

CONDITION MONITORING OF CRITICAL HV EQUIPMENT DURING MONSOON



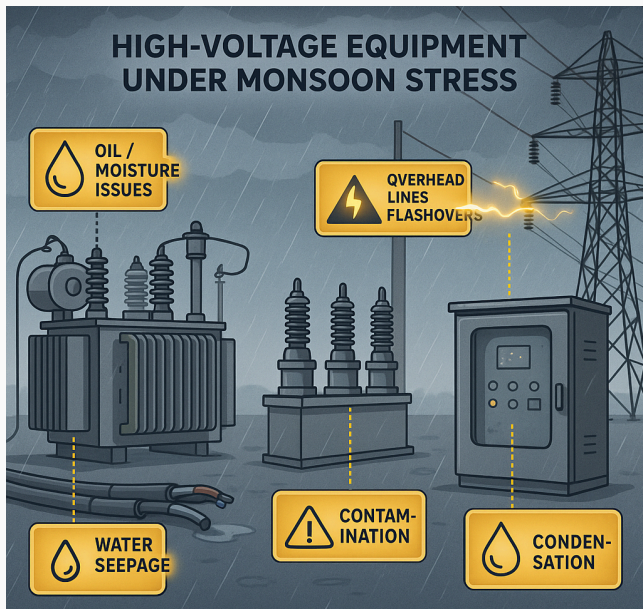
Introduction

The monsoon season brings welcome relief from scorching summer heat, but it also poses significant challenges for high-voltage (HV) power equipment. Heavy rains, persistent humidity, and lightning surges amplify existing weaknesses in assets such as transformers, reactors, cables, circuit breakers, and overhead lines. Even minor defects can escalate into catastrophic failures during this period. For power grids, utilities, and industrial plants, monsoon preparedness and condition monitoring are essential for reliability and safety.

Why Condition Monitoring Matters

Condition monitoring provides utilities and industries with the ability to:

- Detect early warning signs of faults like partial discharge, overheating, and moisture ingress.
- Prevent catastrophic breakdowns by enabling timely corrective action.
- Maintain reliability and stability of power supply during the most vulnerable period of the year.
- Reduce costs, since predictive maintenance is far less expensive than emergency replacements.
- By continuously monitoring asset health, operators gain visibility into potential failures before they cause unplanned outages.



Key Risks to HV Equipment During Monsoon

- **Transformers:** Moisture ingress in oil, overheating of bushings, OLTC failures.
- **Cables & Terminations:** Water seepage at joints, corona activity at outdoor ends.
- **Circuit Breakers:** SF6 gas contamination, resistive contacts, water in marshalling boxes.
- **Overhead Lines:** Corona discharges, insulator flashovers, loose jumpers aggravated by rain.
- **Control Panels:** Condensation inside relay panels and kiosks.

Key Facts (Highlighting the Monsoon Period)

- More than 50% of insulator flashovers in India occur during monsoon due to wet + polluted surfaces.
- Utilities like PGCIL and TPDDL have reduced equipment failures by 30–40% after adopting monsoon-specific condition monitoring.
- Condition monitoring ensures asset health visibility 24/7, avoiding unexpected tripping and outages in the peak monsoon season.
- A dedicated monsoon preparedness checklist is now part of best practices across leading transmission/distribution utilities.

How to Protect HV Equipment During Monsoon

A combination of preventive actions and advanced monitoring technologies ensures asset safety:

- **Insulators & Bushings:** Clean before monsoon, apply RTV or silicon grease to prevent surface tracking.
- **Transformers:** Replace or reactivate silica gel, check seals, use online DGA and moisture-in-oil sensors, scan bushings with thermal imagers.
- **Cables:** Pre-monsoon Tan-Delta and VLF testing; during monsoon, monitor joints with thermal/acoustic scans.
- **Circuit Breakers:** Monitor SF6 dew point, test CRM, check anti-condensation heaters.
- **Overhead Lines:** Acoustic/UV corona cameras for discharges, drone-based IR patrols, leakage current monitoring of insulators.
- **Earthing & Lightning Protection:** Measure and maintain earth resistance, test lightning arresters, tighten grounding connections.



Seasonal Maintenance & Monitoring Schedule

- Online Monitoring: Use thermal imagers, acoustic cameras, PD sensors, SF₆ dew-point meters, and online DGA for real-time fault detection.
- Thermal & Acoustic Scans: Spot hotspots, corona, and surface discharges aggravated by humidity.
- PD Sensors: Capture early discharge activity in transformers, GIS, and cables.
- SF₆ Dew Point: Track gas dryness to prevent internal flashovers.
- Online DGA: Detect moisture or fault gases in transformer oil.
- Frequent Inspections: Increase to weekly checks or after heavy rains for outdoor equipment.