of 400 kV power system using EMTP were used to test the performance of the technique.

Keywords: Phase selection, wavelet transforms, single-pole autoreclosure, digital signal processors, protective relaying, transient analysis.

Preprint Order Number: PE-446PRD (03-2002)

Discussion Deadline: August 2002

Substations

High-Voltage On-Site Commissioning Tests for Gas-Insulated Substations Using UHF Partial Discharge Detection

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Abstract: This paper describes the practical application of the UHF Partial Discharge Detection method that VA TECH Reyrolle has routinely applied to high-voltage on-site commissioning tests on gas-insulated substations (GIS) for over 10 years. The location of the partial discharge (PD) sensors has a significant effect on the sensitivity of the UHF method. Research has been undertaken to quantify the parameters that affect this, i.e., attenuation, GIS geometry, etc. Verifying the correct operation of the detection system and its sensitivity is a crucial step in preparing for an HV test. In order to do this, special test equipment has been developed to ensure that all of the cabling, connections, etc. attached to the detection equipment are correct and the detection level of the couplers confirmed. The paper discusses IEC 60517 (general guidelines for GIS HV testing), its most usual interpretation, and how the application of the UHF technique can transform this interpretation.

Keywords: Partial discharge, UHF, gas insulated substations (GIS), Substation commissioning test, high-voltage testing.

Preprint Order Number: PE-576PRD (03-2002)

Discussion Deadline: August 2002

Switchgear

Application of 800 kV SF_6 Dead Tank Circuit Breaker with Transmission Line Surge Arrester To Control Switching Transient

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Abstract: An 800 kV metal oxide transmission line surge arrester (TLA) has been developed, installed, and tested on the AEP 765 kV Marysville to Kammer transmission line. The purpose of this transmission line surge arrester (TLA) is to pave the way for the development, construction, and application of an 800 kV SF_6 dead tank circuit breaker without closing resistors and free standing current transformers at AEP's 800 kV Orange station. The maximum design operating voltage is 800 kV, and 765 kV is the nominal operating voltage. Successful field test results of the TLA's ability to limit switching overvoltage emanating from circuit breaker operation to below the transmission line switching withstand are given. Successful test results of the 800 kV dead tank circuit breaker design dielectric test are given.

Keywords: Transmission line surge arrester (TLA), polymer, station class surge arrester (SA), switching overvoltage, circuit breaker, oil filled current transformer, closing resistor.

Preprint Order Number: PE-493PRD (03-2002)

Discussion Deadline: August 2002

SF_6 Reclaimer from SF_6/N_2 Mixtures by Gas Separation with Molecular Sieving Effect

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Abstract: Discussing various methods for SF_6 separation from a mixture of low concentrations of SF_6 in N_2, pressure swing adsorption (PSA) with a suitable kind of synthetic zeolite, which is expected molecular sieving effect, has been selected. This molecular sieving effect, derived from molecular size difference between SF_6 and N_2, is confirmed by the difference between two equivalent volumes filled with SF_6 and N_2. Prototype equipment of SF_6 separation and liquefaction, about 1 m cube in size and 150 kg in weight, has been assembled and tested. The ability of gas mixture handling is 13 L/min. in average, and the SF_6 content is reduced to 0.0% (undetectable level) in separated N_2 to exhaust into the atmosphere.

Keywords: Green house effect, SF_6/N_2 gas mixture, SF_6 gas reclaiming, pressure swing adsorption (PSA), synthetic zeolite, molecular sieving effect.

Preprint Order Number: PE-631PRD (03-2002)

Discussion Deadline: August 2002

Transformers

A Simple Method for Calculating Winding Temperature Gradient in Power Transformers

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Abstract: This paper presents a new method for calculating winding temperature gradient in large power transformers. A general formulation of the problem is made using the electrical analogy. An expression for the thermal resistance of the solid insulation is found using analytical methods. Expressions for the thermal resistance of the oil boundary layer for natural and directed oil flow are then found by correlation of test results from actual transformers. A comparison of the results of the new method and previous methods is presented. The new method is found to be a significant improvement.

Keywords: Power transformer, power transformer thermal factors, temperature, windings.

Preprint Order Number: PE-217PRD (03-2002)

Discussion Deadline: August 2002

Three-Phase to Four-Phase Transformer for Four-Phase Power Transmission Systems

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Abstract: A new three-phase to four-phase transformer with four-phase four-leg structure is first proposed, its electromagnetism principle is analyzed, and properties and features of the transformer are discussed. This transformer may be applicable to either four-phase transmission systems or autotransformer (AT) traction power supply systems in electric railways.

Keywords: Multiphase power transmission; four-phase power transmission; balance transformer; three-phase to four-phase transformer.

Preprint Order Number: PE-721PRD (03-2002)

Discussion Deadline: August 2002