ARC SUPPRESSION TECHNOLOGIES
7900 INTERNATIONAL DR STE 300, BLOOMINGTON, MN 55425
www.ArcSuppressionTechnologies.com

The Dry Power Contact Cycle

Contact Activity Without Arc-Supporting Current

By Reinhold Henke and Robert P. Thorbus

The Electromechanical Life of Power Relays and Contactors

*A "**contact**" is a pair of electrodes (typically, one moving; one stationary) designed to control electricity. Power relays and contactors "turn power on" when the moving electrode (**M-electrode**) makes contact with the stationary electrode to carry current. Conversely, they "turn power off" when the **M-electrode** breaks contact and the resulting arc plasma stops burning as the dielectric gap widens sufficiently to prevent current flow (fig. I). Power relays and contactors have two primary life expectancy ratings: "**mechanical life**" is based on operating either without current or below the wetting current (i.e., "**Dry**") and "**electrical life**" is based on operating above the wetting current (i.e., "**Wet**"). These different ratings are due to contacts being designed to compensate for the destructive arcing that naturally occurs between the electrodes during normal **Wet** operation. Contact arcing is so destructive that the **electrical life** of power relays and contactors is a fraction of their **mechanical life**.*

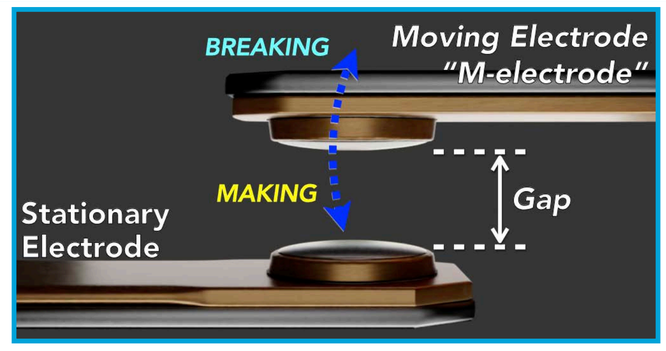

***Figure I:** Elements of a typical contact*

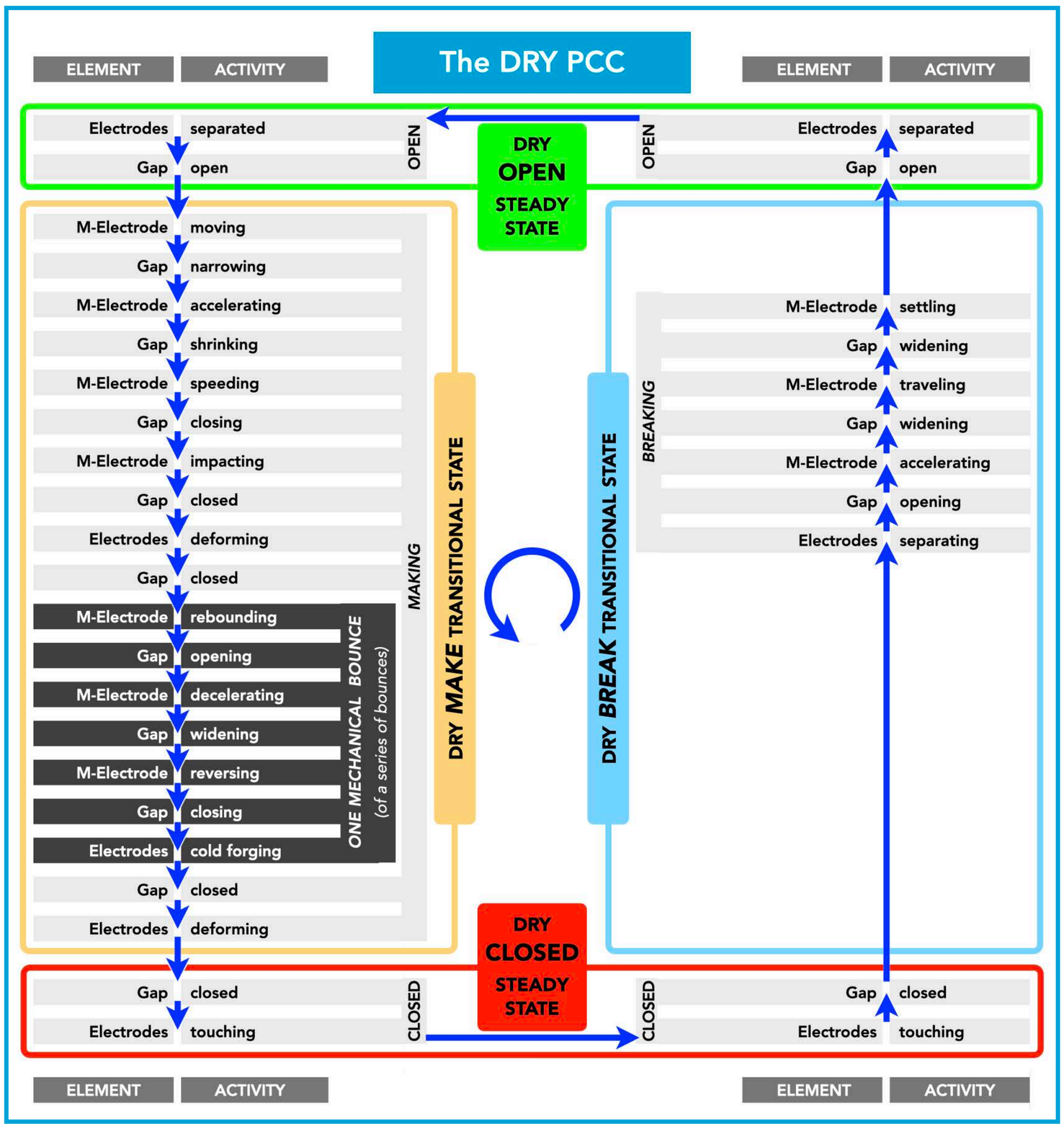

***Figure III:** Abbreviated events that occur during "Dry" Power Contact Cycle transitional states of MAKE and BREAK (**NOTE**: the "BOUNCE" activities represent a single bounce of many that may occur)*

The Dry Power Contact Cycle

The Dry Power Contact Cycle (**Dry PCC**) operates either below the wetting current, i.e., without arc supporting current (fig. II). Because there is no wetting current, the contact is subjected to cold forging and fretting.

