

Close Accord on Partial Discharge Diagnosis During Voltage Harmonics in Electric Motors Fed by Variable Frequency Drives

Waqar Hassan¹, Muhammad Akmal², Ghulam Amjad Hussain³, Ali Raza⁴, and Muhammad Shafiq⁵

¹Institute of Southern Punjab

²Sheffield Hallam University

³American University of Kuwait

⁴University of Engineering and Technology

⁵Tallinn University of Technology

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Abstract

Partial discharge (PD) diagnostics test is reliable for estimating insulation health conditions in power system components. During laboratory PD diagnostics, the effect of harmonic components in the voltage waveform generated by variable frequency drives (VFD) fed electric motors (EMs) is often overlooked. However, these harmonic components can cause significant distortion in the applied voltage waveform. As VFD-fed EMs operate at low speeds, the harmonic concentration in the voltage increases. It has been found that PD activity in VFD-fed EM is significantly affected by the addition of harmonic components in the voltage, thus making it necessary to consider their impact when performing true PD diagnostics. This paper investigates the influence of voltage harmonic distortion produced in VFD-fed EM on PD severity and the subsequent insulation degradation. Eight VFD-fed EM are used to study PD behavior under different levels of harmonic pollution. The PD characteristics, such as inception voltage, pulse repetition rate, accumulated apparent charge, average discharge current, discharge power, and quadratic rate, are determined. With the help of probability distribution functions, the chance of PD activity and its severity at various voltage harmonic levels are estimated. The proposed technique can be used to plan maintenance activities that ensure reliability for industrial applications dealing with voltage harmonic distortion.

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