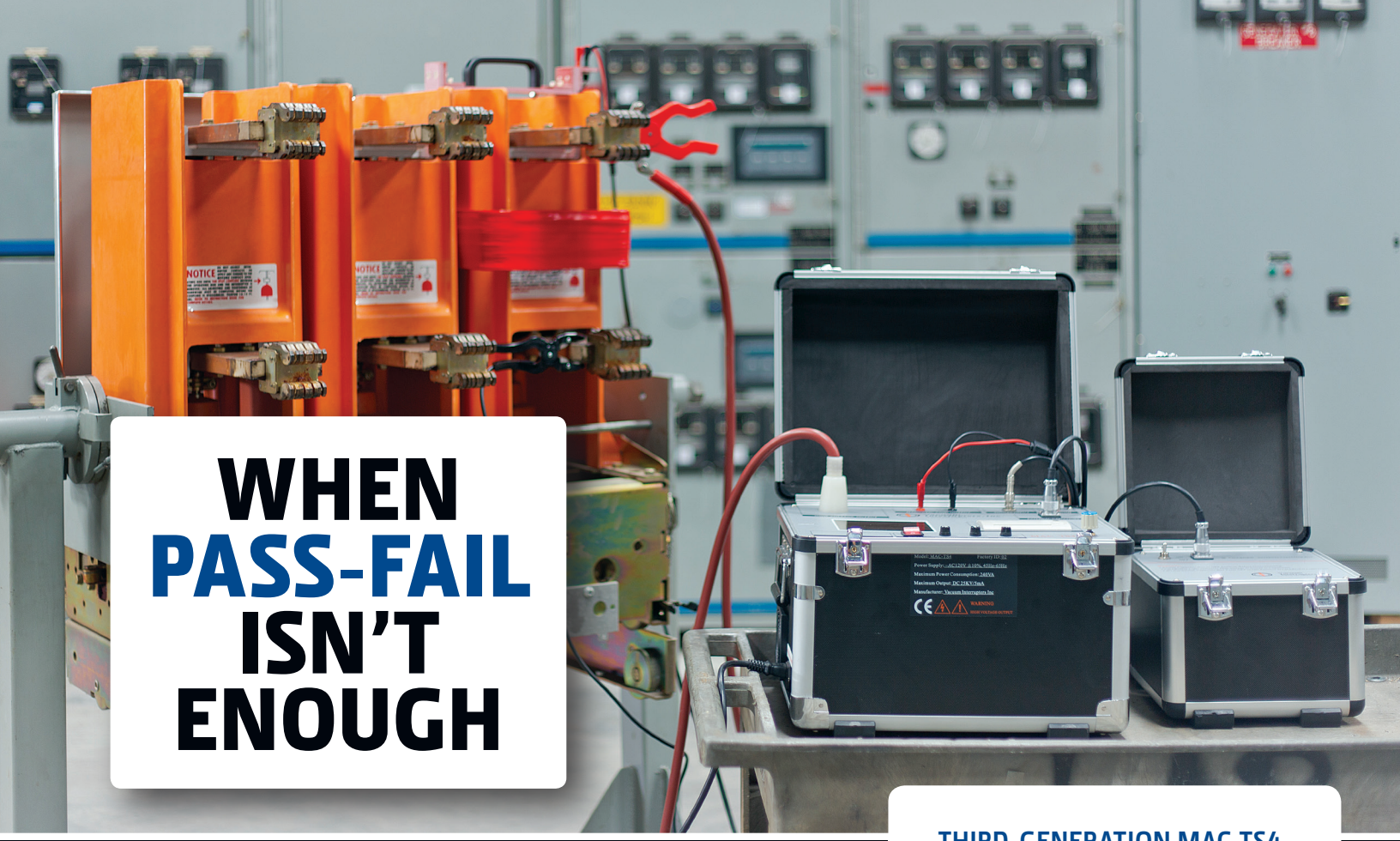

WHEN PASS-FAIL ISN'T ENOUGH

Trust Magnetron Atmospheric Condition (MAC) testing to predict the remaining life of your vacuum interrupters

Until now, the accepted field service test for vacuum interrupters has been a simple go/no-go test performed with an AC high-potential test. Today, testing with our Magnetron Atmospheric Condition (MAC) test sets can prevent unnecessary damage to your circuit breakers and contactors.

