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Wet/Dry Power Contact Switching

About Dry Power Contact Fritting

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Wet/Dry Power Contact Switching

Wet/Dry power contact switching utilizes two separately controlled, sequenced contacts in series.

The dry contact electrodes either *MAKE* contact first or *BREAK* contact last <u>without</u> current flowing through them.

The wet contact electrodes either *MAKE* contact second or *BREAK* contact first <u>with</u> current flowing through them.

The moment current flows through both contacts the wet power contact electrodes are micro arc-welded while the dry power contact electrodes are micro spot-welded (table 1).

Contact Fritting

Contact fritting[1] describes a micro-spot-welding process between contact electrodes.

Contact fritting is an extra two-step process, that may be applied on an as needed basis, to restore the performance of degraded contact electrodes in low-power, non-wetting contacts, e.g., signal relays or "K1" in fig. 4 (tables 2 and 3; fig. 2).

Dry Power Contact Fritting

Dry power contact fritting[2,3,4, and 5] is a normal, continuous process, occurring with every wet/dry power contact switching cycle.

This process requires no additional apparatus or special methods. Dry power contact fritting results in an in-situ, optimized micro-spot-weld (fig. 1) while the contact is operating in the application.

All of this occurs in a few **µs**, ensuring optimal power contact resistance during every power contact cycle, and thus maintains the two contact electrode surfaces in "like new" condition on non-current-switching power contacts, e.g., "K1" in fig. 2 (figs. 1 and 2).

Figure 1: Fritting-created micro spot-welding marks on one set of dry power contact electrodes from ten cycles of carrying the LRA and FLA for a 25Hp, 460Vac, 3-phase induction motor.

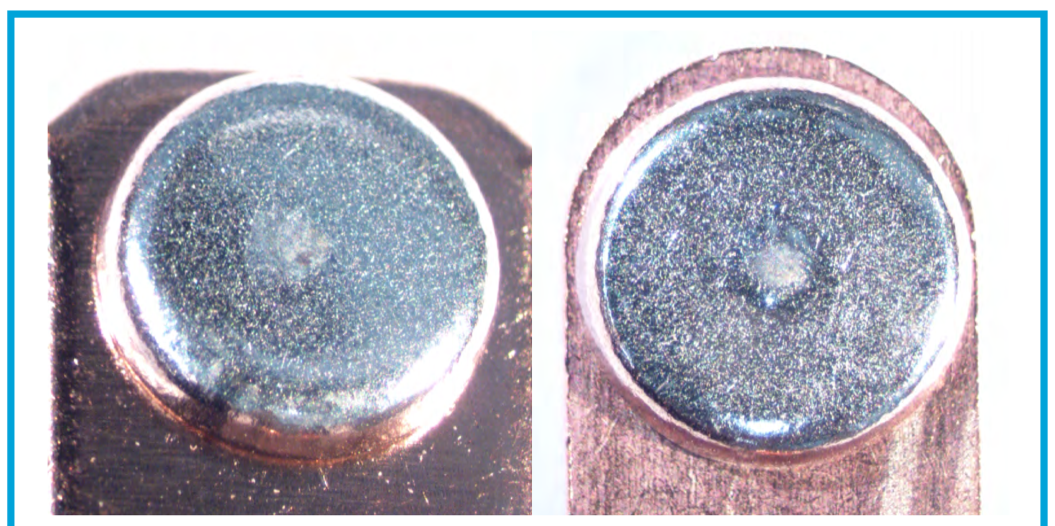

Figure 2 depicts an example of a power interlock application employing wet/dry power contact switching with an electronic power contact arc suppressor (**EPCAS**)[5].

Conclusion

Wet/dry power contact switching with an Electronic Power Contact Arc Suppressor (**EPCAS**) has the following advantages:

- Optimized micro-welds during each contact switching cycle
- High dielectric isolation
- Low leakage current
- Consistently reliable contact electrode surface performance

Micro Contact Arc-Welding:
Contact micro arc-welding, occurs during the arc suppressed contact MAKE state, while the moving contact electrode is advancing and bouncing towards the stationary electrode. Utilizing the naturally occurring process of arcing to heat both electrode surfaces, via plasma flow, to the melting point to temporarily mechanically and electrically join the electrode surfaces for the duration of the contact CLOSED *state.*

Micro Contact Spot-Welding
Contact micro spot-welding, occurs during the contact closed state, while the two contact electrodes are physically touching under pressure. Utilizing the naturally occurring process of fritting to heat both electrode surfaces, via joule heating, to the melting point to temporarily mechanically and electrically join the electrode surfaces for the duration of the contact closed state.

Table 1: Definitions of Micro Contact Arc-Welding vs. Micro Contact Spot-Welding.

