Blocking DC Current In Transformer Neutrals

DEI

Application Note 5A

Introduction

Transformers, which are designed for alternating current, are sometimes subject to DC current from cathodic protection systems, DC powered rail systems, or a geomagnetic induced source. In general, transformers do not tolerate DC current, with some designs being sensitive to currents as low as one ampere. DC current causes half-cycle saturation, over-heating, increased audible noise, and mechanical stress; which can contribute to decreased transformer life. In cases where preventive measures must be taken to prevent DC current from flowing through the transformer neutral to ground, a DC blocking/AC coupling device may be a practical solution.

Product Description

This is a unique application for which there is no one specific product model that can address all applications. This problem may exist in any transformer, from the smallest distribution transformer to the largest power transformer; hence, the product must be tailored to each application. To date, this solution has primarily been implemented in transmission substation and generator step-up transformers using customized blocking devices.

If the stray DC current source is geomagnetic induced, then special considerations apply. DEI will only consider providing neutral blocking devices for geomagnetic induced current applications after a complete systems analysis has been done and certain information is provided as outlined in the DEI document entitled "Specification: Solid-State DC Current Blocking Device for Transformer Neutrals." This specification was written to address blocking of either GIC or DC sources. This specification also includes a description of the product design approach used. Therefore, that information will not be repeated here.

Key Considerations

Depending on the transformer design and circumstances, the DC current may flow through the transformer windings and not involve ground. For this situation, a neutral blocking device is not a solution. The use of a neutral blocking device is only of value when the DC current is flowing through the neutral to ground.

If interested in this application, please provide answers to the questions in the referenced specification. DEI can also suggest knowledgeable consultants for providing the analysis required when dealing with GIC applications.