

1. The Test Set-up

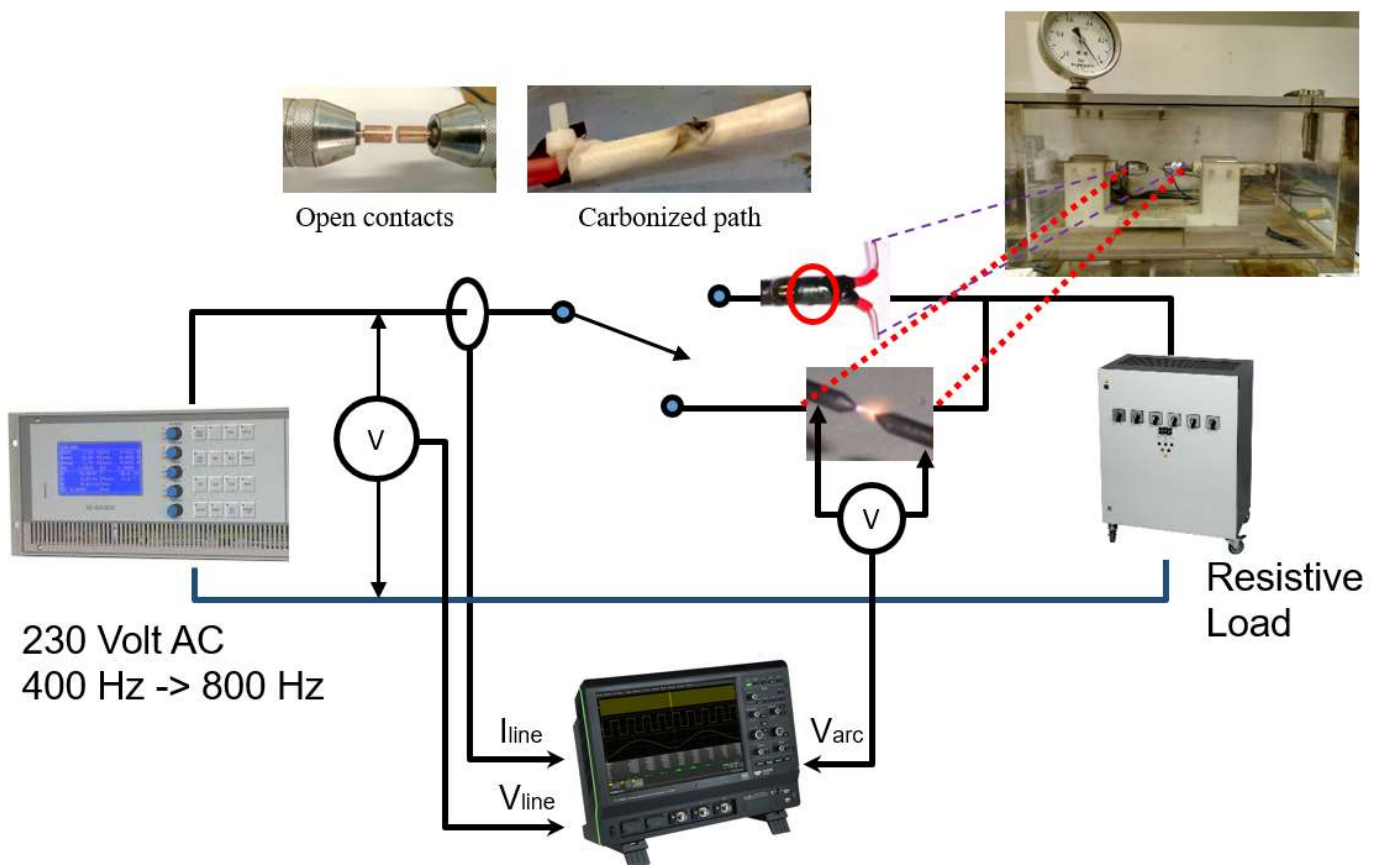
The following figure shows the general experimental test bench used to generate a series-arc fault in an electrical network in order to record the electrical current and voltage signatures and therefore build our database.

The measurements are performed with a Lecroy HDO-6104 oscilloscope (2GHz bandwidth). The sampling rate is 1 Ms/s. A sub sampling can be undertaken if the detection method doesn't require such a high sampling rate.

The measurement of the line current. is taken at the output of the power source (Lecroy AP30 probe – 100MHz bandwidth). To verify that the fault is continuously present in the circuit, the measurement of the arc voltage (V_{arc}) across the fault is also recorded (TT-SI 9010, 70MHz bandwidth). The voltage V_{line} is measured at the output of the supply voltage.

