PD characteristics under the aspect of different voltage wave shapes and frequencies

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Partial Discharge (PD) testing has become a well-established method for condition monitoring and quality control of medium voltage cable systems. Different voltage wave shapes are internationally accepted and used for localizing partial discharge defects. The evaluation and interpretation of the gathered PD data is mainly based on three fundamental PD characteristics: the partial discharge inception (PDIV) and extinction voltage (PDEV), and the level of partial discharge in pC. These three characteristics are mainly used for the interpretation and evaluation of the measured data and support the recommendation for further action on detected defects.

Former and recent publications [Sintev], [Pepper] demonstrate that the shape and frequency of the applied excitation voltage have an influence on the PD characteristics. This paper focuses on comparing several excitation wave shapes: Damped AC using either positive (DAC+) or negative (DAC-) charging ramp, very low frequency sinusoidal at 0.1 Hz (VLF-sin 0.1), very low frequency cosine rectangular at fundamental frequency of 0.1 Hz and polarity reversals between 20 Hz-500 Hz (VLF-CR) and continuous AC at power frequency.

Test objects with artificial defects at laboratory site are initially used for basic analysis of the behaviour of the chosen parameters at the different excitation voltages. Case studies of field measurements on installed medium voltage cables were done to prove matching laboratory results with partial discharge defects in the field.

Finally the measurement results of the three parameters (PDIV, PDEV, PD value) and best practise experience conclude in recommendations for further action of localized defects for each applied excitation voltage individually.

[Sintev] H.L. Halvorson, “Condition Assessment of Wind Farm Medium Cable Joints,” Master Thesis, NTNU, June 2012

[Pepper] D. Pepper, „Grundlagenuntersuchung zum Teilentladungsverhalten in kunststoffisolierten Mittelspannungskabeln bei Prüfspannungen mit variabler Frequenz und Kurvenform,“ Ph D. dissertation, Technical Univ. Berlin, Germany, 2003.