US PATENT NO. 9,031,795 B1

THIRD-GENERATION MAC-TS4 VACUUM INTERRUPTER TEST SET NOW WORKS WITH YOUR PC TO SIMPLIFY TEST REPORTS AND ASSET MANAGEMENT

- WORLD'S FIRST VACUUM INTERRUPTER TEST SYSTEM CAPABLE OF PREDICTING REMAINING LIFE
- MAC-TS4 IS THE WORLD'S FIRST TEST SYSTEM CAPABLE OF TESTING VACUUM INTERRUPTERS IN BOTH THE SHOP AND FIELD
- BASED ON SAME OEM LEAK-RATE TEST PERFORMED AT THE FACTORY
- SYSTEM DOES CALCULATIONS BASED ON MEASUREMENTS OF 3,000 VACUUM INTERRUPTERS

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Vacuum Interrupters, Inc.

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How HiPot Tests Can Make Bad Vacuum Interrupters Appear Good

Under certain circumstances, you may unknowingly place a failed vacuum interrupter back into service.

A West Texas utility company received an alarm on one of its load tap changers. Field technicians found that one of the vacuum interrupters failed an AC high-potential (HiPot) test. The tap changer was disassembled, and the vacuum interrupter in question was tested again. Once removed, the vacuum interrupter passed the AC HiPot test. The vacuum interrupter was reinstalled and placed back into service, where it again failed an AC HiPot test.

How did this utility company place a failed vacuum interrupter back into service? In order to interrupt high voltages, vacuum interrupters are manufactured with a very low pressure (vacuum) inside. At constant temperature, the internal pressure of the vacuum interrupter is directly proportional to the number of gas molecules inside. Therefore, more molecules inside correspond to a higher pressure, and fewer molecules correspond to a lower pressure. When the internal pressure of a vacuum interrupter increases to a certain point, the interrupter will no longer be able to insulate these high voltages. This means the vacuum interrupter will not pass a HiPot test.

If the internal pressure of a vacuum interrupter is just past the point of failing a HiPot test, a phenomenon can occur that can temporarily reduce the pressure inside enough to pass the test. Figure 1 shows a vacuum interrupter with a finite amount of gas molecules inside. Figure 2 shows a high voltage being applied across the open contacts, as in a HiPot test. This high voltage breaks down, or ionizes, the gas molecules inside the vacuum interrupter into charged particles, ions and electrons, seen in Figure 3. After the high voltage is removed, these charged particles immediately begin recombining into gas molecules. Under certain conditions, some of these charged particles may "stick" to the inner surfaces of the vacuum interrupter which, in turn, reduces the number of gas molecules inside, shown in Figure 4.

When the number of gas molecules is reduced, the pressure is also reduced. This reduction in pressure is temporary and dependent on a number of factors; however, it can result in a vacuum interrupter's internal pressure being reduced enough to pass a HiPot test. These remaining charged particles eventually will recombine and return the pressure to an unsatisfactory level. After this recombination occurs, the vacuum interrupter will, again, not pass a HiPot test. ■

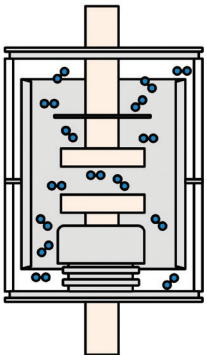


Figure 1: Vacuum interrupter showing gas molecules inside.

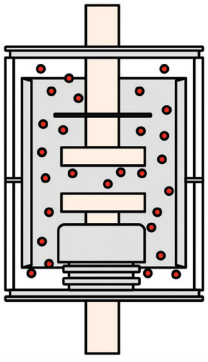


Figure 2: Vacuum interrupter with high voltage applied.

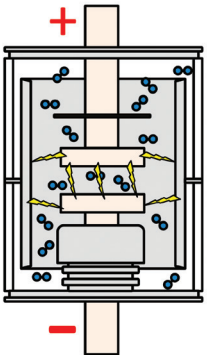


Figure 3: Vacuum interrupter showing ionized gas molecules.

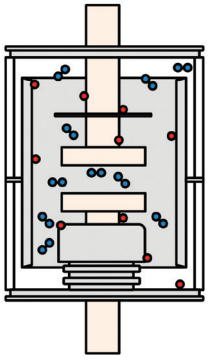
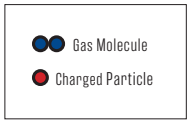


Figure 4: Vacuum interrupter showing partially recombined gas molecules.



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