A STUDY ON THE EFFECTIVENESS OF PARTIAL DISCHARGE MONITORING AS A PREVENTIVE MAINTENANCE

Hideon TANAKA,

Viscas Corporation (JAPAN)

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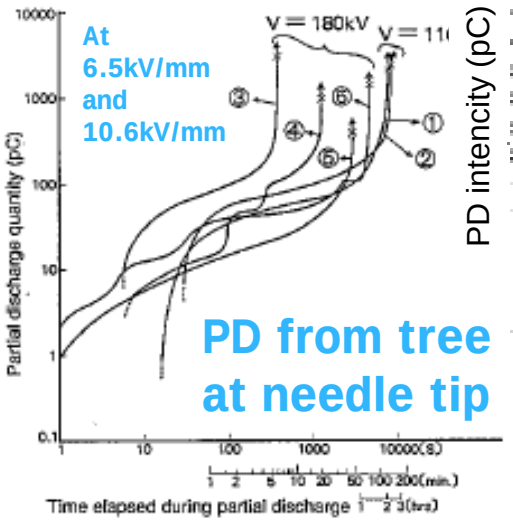
QUESTION !

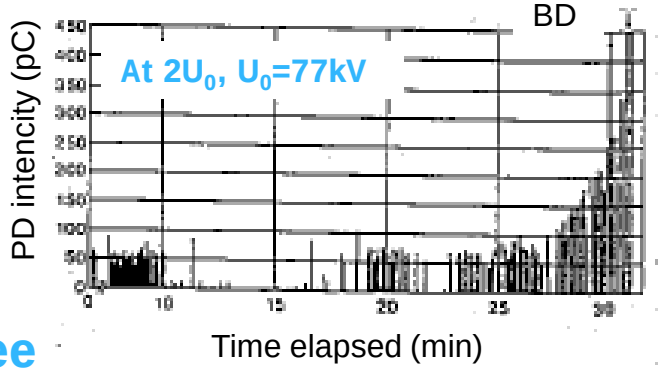
- ***Is partial discharge monitoring effective to assess the cable system condition ?***

- To answer this question, it is important to understand the followings;
  1. PD characteristics of the cable system insulation.
  2. PD shall be measured at site, not at the laboratory. → Measurement environment is not “ideal”.

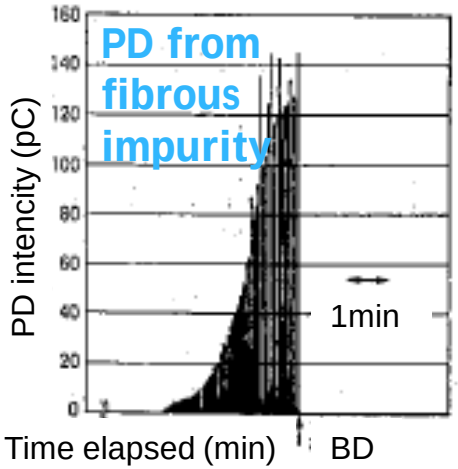
1. PD *Q-T* CHARACTERISTICS

- ✓PD characteristics depend on not only the electric field, but also the origin of PD sources.





PD at the void in the interface of PJ insulation



- ✓What important is not only the discharge, but also its time allowance for judgment before breakdown.
- ✓Typical wrong understanding is that "PD is omnipotent for detection of malfunctions or deterioration in the insulation systems". →To be reviewed from the view point of PD q-t characteristics.

2. GENERAL PROPERTY OF PD *Q-T* PATTERN

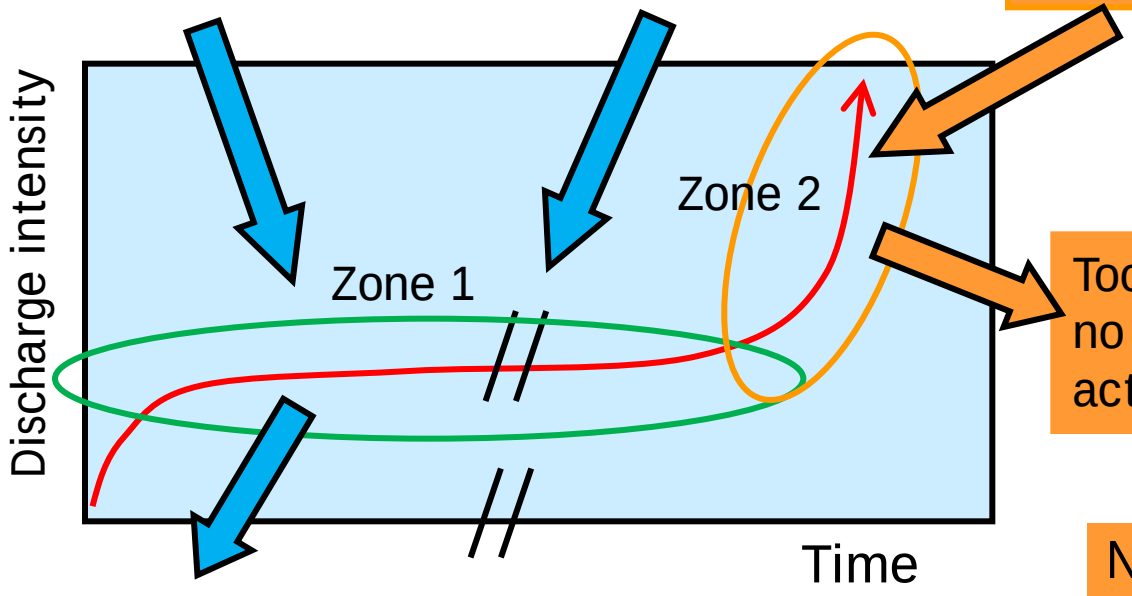
- Partial discharge=

Void discharge + Electric tree propagation

Usually stable and long

Long duration in some cases

Not stable and short duration in some cases



Too short to judge and no time for counter actions.

