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IEEE Standard for Test Methods and Preferred Values for Self-Restoring Current-Limiter Components Used in Telecommunication Surge Protection

IEEE Power and Energy Society

Sponsored by the
Surge Protective Devices Committee

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Abstract: The basic requirements to be met by series connected, solid-state, self-restoring overcurrent protectors (OCPs) for the protection of telecommunication equipment and lines are presented. This standard should be used for the harmonization of existing or future specifications issued by solid-state, self-restoring OCP manufacturers, telecommunication equipment manufacturers, administrations, or network operators.

Keywords: component, electronic current limiter, IEEE C62.39™, overcurrent protection, positive temperature coefficient thermistors, self-restoring, surge protection, surge protective device

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Introduction

This introduction is not part of IEEE Std C62.39-2012, IEEE Standard for Test Methods and Preferred Values for Self-Restoring Current-Limiter Components Used in Telecommunication Surge Protection.

Unlike fuses and heat coils, self-restoring overcurrent protectors (OCPs) automatically reset after the end of the overcurrent condition without the need for manual intervention. All the OCPs covered in this standard are solid-state. Having no moving parts these OCPs are more reliable than thermal circuit breakers and mechanical disk switches.

The current reducing action is for the normally low (untripped) OCP resistance to transition to a very high tripped resistance value, which greatly reduces the circuit current flow. The positive temperature coefficient (PTC) thermistor OCPs transition is caused by the component body reaching a critical temperature. The body temperature rise is caused by the i^2R heating of the overcurrent flowing through the component. Being thermally operated PTC thermistor OCPs do not operate for short duration lightning currents, but for ac overcurrents caused by power faults. Electronic current limiter (ECL) OCPs operate on a preset current threshold level and will reduce both ac and lightning overcurrents to that threshold current level. Under lightning surge conditions both OCP types assist in the protection coordination function.

These OCPs will have untripped resistance values ranging from a few ohms to some 50 Ω. This series resistance provides a coordination element between cascaded overvoltage protectors. In the tripped state (operated) the OCP resistance increases to hundreds of kilohms (kΩ), greatly reducing the prospective overcurrent to the equipment and the i^2t developed in the feed wiring. OCP tripping forces a coordination condition; the ECL does so for both lightning and ac overcurrents and the PTC thermistor for ac overcurrent conditions.

Many of the tests and test values can be applied to the three types self-restoring OCP technology: ceramic PTC (CPTC) thermistors, polymer PTC (PPTC) thermistors, and ECL components. Some tests are specific to OCPs used in a surge protective device (SPD) or to OCPs used in equipment. Differences between the OCP technologies mean that some tests will be specific to a given technology.

Contents

IEEE Standard for Test Methods and Preferred Values for Self-Restoring Current-Limiter Components Used in Telecommunication Surge Protection

1. Overview

1.1 Scope

This standard sets terms, test methods, test circuits, measurement procedures and preferred result values for series connected, self-restoring current-limiter components used in low-voltage telecommunication circuit surge protection. It is only applicable for components in telecommunications circuits with sinusoidal ringing voltages up to 150 V rms at 15 Hz to 70 Hz and dc powering voltages up to 400 V. The self-restoring current limiters covered by this standard have the following properties:

- Excessive current causes a transition from a low-resistance state to a high-resistance state
- Reverts to a low-resistance state when the excessive current ends
- Directly operated by the current flow through the component
- Solid-state (no moving parts)
- Withstands specified levels of impulse
- Withstands specified ac voltage levels when in the high-resistance state

Examples of this type of current-limiter technology are positive temperature coefficient (PTC) step-function thermistors of ceramic or polymeric material and silicon semiconductor based electronic circuits.

This standard does not cover self-restoring current-limiter components used in other applications, such as heaters, inrush-current limiters, or sensing devices. Current interrupting type components, which reduce the current to zero by a mechanical circuit break, are not covered by this standard. In this standard, a *telecommunications circuit* is a circuit that uses metallic conductors to handle the remote transmission of information, such as data, communications, and signalling.

1.2 Purpose

The test criteria and terms of this standard provide a means of component comparison and a common engineering language for users and manufacturers of self-restoring current-limiter components intended for use in low-voltage telecommunication circuit surge protection. The test and measurement of low-voltage telecommunication (data, communications, and signalling) surge protectors is given in IEEE Std C62.36™ [B6].[1] This standard provides the corresponding component tests for the surge protector non-surge and active tests.

2. Definitions and acronyms

2.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause. [2]

electronic current limiter (ECL): Assembly of one or more electronic components that automatically restricts the current amplitude when it exceeds a predetermined threshold level.

NOTE—See Recommendation ITU-T K.82 [B10].[3]

endurance test (life test) ac: Application of a specified number of trip events under specified temperature and trip cycle (on and off time) conditions.

NOTE—See Recommendation ITU-T K.82 [B10].

endurance test (life test) impulse: Application of a specified number of impulses under specified temperature and impulse repetition rate conditions.

NOTE—See Recommendation ITU-T K.82 [B10].

fault current, I_{fault}: Current used when measuring time-to-trip.

NOTE 1—Specific values of I_{fault} used are 1 A and 5 × I_h.

NOTE 2—Modified from IEC 62319-1:2005 [B4].

[1] The numbers in brackets correspond to those of the bibliography in Annex A.
[2] *IEEE Standards Dictionary Online* subscription is available at:
http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.
[3] Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.