Step #1: A-Fritting:
*The process of puncturing the insulating layer with a few volts applied between the touching electrodes for a few **µs** causing the breakdown of the insulating layer via high electric fields between the two contact electrodes.*

Step #2: B-Fritting:
*The process of removing the insulating layer with current. Current is driven through the closed dry contact for a few **µs** to cause Joule heating which softens and melts the contact metal to establish a molten metal bridge between the two dry contact electrodes.*

*Table 2: Two-step contact spot micro welding "fritting" process (see ref. **1**).*

Voltage between the two contact metal electrodes:
Contact electrode metal insulation breakdown voltage ➡ Contact voltage breaks down insulation layer or film

Current flowing through the "cold" contact resistance:
Contact electrode metal softening voltage ➡ Contact current times the cold contact resistance

Current flowing through the "heating" contact resistance:
Contact electrode metal melting voltage ➡ Contact current times the heated contact resistance

*Table 3: About contact electrode metal (see ref. **1**).*

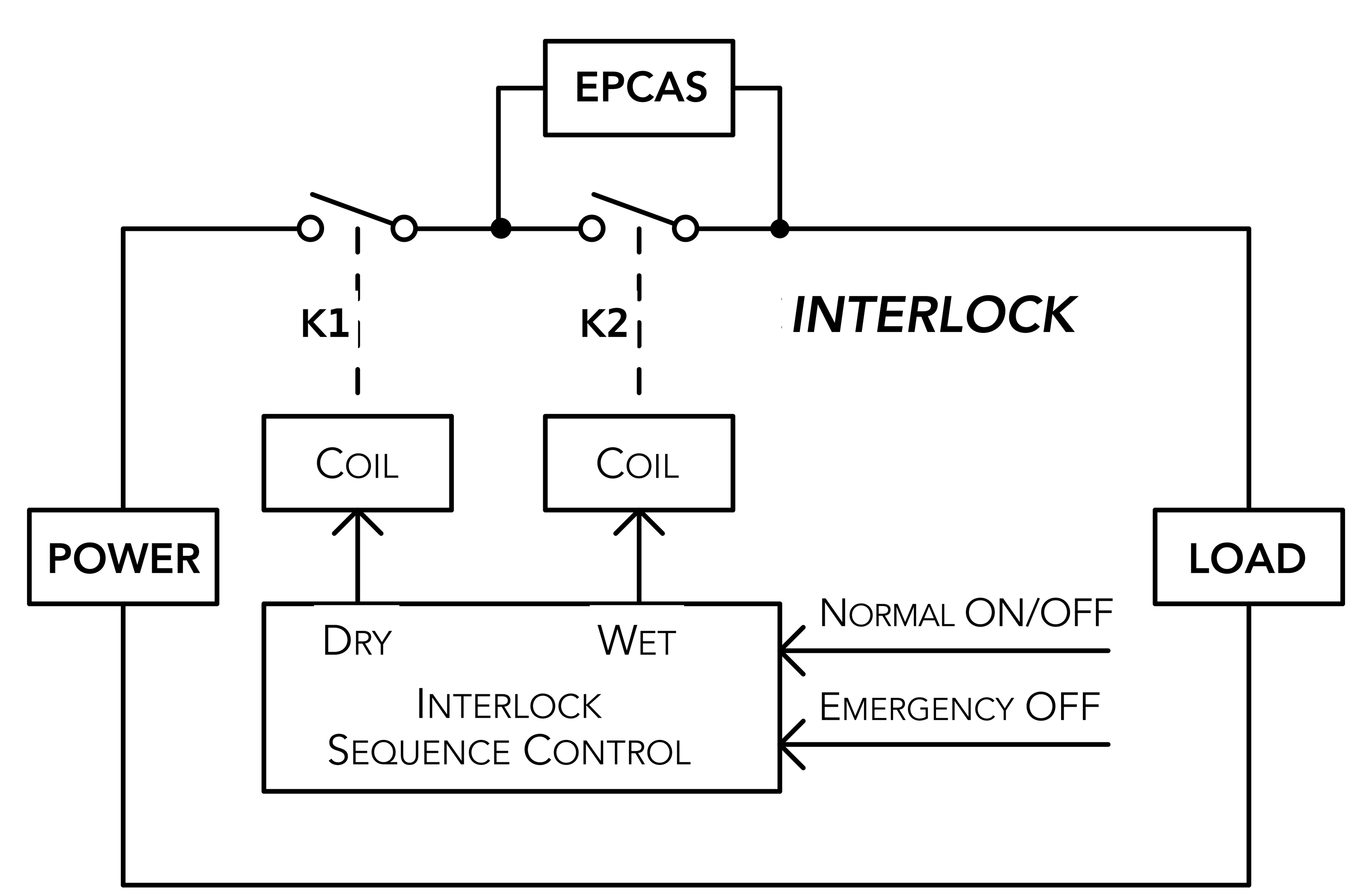

***Figure 2:** An example of wet/dry power contact switching.*

References:
1. R.Holm, Electric Contacts Handbook, Springer Verlag (Third completely rewritten edition of "Die technische Physik der elektrischen Kontakte"), 1958
2. R.Henke and R.P.Thorbus, "The Dry Power Contact Cycle," June 2021
3. R.Henke and R.P.Thorbus, "The Wet Power Contact Cycle," June 2021
4. R.Henke and R.P.Thorbus, "The EPCAS Cycle," June 2021
5. Arc Suppression Technologies, "Application Note #105, Building a Better Interlock - Wet / Dry Switching," rev D, 2016