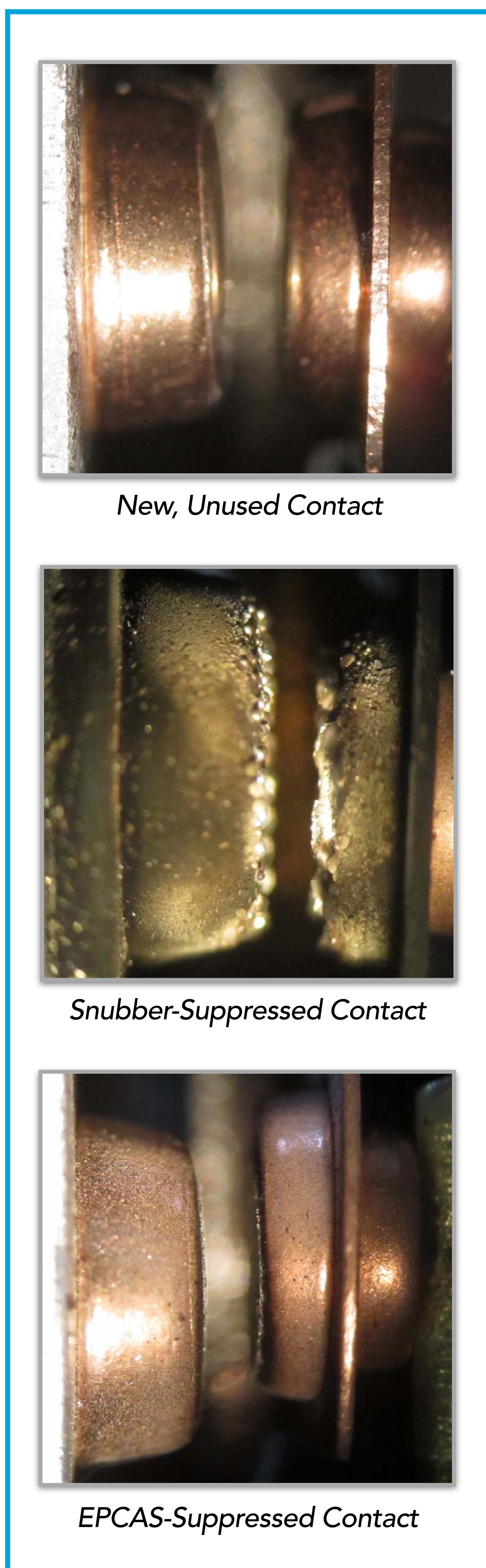*Snubber-Suppressed Contact*

EPCAS-Suppressed Contact

Figure IV: *(Top to Bottom) A photograph of unused (out of box) contacts; failed contacts after less than 100,000 cycles; and EPCAS-protected contacts after 1 Million Cycles (a 10X Increase)*
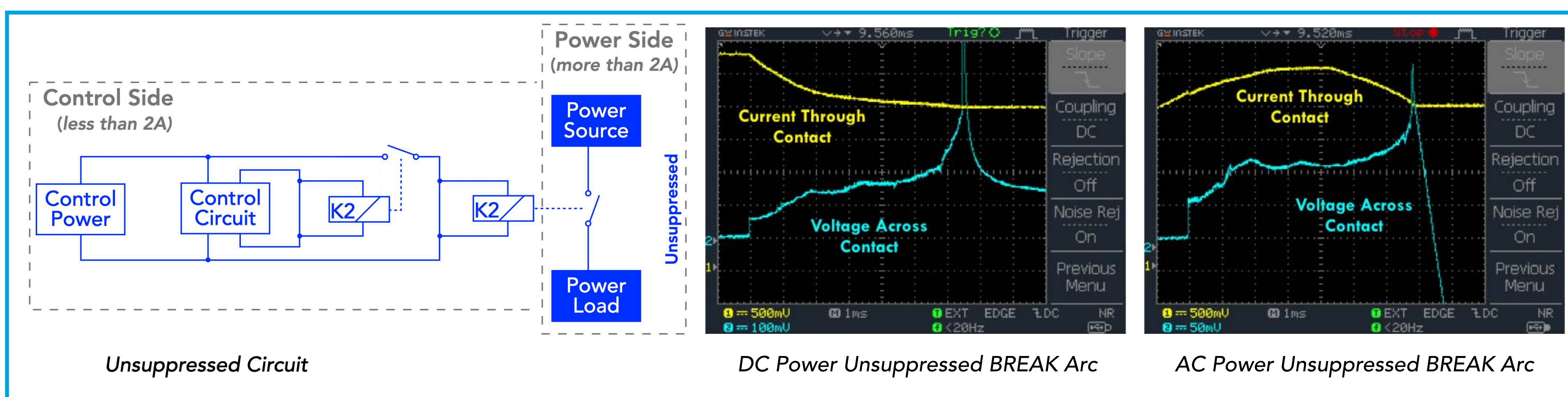

