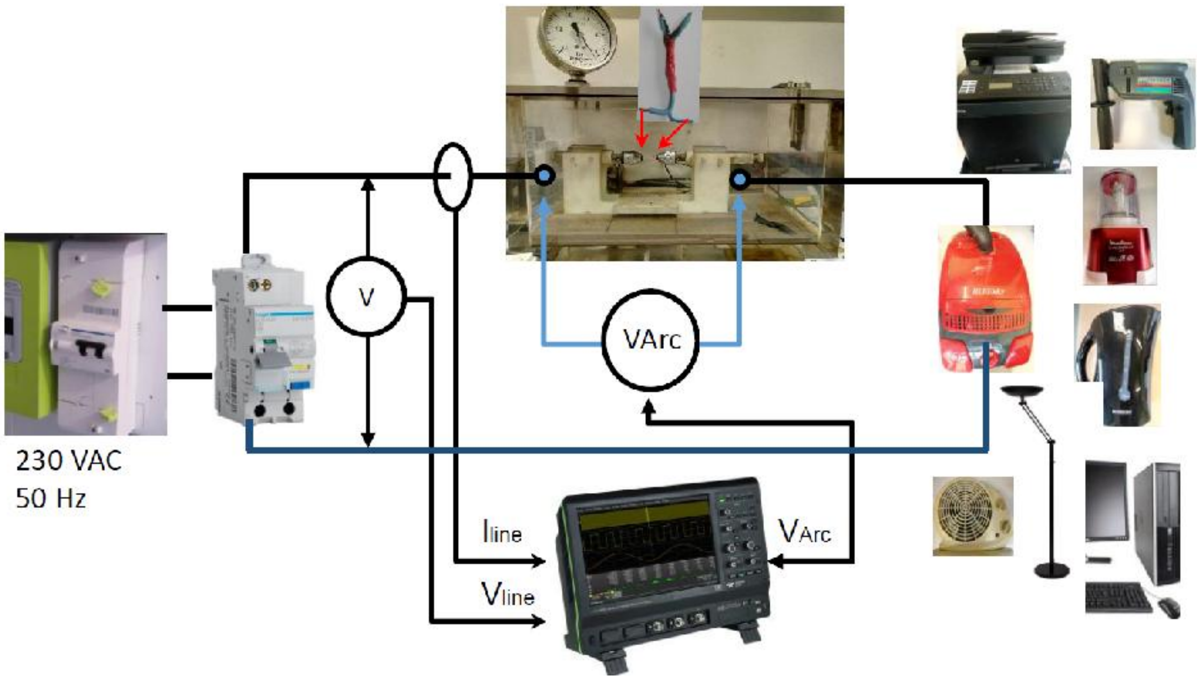
1. The Test Set-up

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 AC power source (230V - 50Hz) supplies a load which can come in the form of a single appliance or can be composed of several linked appliances that are connected in parallel.

The various household appliances considered in this study are listed below:



The experimental test bench

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 requires 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 across the fault is also recorded (TT-SI 9010, 70MHz bandwidth). The voltage V-line. is measured at the output of the supply voltage.

The data files are stored in a Matlab format.

Line current (I_{line}) : C2_*appliance*_*type of arc*.dat
Arc voltage (V_{arc}) : C3_*appliance*_*type of arc*.dat

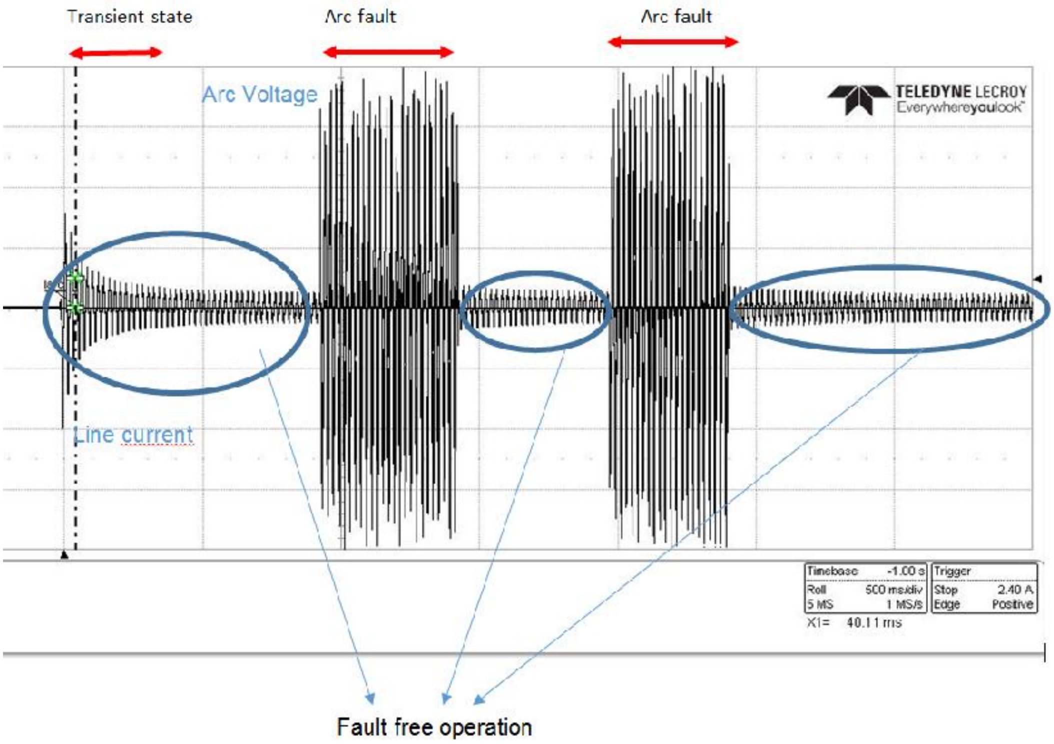
Name of the household appliance

Name	Produced by
opencontact	Open contact electrodes
carbonizedpath	Carbonized path wires

2. The Electrical Signatures

Test : Carbonized Path

The following figure shows the results of one measurement (featuring the line current and arc voltage for a vacuum cleaner).



