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IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

IEEE Power & Energy Society

Sponsored by the
Power System Relaying Committee

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Abstract: Two types of design tests for relays and relay systems that relate to the immunity of this equipment to repetitive electrical transients are specified. Test generator characteristics, test waveforms, selection of equipment terminals on which tests are to be conducted, test procedures, criteria for acceptance and documentation of test results are described. This standard has been harmonized with IEC standards where consensus could be reached.

Keywords: fast transient test, IEEE C37.90.1, oscillatory test, relay, relay systems, surge withstand capability, SWC

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Introduction

This introduction is not part of IEEE Std C37.90.1-2012, IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

Assurance is needed that electronic relays and relay systems will operate satisfactorily when installed in the harsh environment of a substation or switchyard. Standard surge tests will provide assurance that the relays and relay systems will withstand a specified surge level. The use of proper grounding and shielding techniques when installing the equipment will attenuate the actual surge level impinging on the equipment. However, even with proper grounding and shielding, surges may reach the equipment that are above the test levels specified in this standard. In such cases, the addition by the user of surge suppression devices external to the relay system may be required.

The first standard document to specify an SWC Test was ANSI/IEEE Std C37.90a™-1974/IEEE Std 472™-1974 (redesignated ANSI/IEEE Std C37.90.1-1974), Guide for Surge Withstand Capability (SWC) Tests.

Experience with ANSI/IEEE C37.90.1-1974 was good, and in 1978 the Guide was incorporated as Clause 9 of ANSI/IEEE Std C37.90™-1978, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus. This meant that the oscillatory SWC Test became a required test for relays and relay systems containing semiconducting devices.

From the beginning, it was realized that the oscillatory SWC test had limitations and did not adequately represent all conducted transients that may be experienced in substation environments. The need for a complementary test was recognized and the general type of test required was identified. The problem then became one of a search for a circuit that would produce a repeatable, controllable output. During the search, the IEC *showering arc* test was studied as well as a number of other tests proposed by various organizations. These were not chosen because they were not repeatable or controllable.

The combination of the original oscillatory SWC test and the fast transient SWC test ensure that relays and relay systems will function at a level of immunity in the presence of conducted transients that occur in substations. The fast transient test was therefore incorporated into ANSI/IEEE Std C37.90.1-1989, because it is stable, easy to control and can be performed in a minimum time and at a reasonable cost.

A working group was later assembled to harmonize ANSI/IEEE Std C37.90.1-1989 with corresponding IEC standards and to make the standard more understandable through clarifications and improvements to the document. This working group made extensive revisions such that one set of tests are necessary to reach closer harmonization with the corresponding IEC standards.

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1. Overview

1.1 Scope

This standard specifies design tests for relays and relay systems that relate to the immunity of this equipment to repetitive electrical transients. Two types of tests are specified. The oscillatory and fast transient SWC tests are defined as distinct tests. However, it is not intended to prohibit a combined test, provided all requirements of the individual SWC tests are met.

The application of SWC tests to equipment other than relays and relay systems is the responsibility of those specifying the testing.

1.2 Purpose

This standard establishes a common and reproducible basis for evaluating the performance of relays and relay systems when subjected to repetitive transients on supply, signal, control, and communication lines or connections. This standard establishes that an evaluation is performed during both normal (non-tripped) and abnormal (tripped) relay operating conditions.

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