



Advantages of comprehensive monitoring for critical circuit breakers

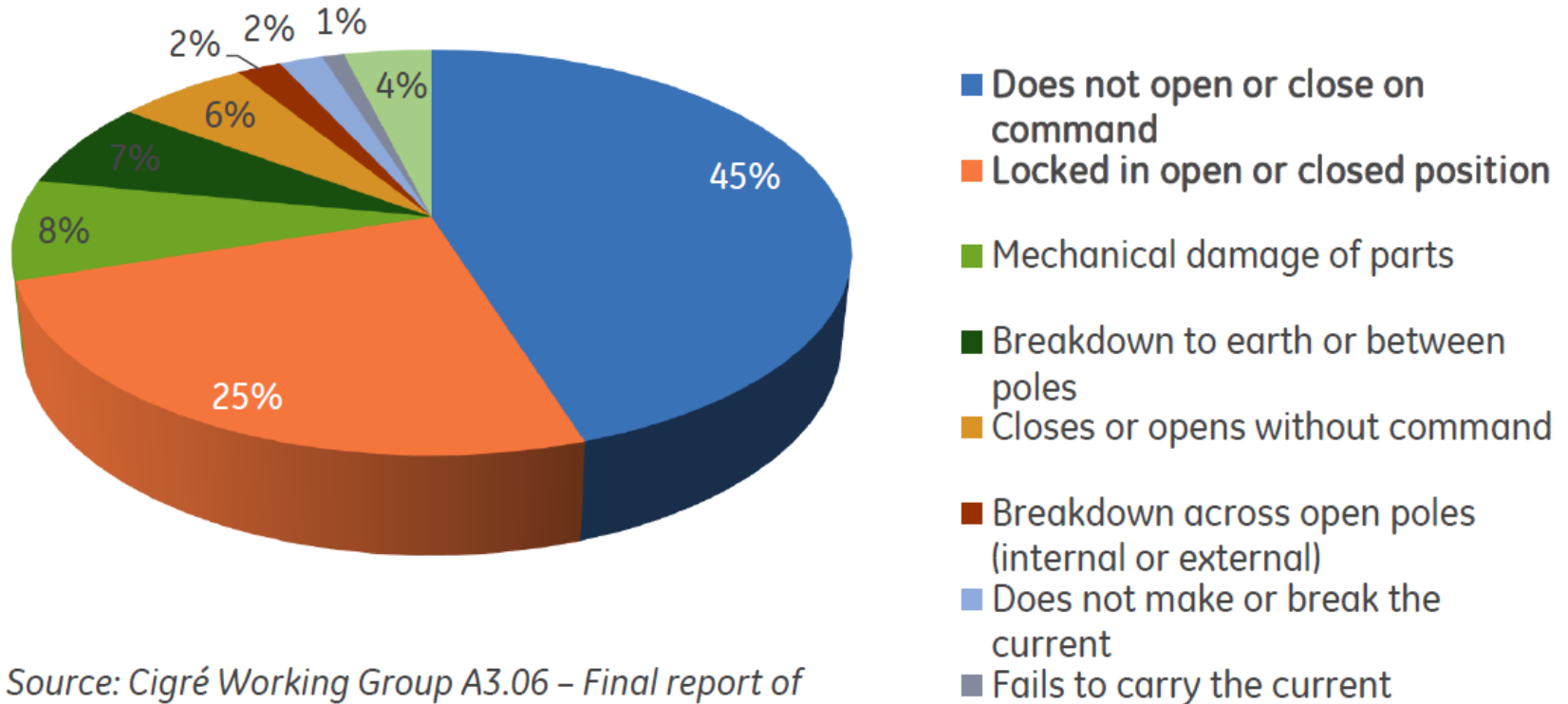
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Why Breaker Monitoring is Important...

- Important piece of equipment for the power system.....
- Optimization of maintenance expenses...

How do High Voltage CB fail?



