

How to choose the best spark tester for your application: AC vs. DC

A guide to types of spark testers for insulated wire & cable

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Spark Tester Types

Spark testing has long been used on the primary insulation line and at packaging, providing first and final insulation quality checks. Increasingly, manufacturers are checking for defects prior to or after such interim processes as twinning, bunching, taping, cabling, jacketing and marking. Following is a discussion of spark tester selection and application.

Spark test equipment is classified by the type of test voltage applied to the product. Available types include Alternating Current (AC) and Direct Current (DC). AC spark testers are of two types: those that operate at power mains frequencies, generally 50 or 60 Hertz, and “high frequency” types that operate at frequencies between 500 Hz and 3kHz. Impulse testers, which are no longer in common use, are not discussed.

Advantages of AC Spark Testing:

- AC creates a field of ionized air (a blue-colored glow called *corona*) around the product. Corona is electrically conductive and provides a good test even when the bead chains are not making physical contact. Corona is caused in part by the AC voltage changing from positive to negative with each cycle. For this reason high frequency spark testers generate more corona than 60 cycle testers.
- A byproduct of corona is heat. If you were to leave a grounded cable stationary in an energized high frequency electrode for a while, you would notice that the insulation is noticeably warmer where it made contact with the corona field. This heating helps to break down weak spots in the dielectric that otherwise might pass through the electrode undetected, only to fail during a later spark or hipot test.

Disadvantages of AC spark testing:

- In wires with very weak insulation (such as telecommunication and Datacom wires having a foamed dielectric), the AC voltage ionizes the air inside the foam cells, reducing the overall dielectric strength of the insulation. The insulation may then fail, damaging the product. This is particularly true with high frequency spark testers, which should not be used with foamed insulation.
- When the capacitance of the product in the electrode is very high, a “leakage current” forms. Because capacitance is a more a function of the ratio of conductor size to insulation thickness than to overall size, products that produce high capacitance can include cables with large conductors and thin insulation, small wires with very thin dielectric, or multiple conductors going through the same electrode (tape and ribbon cables, for instance). For safety reasons, the spark tester’s current output is limited to 4 to 6 milliamps. When the leakage current reaches this level, there is no more available supply current to generate a greater test voltage. The maximum possible voltage attainable with that product may not be high enough to provide a good test.

Advantages of DC spark testing:

- DC generates practically no corona and no heat and is therefore a gentler test. DC can be used on foamed insulation and thin insulation.
- DC has no problem with capacitance. Very large wires and multiple conductors can be tested with one power supply. DC is often used in cabling operations, sometimes testing 25 twisted pairs within a single electrode.

Disadvantages of DC spark testing:

- ***THE PRODUCT MUST BE GROUNDED!*** The center conductor or shield should be grounded for reasons of safety and efficacy. If the product is not grounded and a fault passes through the electrode, the spark tester will count, but the entire reel will become charged to high voltage and will maintain this potential until something discharges it. Subsequent faults may not be detected because the center conductor will be nearly the same potential as the electrode, and detection circuits require differentiation.
- A different test voltage must be used, compared with AC ($1.414 \times \text{AC RMS Voltage} = \text{DC Peak voltage}$). This is not really a disadvantage but a difference in the way the two types of voltage are measured. AC is measured in RMS (root means squared) while DC is measured as Peak Voltage.