

Partial Discharge Measurement Under DC & Impulse Voltages

Key Concepts

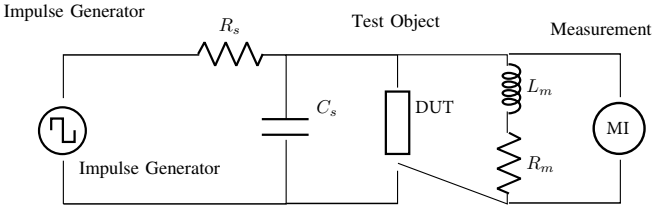
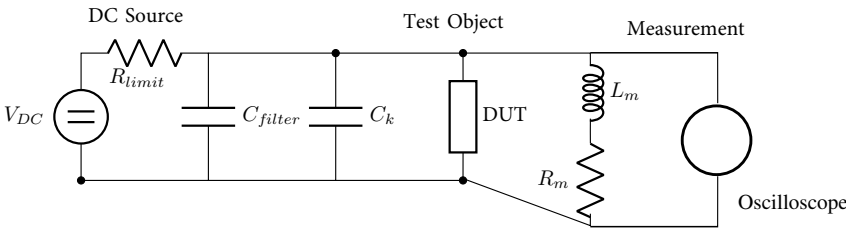
Partial discharge (PD) phenomena require two fundamental conditions:

- Local electric field strength (E_{loc}) must exceed dielectric strength (E_d)
- Availability of free charge carriers (electrons)

Mathematical Foundation

$$E_{loc} \geq E_d \tag{1}$$

Circuit Diagram



Measuring Impedance
 $Z_m = R_m + j\omega L_m$

Circuit Components

Component	Purpose
V_{DC}	DC voltage source
$V_{Impulse}$	Optional impulse source (dashed)
C_k	Coupling capacitor
DUT	Device under test
Z_m	Measuring impedance
Voltmeter	PD pulse detection

Practical Considerations

- **Transient Effects:** Field establishment may take seconds/minutes
- **AC Ripple:** Superimposed AC components affect PD characteristics
 - Typical ripple frequency: 100Hz-10kHz
 - Amplitude typically 5% of V_{DC}
- **Space Charge:** More significant in DC than AC systems

Measurement Protocol

1. Ramp up DC voltage gradually
2. Monitor for PD inception voltage
3. Record pulse magnitude and repetition rate
4. Analyze with/without ripple component