Source: Cigré Working Group A3.06 – Final report of 2004-2007 International Enquiry on Reliability of HV Equipment, Part 2: HV CB Failure - 2012

Frequent Failure Modes

Does not open/close

- Damaged coil
- Latch mechanism
- Loss of stored energy
- Control circuit failure
- Mech link failure
- Drop in Cab Temp.
- External Circuit

Monitoring

- Continuity/Current
- Time to operate/energy
- Position of spring
- Continuity/aux con timing
- Current interruption
- Mech temp or heat current
- Batt Volt at breaker

Frequent Failure Modes

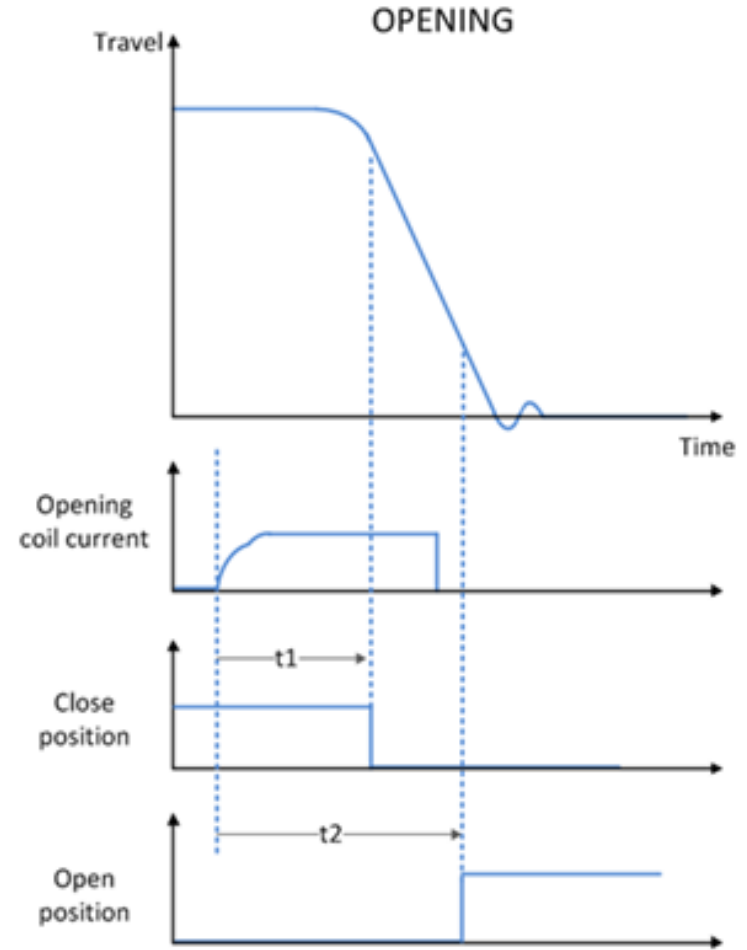
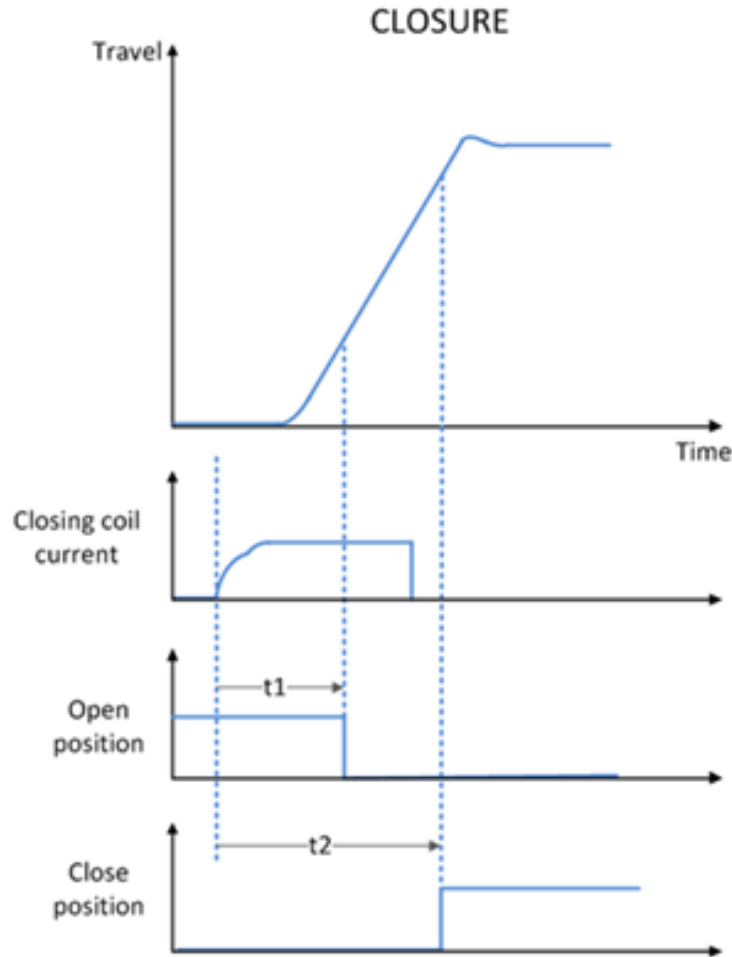
Locked in Position