Not suitable for on-site PD measurement.

PD monitoring will be usually possible for this stage.

Possible target of on-site PD measurement.

3. TARGET OF PD MEASUREMENT

Type of defect	Zone 1 Stable PD	Zone 2: Unstable and rapidly intensifying PD
Outer injury	Usually YES	YES
Insulation/Interface void	Usually YES	YES
Inferior workmanship in accessory fitting (Wrong position of deflector, etc.)	Some cases YES	YES
Impurity and protrusion	Some cases YES	YES
Water tree	NO	YES

Out of scope of PD measurement

PD measurement suitable

PD measurement not suitable

Partial discharge is **not omni-potent** for the detection of all possible defects of power cable.

4. LIMITATION OF PD MONITORING

- PD measurement cannot monitor all kind of insulation defects.
- Defining the targets (defects) of PD detection is important and it shall make PD measurement effective.

- PD monitoring as asset diagnosis
  - → Effective but auxiliary method giving some additional information on the health status of the assets.
  - → On-line and permanent monitoring will not be practical, especially from the view point of "How to make interpretation of measurement results under on-site noise-coming environment".
  - → **More suitable for "Spot measurement", not permanent.**

5. ON-SITE PD MEASUREMENT TRACK RECORDS IN JAPAN (1)

- Early ’90s ~ : HVAC test with PD for 275kV XLPE cable lines commissioning test
- In 2000 : HVAC test with PD for 500kV XLPE cable line commissioning test

Temporal PD measurement system for whole cable system

5. ON-SITE PD MEASUREMENT TRACK RECORDS IN JAPAN (2)

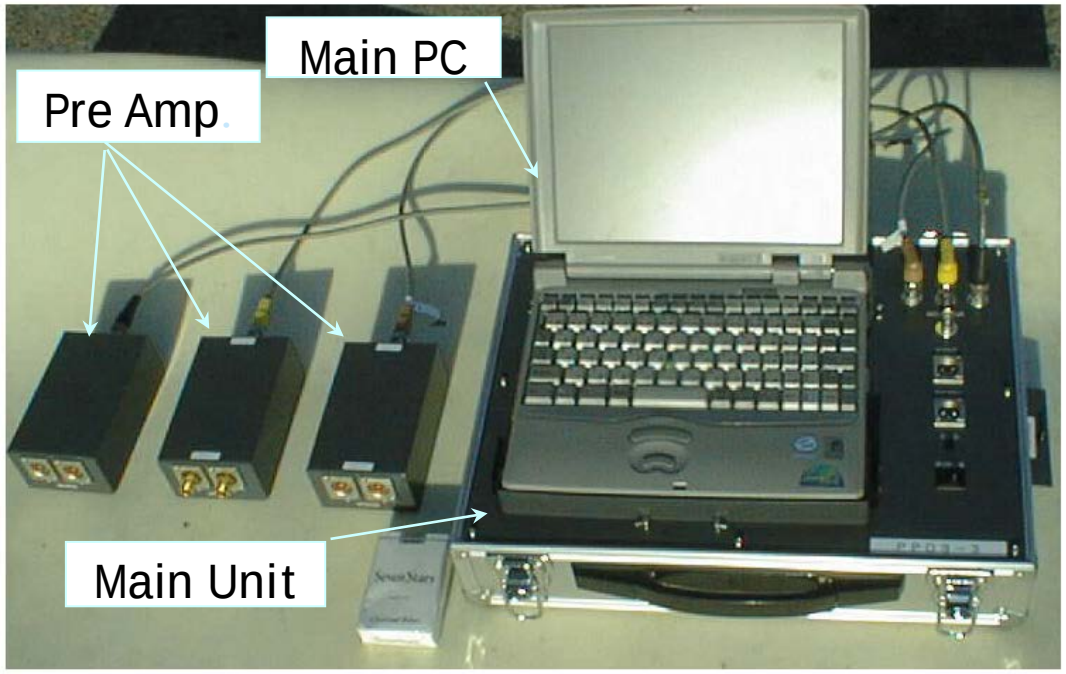
- 21st Century ~ : Some utilities abandoned HVAC commissioning test as well as PD test for EHV XLPE cable line, and it was substituted by soak test without PD.

  → QA/QC system has been established not only in manufacturing plants but also fitting work at site.

  → Pros and Cons on PD measurement in commissioning test had been compared and concluded as above.

5. ON-SITE PD MEASUREMENT TRACK RECORDS IN JAPAN (3)

- Currently, on-site PD measurements are mainly carried out as “Spot measurement” to check the cable line with simplified device.
  - Examples of application
    - After repair work
    - Periodical check
    - Trouble shooting
    - etc. etc.



6. CONCLUSIONS

- PD measurement gives useful information for some **specific** kind of **insulation defects**.
- Hence, PD measurement is **not omnipotent** and understood as **auxiliary method** to check the insulation status of the cable system, i.e. **it has limitation**.
- On-line and permanent monitoring will not be practical. **This means it shall not be considered a omnipotent method for preventive maintenance**.