Unsuppressed Circuit

DC Power Unsuppressed BREAK Arc

AC Power Unsuppressed BREAK Arc

Figure I *(L to R): Unprotected contact circuit diagram, DC Power Arc Profile, and AC Power Arc Profile*

= RC Snubber

DC Power Snubber-suppressed BREAK Arc

AC Power Snubber-suppressed BREAK Arc
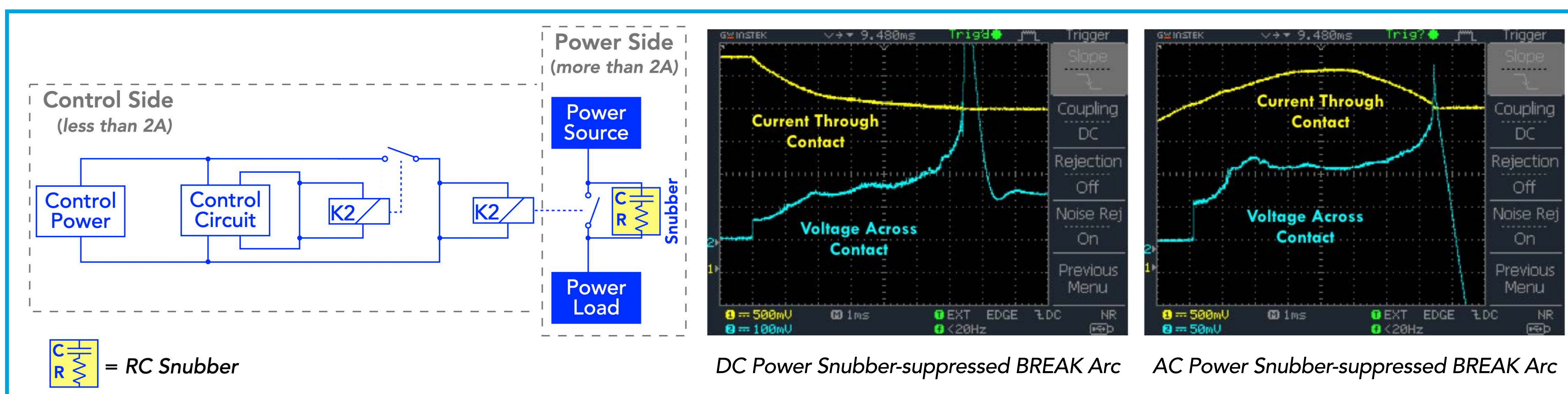
Figure II *(L to R): Snubber-protected contact cCircuit diagram, DC Power Arc Profile, and AC Power Arc Profile*

