

# Cable fault location in power cables



## Systematics for cable testing, diagnosis and cable fault location



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**Contents:**

- 1. Testing, diagnosing and partial discharge measurements**
- 2. Cable fault location**

Regarding the task to be performed, a distinction must be made between two main groups:

**Testing, diagnosing and partial discharge measurement**

Condition-oriented maintenance

**Localising all types of cable faults**

Result-oriented maintenance

**1. Testing, diagnosing and partial discharge measurement**

**Objective of the cable test:**

- ▶ Checking quality before running and fitting a cable
- ▶ Correcting weak points in the cable which can jeopardise the operation

During the cable test, flash-overs are generated at the weak points in a cable. These faulty points must then be localised (cable fault location). Depending on the insulation and the test object, the following voltage forms are mandatory:

Paper-insulated lead-covered cable (PILC)	DC voltage AC voltage 50 – 60 Hz VLF (0.1 Hz)
PE/XLPE cable	AC voltage 50 – 60 Hz VLF (0.1 Hz)
Components	DC voltage and AC voltage 50 – 60 Hz



## **Objective of the dielectric diagnosis and partial discharge measurement:**

A non-destructive check for testing the condition of the insulation in cables and fittings and localising faulty points.

### **Dielectric diagnosing**

- ▶ Integral check of how the cable has aged by means of IRC analysis (isothermal relaxation current analysis) in PE and XLPE cable insulation types
- ▶ Integral check of the moisture content by means of RVM analysis (return voltage measurement) in paper-insulated lead-covered cables

### **Partial discharge measurement (PD measurement)**

Recording, location and evaluation of partial discharges (PD) in the insulation and fittings of medium voltage cables.

**Remark:** These subjects are dealt with separately in the following articles.

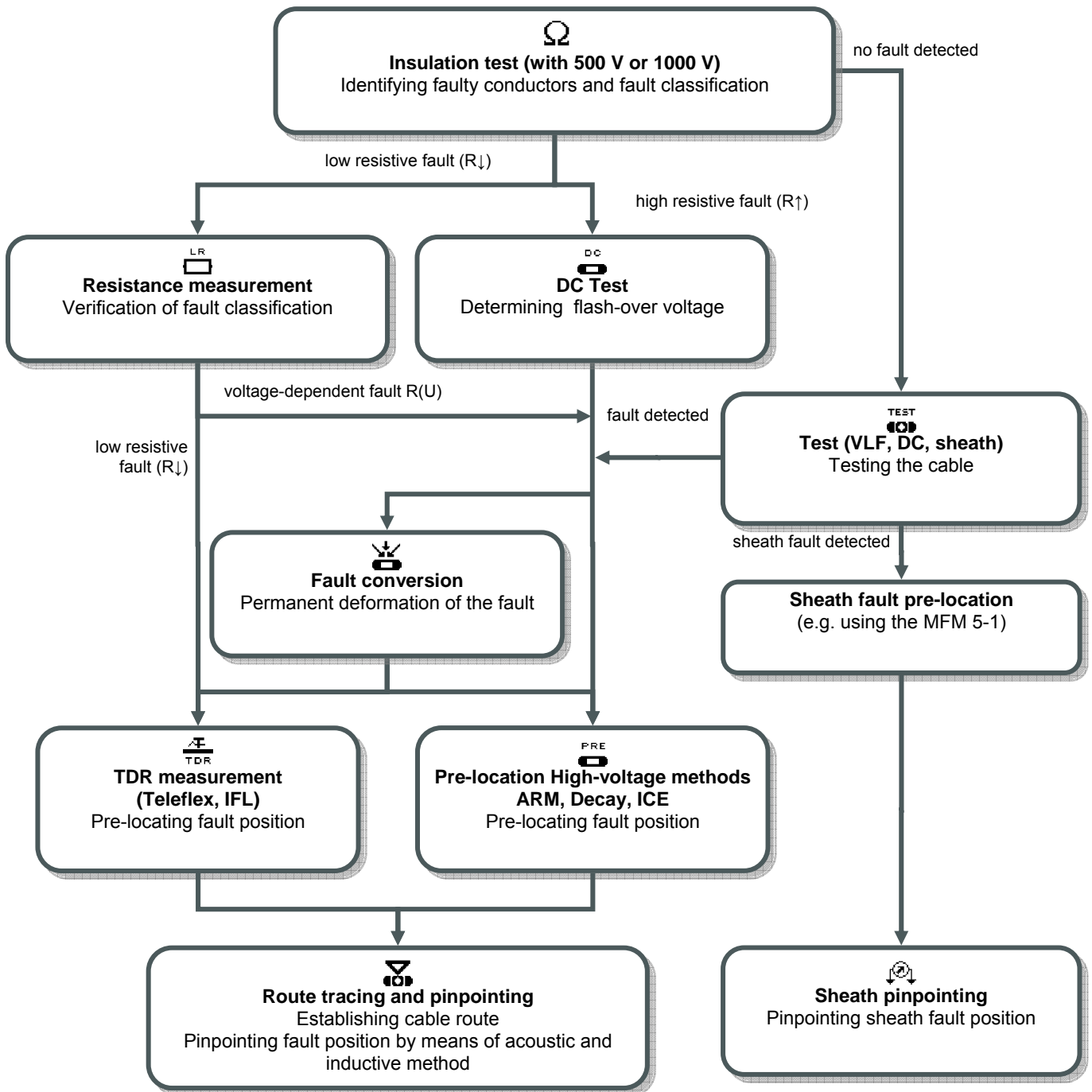
## **2. Localising all different types of cable faults**

The steps necessary for determining fault locations can be sub-divided into five main categories.

1. **Fault classification** – identifying the type of fault
2. **Pre-location** – determining the distance to the fault
3. **Route tracing** – determining the route of the cable at the site
4. **Pinpointing** – determining the exact position of the cable the site
5. **Cable identification** – determining the faulty cable amongst several cables



The following diagram shows the common procedure for identifying and locating cable faults:





## **Measuring methods in cable fault location:**

Insulation test, measuring the resistance of a fault

### Testing

- ▶ DC test (determining the flash-over voltage)
- ▶ Sheath fault test
- ▶ VLF test (determining the flash-over voltage)

### Pre-location

- ▶ Teleflex measurements (pulse reflection measurements, TDR measurements)
- ▶ ARM (Arc Reflection Method)
- ▶ ARM Plus (Arc Reflection Method Plus)
- ▶ ARM power burning
- ▶ Decay Plus (Arc Reflection Method – igniting the fault using DC generator)
- ▶ Decay (travelling wave method, oscillation method)
- ▶ Current catching (ICE)
- ▶ Three-phase current catching (ICE)
- ▶ ICE Plus (low-voltage networks only)
- ▶ High-voltage bridge method (pre-locating sheath faults)
- ▶ Voltage drop method (pre-locating sheath faults)

### Fault conversion

- ▶ Burning
- ▶ Performance burning

### Route tracing

- ▶ Line location
- ▶ Line routing

### Pinpointing

- ▶ Audio frequency generator (twist field method, minimum turbidity method)
- ▶ Shock discharges (acoustic field method, acoustic pinpointing)
- ▶ Pinpointing sheath fault

### Cable and phase identification

- ▶ Phase identification when earthed
- ▶ Phase identification and phase determination on live systems