- Operation Blocked

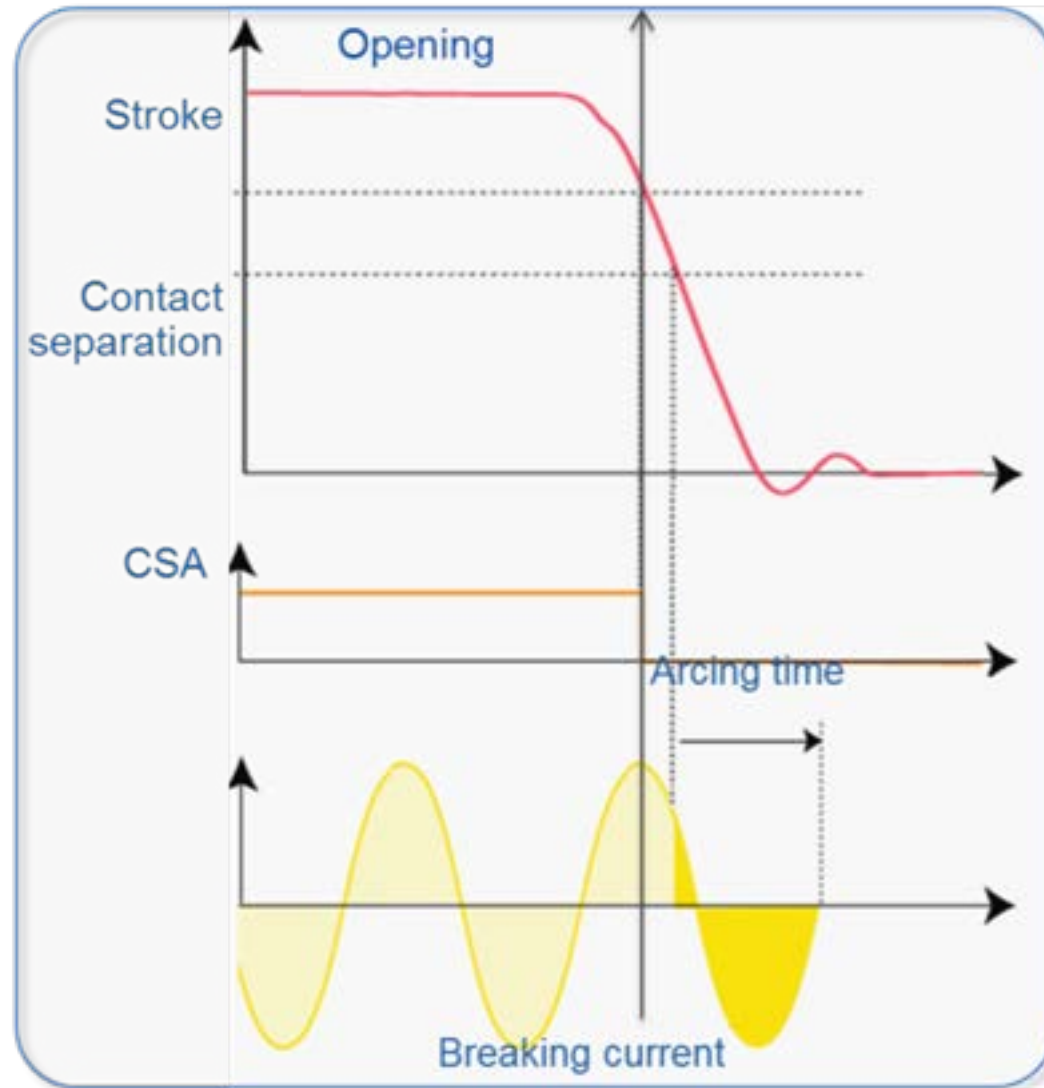
Monitoring

- Early Warning of Gas Leaks
- Trending to catch abnormalities.

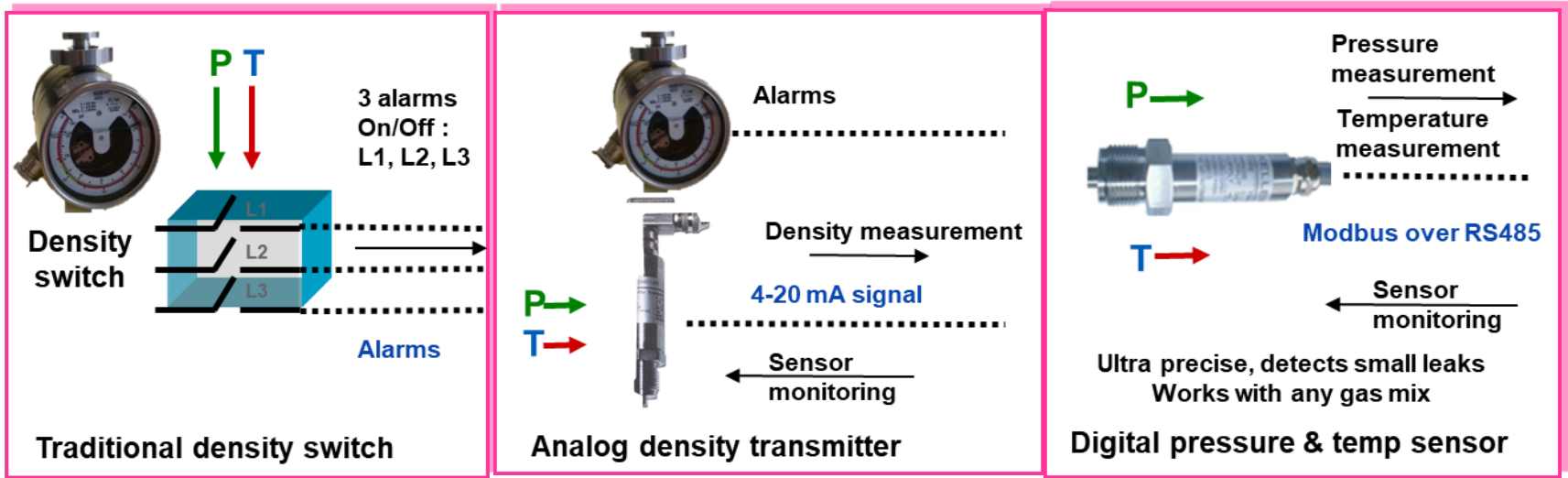
Mechanical Integrity



Excessive Arcing Time



SF6 Gas



Conclusions

- Because of their importance on the power system Circuit Breakers should be monitored.
- To correctly monitor we should:
 - Catch all common failure mechanisms
 - Reduce maintenance costs by moving to condition based maintenance.

Thank you for the time