The **Dry PCC** is comprised of four (4) distinct states: OPEN, MAKE, CLOSED and BREAK (fig. III). The transitional MAKE and BREAK states are generally of short duration, while the non-transitional OPEN and CLOSED states are generally longer in duration. During the OPEN state, there is no arc-supporting current flowing across the contact. The MAKE state starts with the **M-electrode** accelerating towards the stationary electrode. After a series of mechanical contact bounces, the CLOSED state is achieved. As the contact cycles through the BREAK state, the electrodes separate and the **M-electrode** settles back into the OPEN position.

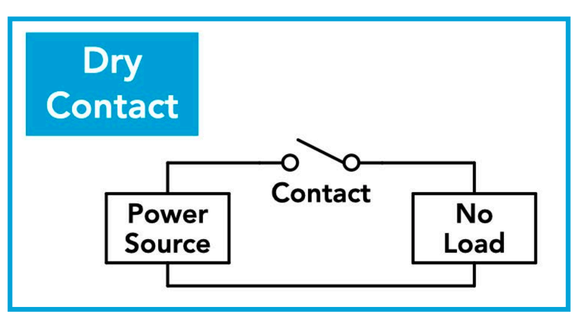

***Figure II:** Schematic diagram of a "Dry" contact*

The Dry PCC as a Benchmark

The **Dry PCC** establishes the mechanical end-of-life projection, or benchmark, of a power relay or contactor. Without an arc-supporting current there is no arcing, and without arcing a contact operated **Dry** will appear "like new" (fig. IV) through the mechanical life … until the physical mechanisms of the electromechanical switch ultimately fail.

Understanding this benchmark is critical both for realizing how the damage caused by contact arcing during the Wet Power Contact Cycle (**Wet PCC**) drastically foreshortens an electromechanical switch's life span and how an Electronic Power Contact Arc Suppression Cycle (**EPCAS Cycle**) yields an operating life that **equals** the operating life of a **Dry PCC**.

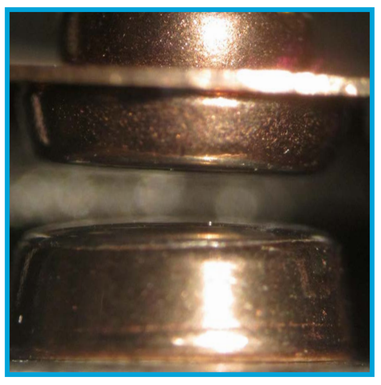

***Figure IV:** Without an arc-supporting current, the Dry PCC contact remains "like new" until mechanical failure*

References:
1. R. Henke and R.P. Thorbus, "Rethinking Contact Current Arcing," Arc Suppression Technologies publication, 2015
2. R. Henke and R.P. Thorbus, "Arcs vs. Sparks," Arc Suppression Technologies publication, November 2020