Each recorded signal is composed of two distinct parts:

- The segments which correspond to a fault-free operation (Varc = 0).

- The other sequences obtained, when the fault 7. is inserted into the circuit via the switching of a relay.

3. The Household Appliances

	 Moulinex Mini Food Processor

Titan 710 Power Drill_

Peugeot 550 Watt Power Drill_

Bluesky Optimo 1200 Vacuum Cleaner_

Blow Heater

Kettle

Severin 2200 W

 Mewal Halogen Lamp	

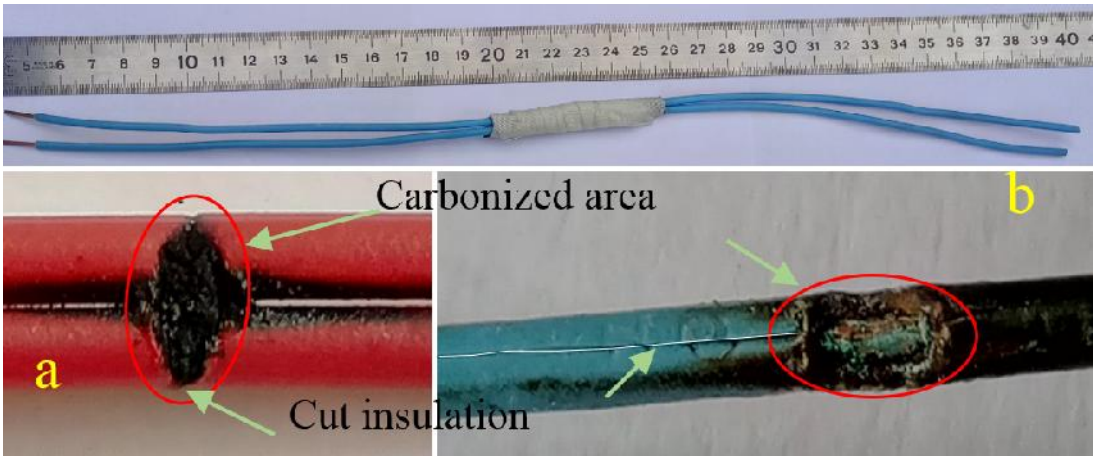
Res 4,5A= resistance (Imax = 4,5 A)

Res 7,9A = resistance (Imax = 7,9 A)

4. The Arcing Fault

4.1. The First Method

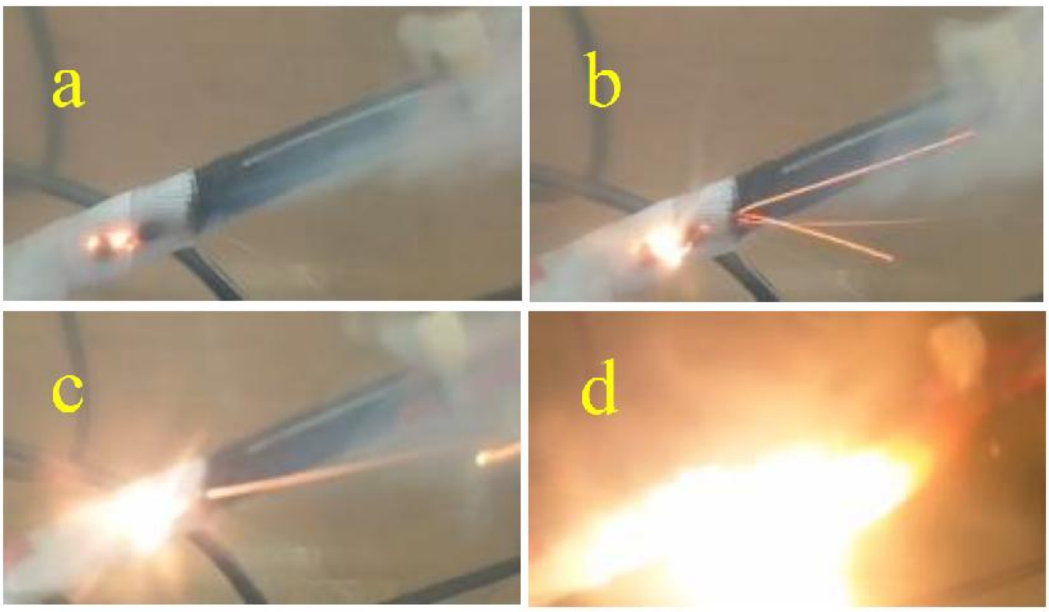
A carbonized conductive path is created between the two copper wires (following the protocol defined by the UL 1699 or IEC 62606 standards).



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).

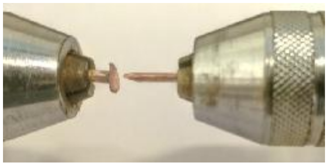


4.2. The Second Method (open contact)

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 (1mm in diameter)