Power source : AC Source ETSYSTEM
Supply voltage (230 Volts) frequency [400Hz, 800Hz]

Load : Resistance (R)



The experimental test bench

2. The Electrical Signatures

Supply Voltage (V_{line}) : C1_type of arc_frequency_current value.dat
Line current (I_{line}) : C3_type of arc_frequency_current value.dat
Arc voltage (V_{arc}) : C2_type of arc_frequency_current value.dat

Name	Produced by
OC	Opening arc between two electrodes
CP	Carbonized path wires

Max current
amplitude value

Frequency of the power
supply signal

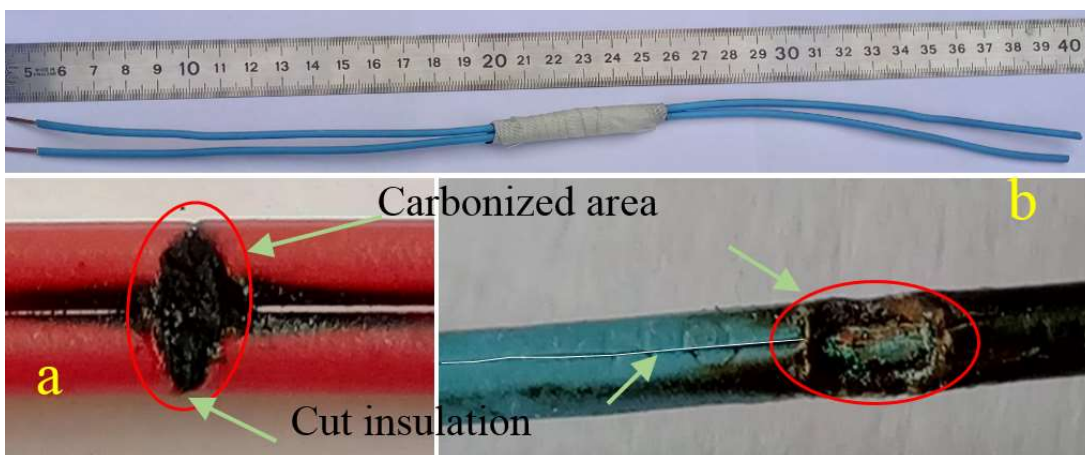
Each recorded signal is composed of two distinct parts:

- The first part corresponds to a fault-free operation (In this case $V_{arc} = 0$).
- The second part of the signal is obtained when the arc fault is inserted into the circuit.

3. The Arcing Fault

3.1. The First Method

A carbonized conductive path is created between the two copper wires (following the protocol defined by the UL 1699 or IEC 62606 standards).



Two copper cables (measuring 20cm in length), with a slit across the insulation (measuring 5cm in length), are closely tied together and then wrapped. A carbonized conductive path is therefore created between the two conductors.

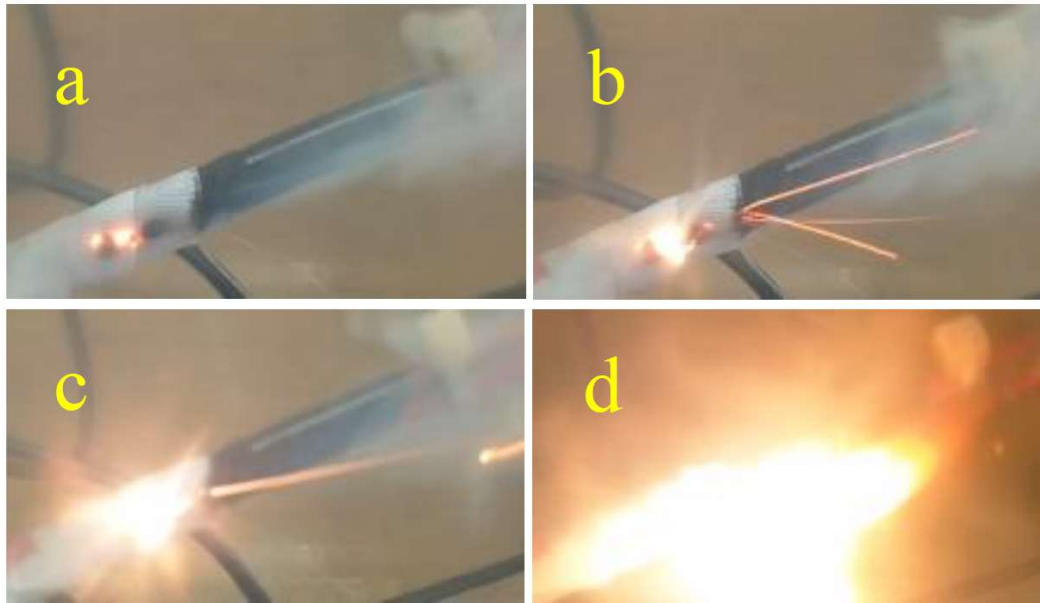
This pre-prepared sample cable can subsequently be directly inserted into the circuit, in order to reproduce the arcing fault.

The arc fault is created according to the protocol defined in the UL 1699 or IEC standards.

Two copper cables (of 20cm in length), with a slit across the insulation (5 cm length), are closely tied together and then wrapped. A carbonized conductive path is created between the two conductors.

The prepared sample cable can be inserted directly into the circuit to reproduce the arcing fault.

An arc fault. is created (see Figure a) which produces smoke and sparks may also appear (see Figure b). The process continues to intensify (see Figure c). If the circuit is not cut, the cable sample will completely ignite (see Figure d).

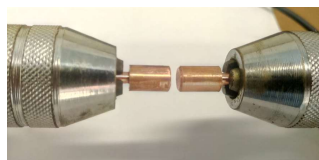


2.2. The Second Method (Opening arc between two electrodes)

The arc is created between two copper electrodes

The two electrodes. are placed into the two drill chucks and. are initially in contact. One is fixed into position and the other can be moved. An arcing fault is created each time a contact opening occurs (for a small gap < 0.5 mm).

Several contact openings/closings are produced by moving the adjustable electrodes towards and away from each other.



Copper electrodes (6mm in diameter)