= Electronic Power Contact Arc Suppressor

DC Power EPCAS-suppressed BREAK Arc

AC Power EPCAS-suppressed BREAK Arc

DC Power EPCAS-suppressed BREAK Arclet

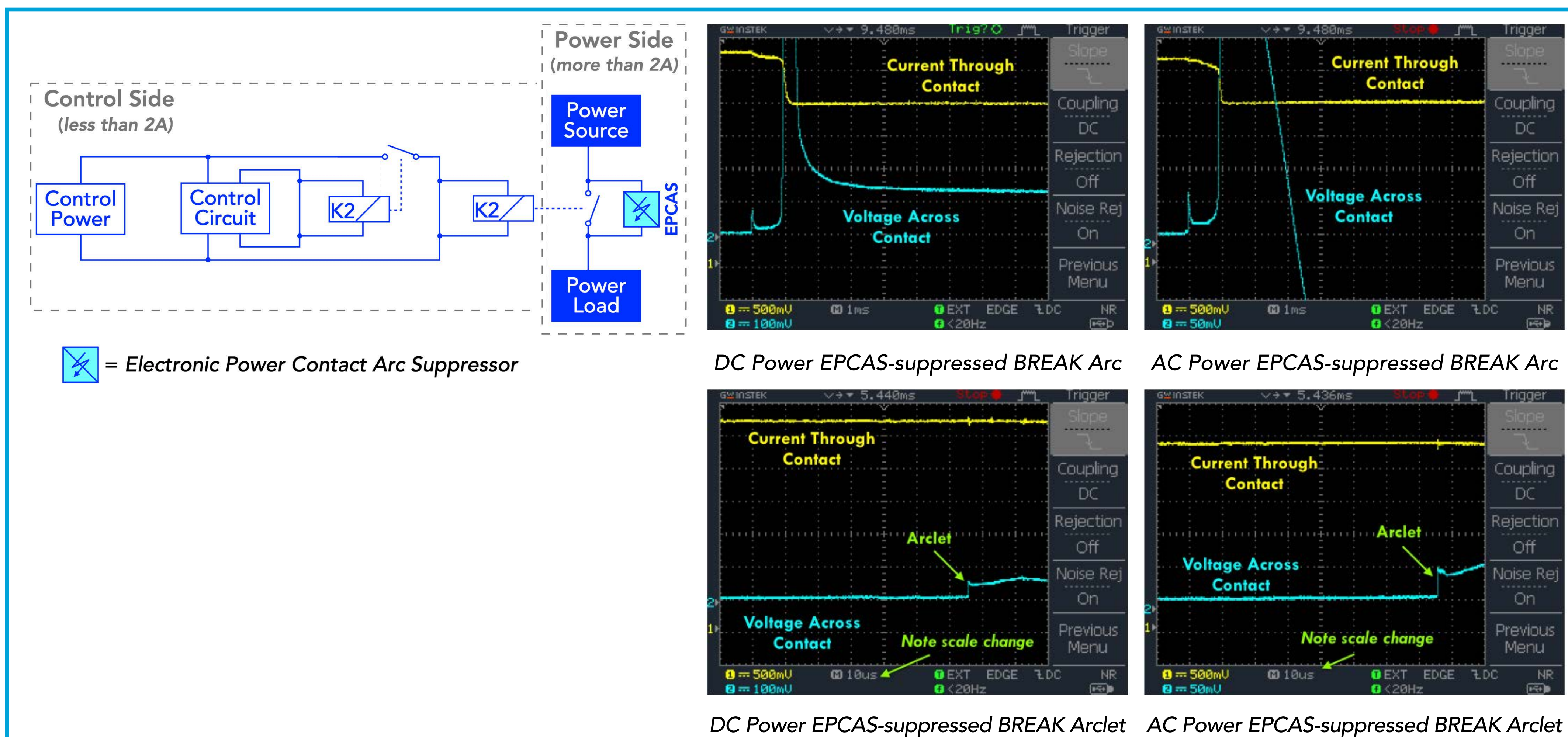*AC Power EPCAS-suppressed BREAK Arclet*

Figure III *(top, left to right): EPCAS-protected contact circuit diagram, DC Power Arclet Profile, and AC Power Arclet Profile; (bottom, left to right): DC Power Arclet Profile (detail), and AC Power Arclet Profile (detail)*